Band Together

Exploring Platforms for Remote Musical Collaboration

A Research Study by Wavelength Music Arts Projects
Funded by The Canada Council for the Arts' Digital Strategy Fund

Canada Council for the Arts
Conseil des arts du Canada

Project Leaders

Jonathan Bunce
Gurpreet Chana
Aaron Dawson

Core Team

Jonathan Bunce
Gurpreet Chana
Aaron Dawson
Samantha Roshanie Dharmasena
Olivia Shortt
Guillermo Subauste

Facilitators
Jai Djwa
Ella Cooper

Collaborators
Jesus Aurazo
Greg Chambers
Dan Dwoskin
Manalang
Andrew McAllister
Marley Rosen
Truss
Vakho

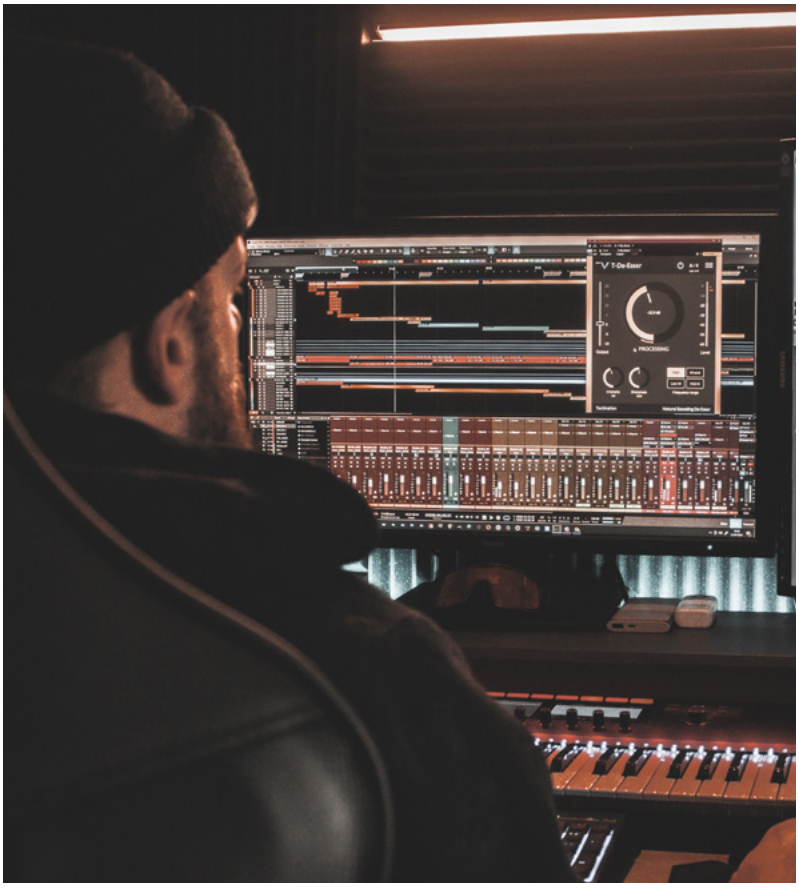
Project Coordinators
Emmalia Bortolon-Vettor
Kat Estacio

Report Design
Derek Ma

Videography
Last Frame Pictures

Link to video report:
http://bit.ly/WLbandtogether

Funded by The Canada Council for the Arts



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Introduction

In March of 2020, the COVID-19 pandemic brought all live music events to a halt. Not only was it unsafe for audiences to gather in clubs and concert halls to listen to musicians perform together, but lockdown restrictions prevented musicians from even meeting in the same room to rehearse. Many bands, who were like family to one another, were suddenly unable to be together and play together.

The aim of the Band Together initiative, with the support of the Canada Council for the Arts' Digital Strategy Fund, was to foster human connection and collaboration between musical artists, within the technical limitations of digital connectivity and the pandemic-imposed limitations of physical distancing. Over the course of 2021, Wavelength Music Arts Projects (Wavelength) convened a core team of musical artists, curators and digital audio experts to engage in a series of online workshops/discussions to research and explore existing platforms for real-time, remote musical collaboration, with the aim of developing our digital literacy to increase the efficacy of live, real-time telematic music performance. In later sessions, the core team collaborated with other musicians to test the efficacy of a slate of identified software and hardware solutions, assessing them on the basis of a defined series of attributes.

The result is something of a "consumer guide" to remote musical collaboration, which even as the pandemic subsides, we hope will bring the musical world closer together.

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Background & Methodology

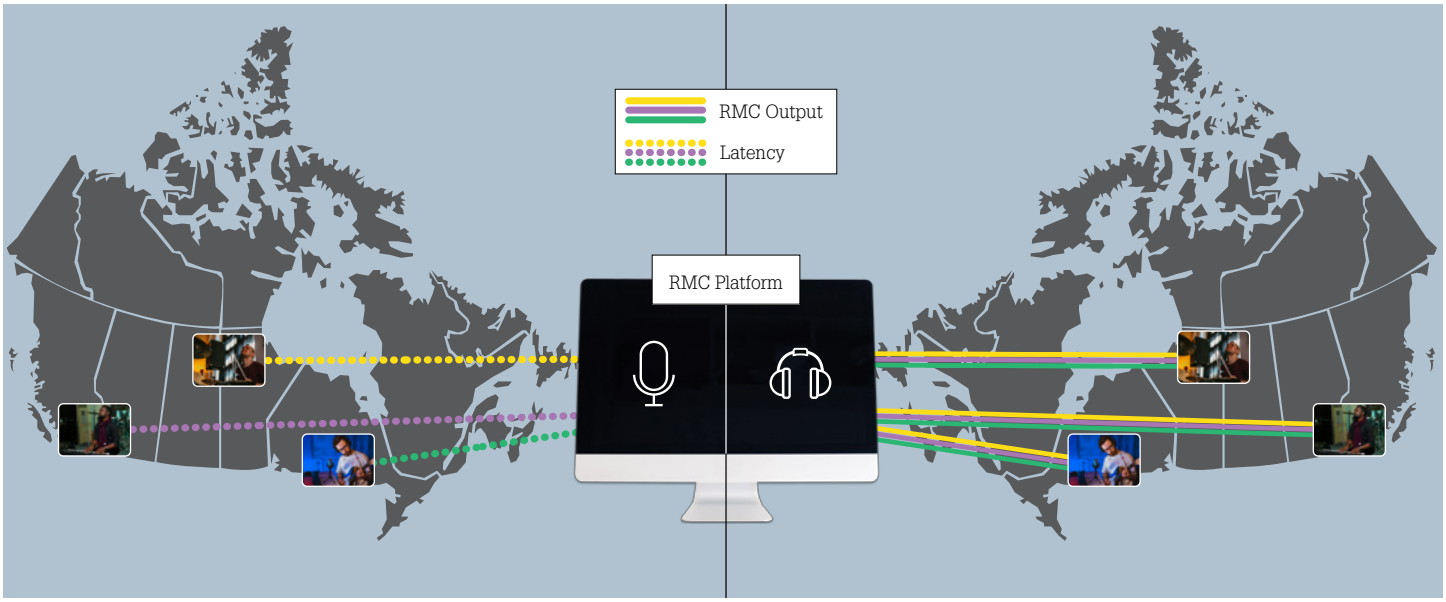
Background

Though COVID-19 has enacted a huge toll in terms of public health, mortality, and socio-economic well-being, it has also presented some unexpected opportunities. The early months of pandemic lockdowns in the spring of 2020 saw a renaissance of digital performance in the form of livestream and online concerts presented by music creators broadcasting from their own homes. This enabled newfound connections between artists and audiences and a level of interactivity and engagement previously unseen and unexplored.

However, the lockdown-bound livestream format also had its limitations: the medium privileges solo performers as well as a smaller number of duos or groups based in domestic partnerships. There are many creative musicians who are not active as solo performers that were excluded from participating. Certain musical genres also benefited more from the livestream format: singer/songwriters, experimental musicians, electronic DJs, and hip-hop emcees were in the spotlight, while rock and jazz bands, and classical/new-music and world ensembles, faced new challenges.

The idea of the "band" — which is the basis for much popular music culture of the last 60 years — was under threat during the pandemic, and this proved to be a motivating idea for this project. The band paradigm thrives because it is based in human connection: the ineffable joy that comes from playing music with other people. The diminishing of this format not only negatively impacts the quality and diversity of music being created, it also has a detrimental effect on the health and well-being of our society.

The aim of the Band Together initiative, then, was to foster human connection and collaboration between musical artists, within the current limitations of digital connectivity and physical distancing. Though obstacles remain to groups of musicians collaborating remotely in real time with each other, due to latency issues, we began this project believing these challenges are not insurmountable.



The importance of real-time RMC

Real-time remote musical collaboration (RMC) has been a dream since the dawn of the Internet, though the reality has often fallen short. Still, the increase in Internet download speeds, computer processing speed, and the accessibility of home audio production software and hardware over the last two decades, has made real-time RMC much more attainable.

Andrea Pejrolo discussed the issue in *Sound on Sound* Magazine: "The last few years have seen long-distance recording projects using this technology blossom: the steady decrease of record–production budgets across the board makes the RMC approach particularly attractive to commercial artists and producers. But while this financial efficiency is a factor, there's a much greater benefit: it's now possible to access an almost endless pool of creative and musical talent that would be impossible to utilize if everyone had to be in the same room at the same time."

With artists around the world able to exchange audio files and overdub their parts at home, RMC has become commonplace — at least when it comes to recording. It remains a challenge for musicians to perform and collaborate together live, in real time.

It is the ineffable creative spark that arises from live musical collaboration that, at the time of this project's conception, was in danger of being extinguished by the physical distancing requirements and travel restrictions imposed in reasonable response to the COVID-19 pandemic — and could again be threatened by a new variant or another pandemic.

Our approach: Rooted in community and collaboration

Wavelength Music Arts Projects is an artist-run, community-oriented non-profit arts organization, primarily active as a live music presenter. Our ongoing concert series has produced over 800 events since its inception in the year 2000, primarily in Toronto. While the province of Ontario was under pandemic restrictions, we presented over 30 digital/online events. Prior to offering these events, we conducted independent research of the existing landscape for digital music presentation, and engaged with some of Canada's pre-eminent experts on the topic, including Dan Mangan of Vancouver-based online concert platform, Side Door, and Guillermo Subauste, one of our project's Core Team members.

Though the pandemic was a motivating force for this project, the seeds of Band Together were laid in 2019, before most non-epidemiologists had heard of a coronavirus. What unfolded was the organic result of ongoing conversations between artist Gurpreet Chana and Wavelength's professional leadership Jonathan Bunce and Aaron Dawson, beginning in late 2019, months before the COVID-19 pandemic. Chana and Dawson had previously collaborated on the audio-visual project kLoX and Chana performed two fantastic concerts for Wavelength in 2019-20, including a cross-genre collaboration with the art-rock band, Absolutely Free, at the Aga Khan Museum in Toronto.

Project Leaders:

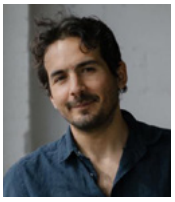
Gurpreet Chana made for an ideal collaborator with Wavelength to undertake this project. The Toronto-based artist's practice explores the intersection of music and technology, and thanks to his background in engineering, he created the custom digital musical interface TABLIX over ten years of intensive R&D — an instrument that pushes the relationship between the ergonomics and sounds of the time-honoured tabla tradition with the infinite possibilities of the digital.

In addition to his erstwhile role as General Manager at Wavelength, from which he departed for a new opportunity in 2021, **Aaron Dawson** (Toronto) is an experienced ambient/electronic music composer/producer/performer and curator, with musical projects such as Dirty Inputs and Off The International Radar, and music series Nite Comfort. He has also worked as a live video and interactive installation designer.

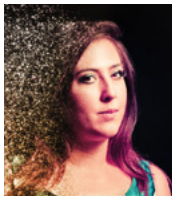
Wavelength Artistic/Executive Director and co-founder **Jonathan Bunce**, is a 20+ year veteran concert presenter, writer, musician and organizational leader. With the 2020 publishing of his first book *Any Night of the Week: A D.I.Y. History of Toronto Music 1957-2001* (published under his nom de plume Jonny Dovercourt), Bunce has expanded his skills as a researcher and scholar.

Core Team:

Samantha Roshanie Dharmasena a.k.a. Roshanie is is a Toronto-based DJ and community organizer active in the world of electronic dance music. She hosts two shows on internet radio station, ISO Radio. Roshanie also began streaming DJ sets on Twitch during the pandemic.



Guillermo Subauste is an audio engineer, producer, and musician originally from Lima, Peru, now based in Toronto. During COVID-19 he started Stream Tune-up, a consultation service for performers to improve the quality of their livestream audio and video, and has arguably become one of the nation's leading experts on online concert production techniques.



Olivia Shortt (Anishinaabe, Nipissing First Nation) is a Tkarón:to-based storyteller and performing artist. They are a multi-instrumentalist, vocalist, noisemaker, improviser, composer, sound designer, video artist, drag artist, curator, administrator, and producer. Shortt was featured in the 2020 Winter edition of *Musicworks* Magazine and was described as a "glittering, rising star in the exploratory music firmament." *(Photo by Alejandro Santiago. Glitter edits by Heshaka Jayawardena)*

Facilitators:

Jai Djwa is an artist, creative technologist, coach and digital strategist. He is the principal of Agentic Communications. Djwa's work uses the values of creativity, collaboration and community. He works with arts organizations on digital projects, but clients also include First Nations, progressive non-profits, and social ventures. Djwa brings an understanding of the world as a person of colour.

Ella Cooper is an award-winning independent producer, multimedia artist, educator, writer and director based in Toronto. Ella is the founder of Black Women Film! Canada, a not-for-profit supporting Black women in film and media, and runs Brown Rabbit Studios, a BIPOC production company. As an impact producer, renowned facilitator and social entrepreneur, Ella has worked with numerous established arts organizations.

Project Coordinators:

Emmalia Bortolon-Vettor is a guitarist and multidisciplinary researcher. Their current musical project is Bonnie Trash, whose debut album Malocchio was released in October of 2022 on Hand Drawn Dracula. Emmalia is currently an MA student in the Critical Studies in Improvisation program at the University of Guelph, where their research involves piloting an afterschool recording workshop involving smartphones.

Kat Estacio is an experienced administrator, with a B.Comm and over a decade of on-the-ground work with community non-profits and arts organizations. Kat is Managing Director of Wavelength and is Exclaim! Media's print magazine layout editor. They are also a member of Pantayo, an all-women Filipino kulintang gong ensemble, whose debut album was shortlisted for the 2020 Polaris Music Prize.

Our process: a digital group discussion/ workshop series

As this project took place over the course of the pandemic, with participants located across Canada, though mostly in Southern Ontario, the workshop sessions were held entirely remotely via Zoom. All sessions were recorded, with minutes taken to capture all participants' contributions.

Initial sessions laid the groundwork for how the collaboration would proceed, creating a community agreement emphasizing self-care and what participants needed to create a safe space together. The common themes that emerged in the first session were collective creation, collaboration, and creative modalities. During the second session, participants discussed their creative practice before COVID, how the pandemic affected it, and what inspirations they were taking from livestreaming opportunities.

After original facilitator Ella Cooper needed to depart, the group had a reset and established a new roadmap for the project with new facilitator Jai Djwa. Miro was used as a white-boarding tool and the group established a decision-making process.

Some time was spent brainstorming a name for the project using the digital whiteboard, and "Band Together" was selected as best exemplifying the playful, communal spirit of the project. Much time was spent discussing the attributes that the core team would be looking for from the ideal RMC tools.

These attributes came from suggestions from the group. These were then ranked in order of priority by the core team to narrow down to a list of 25-30 key attributes. It is worth noting that the majority of the participants are professional musicians or producers, so accessibility considerations such as affordability became of equal importance to audio quality, for example. Some of the participants used these as a point of comparison and some also added their own. It was important to trust the musician participants to use these as benchmarks, but not to be limited by them.

It was determined that the ideal RMC solutions would possess the following attributes:

- **User-friendly** (easy to set up, synchronize with audio equipment, multi-platform compatible, intuitive, not a steep learning curve, etc.)
- **Accessible** (affordable, multilingual, internationally compatible, open to many participants, secure, private, etc.)
- **High quality output** (low latency, high audio clarity & quality, video capability)
- **Additional functions/designs** (eg. synchronous ability, recording ability, saving previous sessions, bandwidth adaptable)

These attributes were captured in a spreadsheet for assessment purposes, with all team members assigning a ranking to each attribute. These attributes then became the criteria for evaluating software.

Each member spent time researching RMC platforms between sessions, with the aim of identifying up to five pieces of software and using this criteria to give an initial evaluation.

From there, discussions moved to what audience(s) the findings would be speaking to, with a conclusion that the report would benefit musicians and producers as well as the wider music sector. With this in mind, it was decided that the final phase of testing would take the form of a "consumer guide" to RMC tools.

An online culture develops

Individually, the core team did online desk research, reviewed existing literature, and conducted interviews to learn more about potential RMC platforms that interested them - and looked like a potentially good fit with their practice. We were delighted to learn that during the first year of the pandemic, online collaboration was blossoming around the world, and beginning to develop its own unique musical culture.

Testing phase

Having selected their software platforms to test out and conducted initial evaluations individually, the core team presented their separate findings to the whole group. A few promising platforms were identified. But a crucial element of the software evaluations was missing — testing solutions with outside collaborators. It was decided that each of the team members would be able to invite a guest musician to collaborate with them and test out their chosen software - at a distance.

(Please note: At this stage, Core Team member Olivia Shortt needed to withdraw and was unable to participate in the testing phase.)

Using the assessment framework, the core team then worked with their invited collaborator(s) to test out the effectiveness of various RMC platforms. Upon completion, team members submitted their assessments through a Google Form, and the Project Leaders read through the results to choose our "Top Five" RMC solutions. (It should also be noted that all collaborators resided within the same geographical area, and the latency imposed by global distances was less of a factor.)

Please see the Platform Assessments section of the report to learn more about our findings and recommendations.

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RMC Platform Assessments

Syncspace

(Jamulus Solution) Best overall

Developed by: Syncspace
syncspace.live
Assessed by: Gurpreet Chana
With Collaborators: Truss, Vakho

Syncspace allows a group of up to 30 musicians to collaborate musically in synchronous real time. This collaboration takes place via audio, video, and a chat box. The audio is sent through the Syncspace server, which the collaborators connect to via the Syncspace desktop app and the video is sent directly via the web browser.

Currently the Syncspace solution is most ideal for rehearsing, jamming, or teaching. The group of remotely collaborating musicians can also broadcast and record their performance if they pay for broadcasting services by Syncspace, or if one of the collaborators takes on the broadcasting responsibilities. A third party software such as OBS would be required for this.

Syncspace is also a homegrown, Canadian solution - based in Ottawa, Ontario.

Our assessor's experience:

A very cool and positive experience, as opposed to a troubleshooting situation. Also a greatly helpful learning experience, highlighting the importance of Internet connectivity in relation to the creative process. It also reinforced the importance of internet accessibility and equity and how important it is for all to have access to the internet.

Syncspace was fairly straightforward to set up, but monitoring took some time to figure out. We would definitely use this for personal and professional project. It opened doors previously closed for connection and collaboration.

> *"We were literally making music in a new dimension and it opened up a sense of potential that, up until that moment, was only a dream or a wish."*

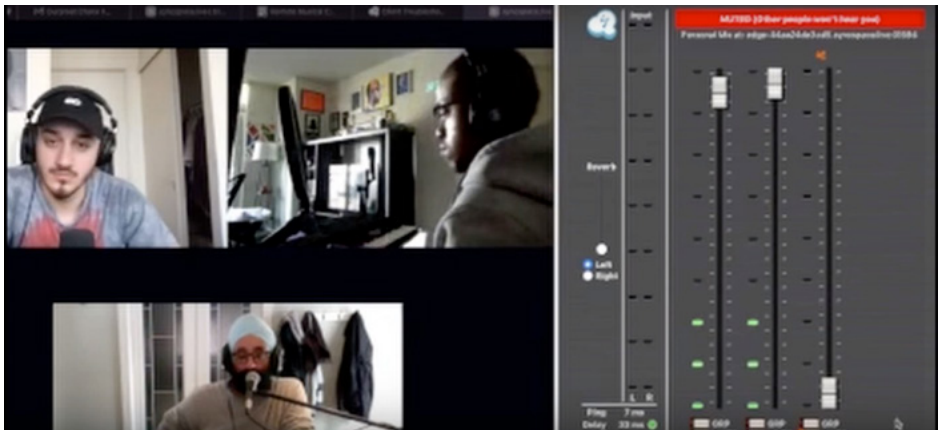
Potential improvements:

Recording — It would be great to record within the Jamulus software, Syncspace app, or directly into a Digital Audio Workstation (DAW) by any one or all of the collaborators. Currently this is only possible if we broadcast through the Syncspace service, which is for an additional fee. It would be ideal if there was a way to better integrate the Syncspace/ Jamulus server into an audio interface so that one could utilize the full potential of their audio interface inputs, outputs, and processing. Or if there was a way to better integrate this into major DAW platforms through a plugin type function so that the connection, routing, and potential of the DAW is fully possible.

Both of the above may possibly make the setup easier and less confusing, as most musicians are likely to have some familiarity with an audio interface or DAW and hence make the learning curve of/for remote musical collaboration more seamless, user-friendly, and widely integrated into the current music making process.

Overall:

It was an awesome experience. It was a relief and liberating to find a "solution" that really and finally worked. It left us with a sense of ecstatic disbelief when that remote musical connection and collaboration actually happened. We were literally making music in a new dimension and it opened up a sense of potential that, up until that moment, was only a dream or a wish. Experiencing the emotions and the actual connection made us want to share this with everyone so that they could also experience the connection and realize the potential of their ideas in a time like COVID or other situations where we can't connect.



File next to: Jamulus, Jacktrip, Aloha by Elk, LiveLab, LoLa, Ninjam for Reaper, Bridgr

Plays nice with: Jamulus, various audio interfaces, laptops, and operating systems. Not compatible with tablets or mobile devices.

Browser based, or installed program? Can be both

Compatible browsers: Chrome, Safari (no stated limitations)

Compatible OS: Windows, Mac, Linux (desktop only).

Minimum requirements: Computer (laptop or desktop), Internet connectivity, audio interface, video camera.

How it works: A "Syncspace" is a space where performers sync up through audio and video. Audio and video are decoupled so that the audio arrives with minimal delay. Each performer sends their audio to their servers where it is mixed. Syncspace uses the location and network information from each musician to help find the best location for the server, which should be used for each ensemble so that latency is minimized.

Overall ease of setup: Easy

Save presets? Needs to be set up every time

Ease of connection with DAW? Difficult

How was the latency? Some latency but still able to collaborate.

If you know the amount of latency, list it here: Collaborator 1 - Latency 21ms, Collaborator 2 - Latency 2.7ms, Collaborator 3 - Latency 19.3ms. Depends on internet connection but good to work with if/when things are connected successfully.

Does the software allow for high-quality audio? Yes

Recording capable? No

Can you create your own audio mix within the software? Yes

Cost: Reasonable: $44/month for up to 7 people, month-to-month commitment.

Onboarding: Very helpful, specifically for Syncspace and in general to understand the complexities, realities, and possibilities with regard to remote musical collaboration. Users and potential users should spend some time on the Syncspace site to understand RMC and the solution that Syncspace provides. Some additional equipment may be required.

Chat functionality? Yes

Video communication? Yes

Maximum number of participants: Up to 7 for small studio, up to 15 for medium studio, and up to 30 for large studio.

Works internationally between countries? Yes

Multilingual options? English only

How private is it? Very private

Any privacy concerns? None at the moment. Broadcasting with syncspace might have its own set of issues.

Potential uses:
Rehearsing, writing, jamming, teaching, performing and broadcasting (if you have a broadcaster in your group or use the Syncspace broadcaster). If broadcasting yourself, you will need additional third party software such as OBS. Could be used for producing and recording if audio stems and recording were more convenient.

Interview: Adrian Cho (syncspace)

Syncspace was developed by Adrian Cho, an Ottawa-based jazz musician, tech industry veteran, and world-traveled wildlife photographer. Drawing on his decades of experience in arts and technology, Cho conceived of syncspace as a platform for artists and educators to connect with "virtual live music." After founding in late 2020 and launching in early 2021, syncspace has since presented over 100 concerts at its "virtual venue."

What inspired you to develop syncspace?

Syncspace came out of the very real need for musicians to continue performing live when social distancing during the COVID pandemic made it impossible for us to be in the same room.

What challenges did you hope to solve with the platform?

Although I knew it was possible to play together in some form online, the real challenge was coming up with a platform that was good enough that professional jazz musicians could play together and negotiate in real-time even if they had never played together before. I also wanted to be able to broadcast in real-time to audiences with audio and video that was good enough that people would pay to attend concerts. At the time, most people thought it was impossible for musicians to play together online and in fact many people told me exactly that. I think it's fair to say that in a lot of cases, we exceeded the expectations of musicians and audiences. We had musicians meeting up for the first time, playing live gigs to live audiences, with audio that was often better than many livestreams of bands playing together in the same room. We also made it possible for audiences to attend live shows together and chat with one another while watching and listening.

How do you hope musicians will use the platform?

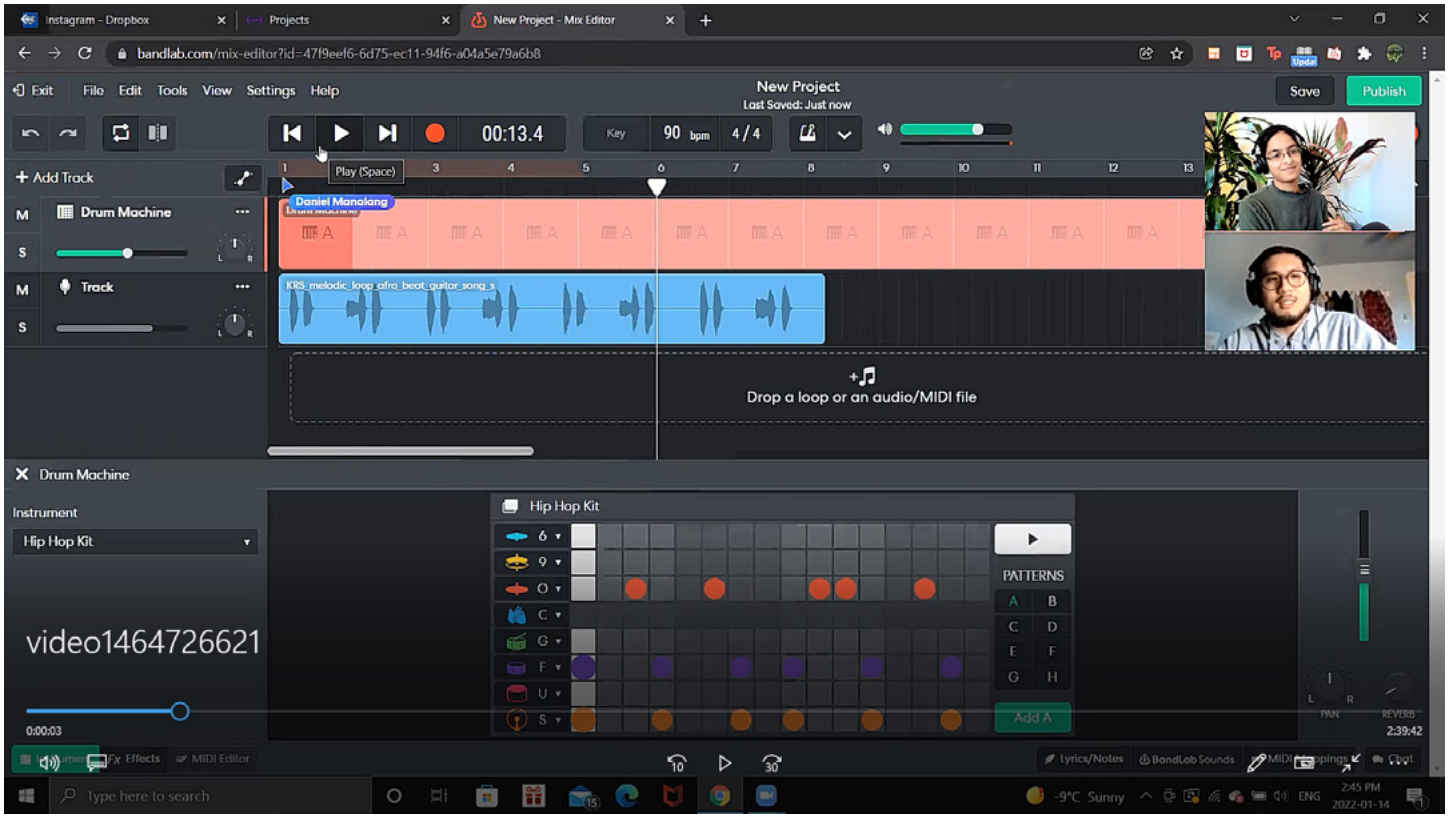
The original goal was always to enable live performances but as we started to use the platform, we realized the benefit of using it for rehearsing and teaching. It enables people to perform together online, who might otherwise never get the chance to meet in person. Alternatively, it enables people to rehearse or perform together without the cost and hassles of travel. Even while we stopped live performances during the warmer months this year, we've been continuing to use the platform to allow musicians to record together across distances. For example, trumpeters Kevin Turcotte and Ed Lister, recently co-led a quintet split across Toronto and Ottawa, to record a show for Concerts in Care.

Can you describe the unique online music culture that syncspace has been cultivating?

I'm most proud of the fact that we built a little community of jazz musicians, especially between Toronto, Ottawa, and Montreal, who played together. Some of them even met online through Syncspace and later went on to meet, and even record, in person. We also established an online audience and in some cases those people also initially online and later met in person. We opened up new possibilities, helped people to connect, and had a lot of fun, all while enabling jazz musicians to earn money and for jazz fans to continue to support artists. We also had a few other ensembles, including some classical and folk groups.

And in your experience, what is the geographical distance limitation beyond which the latency becomes too much of an issue?

Good question. It depends a little bit on what music is being played and the kind of distance that we want it to feel like people are apart, if they were in the same room. For example, between Toronto and Ottawa, it can feel like we are about 6 to 8 feet apart. The furthest we've done is a show with the rhythm section spread between Toronto, Ottawa, and Montreal, and the horn players in Antigonish, Nova Scotia! Generally speaking, limiting it to about 800 km is good.



Bandlab

Best for beginners

Developed by: Bandlab technologies
bandlab.com
Assessed by: Sam Dharmasena
Collaborator: Manalang

Bandlab is a collaboration tool that is free and cloud-based. Users can collaborate remotely and even upload it on their Bandlab profiles. Audio from these profiles can be "fork-able" if users choose, so that others on the platform can remix them. This fork-able option creates another avenue for remote collaboration. Bandlab can be accessed via browser, or iOS/Android apps available for free download.

Our assessor's experience:

During my session with Manalang, we created a simple beat using Bandlab. We really enjoyed the ability to view each other's mouse while working in the program. While there wasn't a video option for Bandlab, we had a Zoom call going to hear and see each other while we worked. We also really enjoyed the fact that Bandlab doubles as a DAW and social media platform. That option to upload tracks and livestream was really intriguing to us.

Overall, we enjoyed the experience but noticed many shortcomings. Within the drum kit, there doesn't seem to be an option to adjust the volume of the individual sounds. And you cannot add your own sounds to the drum kit, which is frustrating. The DAW is also quite sensitive, so clicking on something within the track view would actually shift it slightly. This was another issue that slowed down our collaboration process.

I would only recommend Bandlab for beginners. It's a cost-effective way to get introduced to music production, but I wouldn't recommend it for folks that are already using other DAWs. The primary reason is the aforementioned limitation of the drum kit. You can add these sounds into the track view, but then it becomes difficult to create patterns and use them effectively. If Bandlab is your entry point to beat making and music production, this won't matter as much. But if you're set on creating a certain sound, it might not be possible with the current limitations. Because 50 users can collaborate at a time, this may be a useful tool for bands as well. Perhaps as Bandlab evolves, it would be an effective tool for this type of user. Right now, bands would be quite limited with their collaborations on Bandlab.

File next to: Soundtrap, Garageband

Plays nice with: Compatible with MIDI controllers, beatpads, etc.

Browser based, or installed program? Browser based

Compatible browsers: Chrome, Firefox, Edge

Compatible OS: There are iOS/android apps available for Bandlab

Minimum requirements: Android 5.0 and above. iOS iOS 12.4 and above. Web: latest version of Chrome, Firefox or any Chromium-based browser.

How it works: Since it's browser based, the set-up is pretty straightforward. Login to Bandlab and click "create" to enter the DAW. Click "invite" to bring in collaborators. You can also connect mics and other hardware to Bandlab as well.

Overall ease of setup: Very easy

Save presets? Yes.

Ease of connection with DAW? N/A

Does this software facilitate real-time collaboration? Yes

Is the remote musical collaboration supposed to be synchronous or asynchronous? Can be both

How was the latency? No noticeable latency

If you know the amount of latency, list it here: Note: Bandlab has a latency correction feature.

Does the software allow for high-quality audio? Yes (uses WAV, AIF, Ogg, FLAC, etc)

Recording capable? Yes

Bandwidth adaptable? I don't know

Can you create your own audio mix within the software? No

Cost: Free.

Onboarding: Lots of helpful information is available on the Bandlab blog and help centre. There are also YouTube tutorials by Eumonik and Inclusive Music.

Chat functionality? Yes

Video communication? No

Maximum number of participants: 50

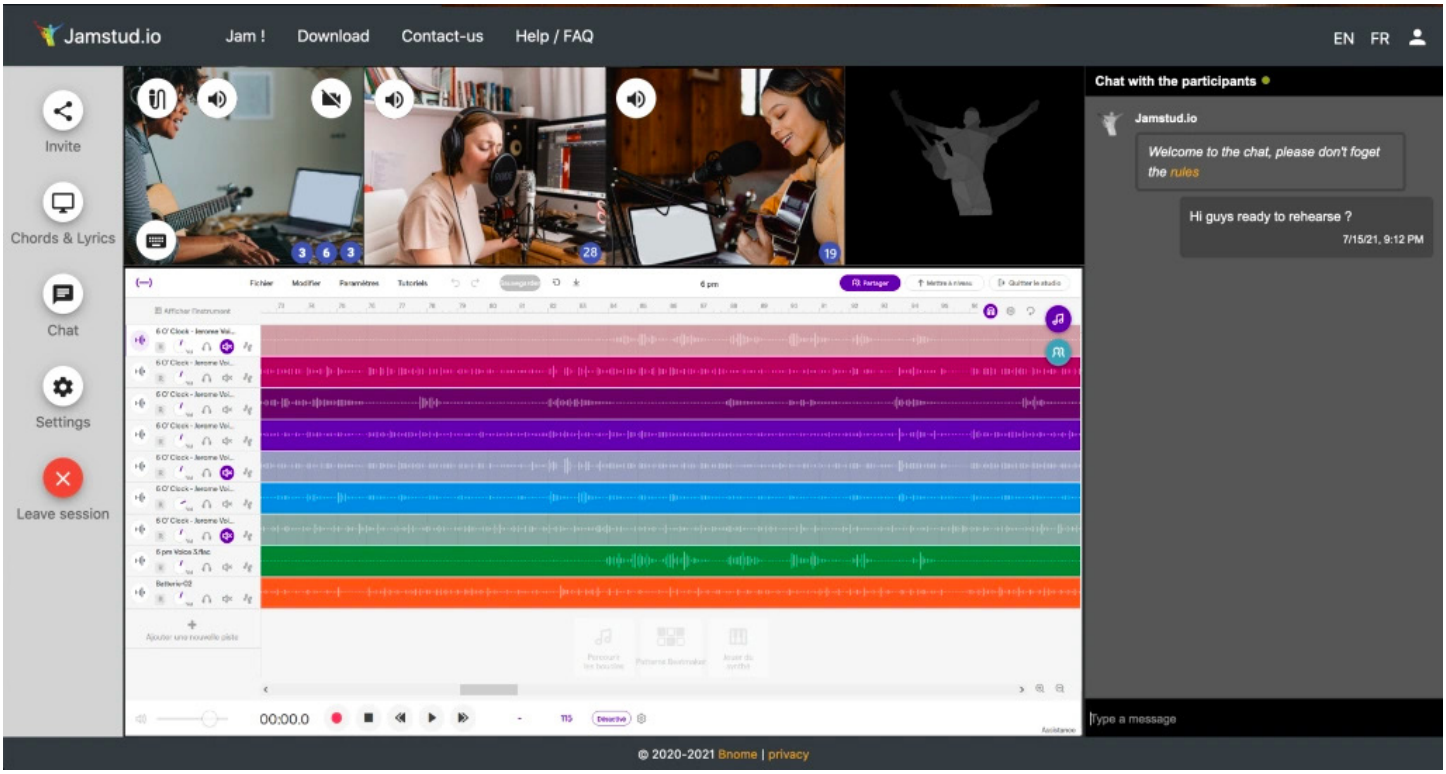
Works internationally between countries? Yes

Multilingual options? Yes

How private is it? Very private

Any privacy concerns? N/A

Potential uses: Bandlab has a version for educators and I think this is a great tool within music classes. For those learning production basics, this could be a great way to introduce people to musical concepts. Then they can eventually graduate to other DAWs that offer more flexibility when it comes to sounds and mixes.



Jamstud.io

Best for bands on the road

Developed by:
jamstud.io
Assessed by: Guillermo Subauste
Collaborators: Dan Dwoskin, Jesus Aurazo

Jamstud.io connects to different computers with its interface online, both video and audio. It allows for pretty synchronous jamming. Quality of the audio is not .wav but MP3, pretty acceptable! Set-up is not very complicated at all.

Our assessor's experience:

This is a great solution for bands that are on the road or people wanting to collaborate remotely.

There are a lot of similar programs, but I found they all fall short in one way or another. This one was the closest one to real-time collaboration I could find. For actual high quality recorded audio, I still use Audiomovers or SessionWire.

File next to: JamKazaam, Jamulous

Plays nice with: Mac, Windows, UAD interfaces, Focusrite interfaces, ASIO, Core Audio

Browser based, or installed program? Requires both

Compatible browsers: Chrome

Compatible OS: Windows, Mac

Minimum requirements: 16Gb of RAM, USB or Thunderbolt interface, I7/M1 processor.

How it works: Each computer needs to download the host program and also use the browser. You select which inputs you'll be using for both audio and video. There's no recording or streaming available, but it allows for songwriting or rehearsing.Once you select the different sources, you can set up the volume of each source.

Overall ease of setup: Mildly difficult

Save presets? Needs to be set up every time

Ease of connection with DAW? Difficult

Does this software facilitate real-time collaboration? Yes

Is the remote musical collaboration supposed to be synchronous or asynchronous? Synchronous

How was the latency? Some latency but still able to collaborate

If you know the amount of latency, list it here: 40ms. Some jitter, but minimal

Does the software allow for high-quality audio? No (uses compressed files like .mp3)

Recording capable? No

Bandwidth adaptable? Yes

Can you create your own audio mix within the software? Yes

Cost: Free

Onboarding: All information is on their website. Wasn't able to find any tutorials.

Chat functionality? Yes

Video communication? Yes

Maximum number of participants: 4

Works internationally between countries? Yes

Multilingual options? No, English only

How private is it? Partially private

Any privacy concerns? It's not a big company so not too sure about their encryption.

Potential uses: Rehearsing, songwriting, jamming.

Pedál

Best for one-on-one spontaneous collab

Developed by: Pedál
collabwithpedal.com
Assessed by: Sam Dharmasena
Collaborator: Manalang

Pedál allows you to collaborate remotely while using your own DAW. The program allows you to record audio with a collaborator, drop it into your DAW, and screenshare the whole process. You're also able to hear your collaborator's voice — like a phone call — so you can discuss the project.

Our assessor's experience:

Manalang and I thoroughly enjoyed working with this remote collaboration tool. When I was setting it up on Windows, I ran into an obstacle, though. My Pedál was stuck in the sign-up stage because I didn't get a prompt notifying me that my username was already taken. Without this prompt, I was frozen in the sign-up process without any idea why. Only when I tried to install the program on a Mac, did I understand what was happening.

Because of that, another problem with this collaboration was that our Pedál crashed a few times. Sometimes the DAW would also crash because there was too much going on. So while this is a free program, it requires solid devices to run smoothly. The crashes weren't a big issue for us, though, more of a minor inconvenience.

Overall, we enjoyed working within Pedál and would recommend it. You can record and transfer files very easily and it's a comfortable experience because you're working within your own DAW. The call and screenshare functions through Pedál is also very helpful. With this remote collaboration tool, you don't really need to have a Zoom call going simultaneously.

File next to: Dropbox/WeTransfer + your DAW

Plays nice with: Audio interfaces, DAWs, etc

Browser based, or installed program? Installed program

Compatible browsers: N/A

Compatible OS: Windows, Mac

Minimum requirements: OS X 10.10: Yosemite-2014, Windows 10 or later.

How it works: Download, install Pedál. After you sign up, open your DAW and set audio out to "Pedál (Virtual)." On windows set it to "CABLE Input." You can also set your mic.

Overall ease of setup: Easy

Save presets? N/A

Ease of connection with DAW? Easy

Does this software facilitate real-time collaboration? Yes

Is the remote musical collaboration supposed to be synchronous or asynchronous? Synchronous

How was the latency? No noticeable latency

If you know the amount of latency, list it here: Through the Pedál call function, we could hear a slight difference in our voices. It's hard to tell if this happens often but its something to be aware of.

Does the software allow for high-quality audio? N/A

Recording capable? Yes

Bandwidth adaptable? I don't know

Can you create your own audio mix within the software? Yes

Cost: Free

Onboarding: Because of the generic name Pedál, it feels harder to Google information about the program. Pedál does have a useful guide which is called their "Knowledge Base."

Chat functionality? No typed chat, mic only.

Video communication? No

Maximum number of participants: 2

Works internationally between countries? Yes

Multilingual options? No, English only

How private is it? Very private

Any privacy concerns? No.

Potential uses: One-on-one collaborations, especially where only one collaborator needs the DAW going (the other can record audio or offer suggestions through screensharing)

Soundjack

Best for experimental tinkerers

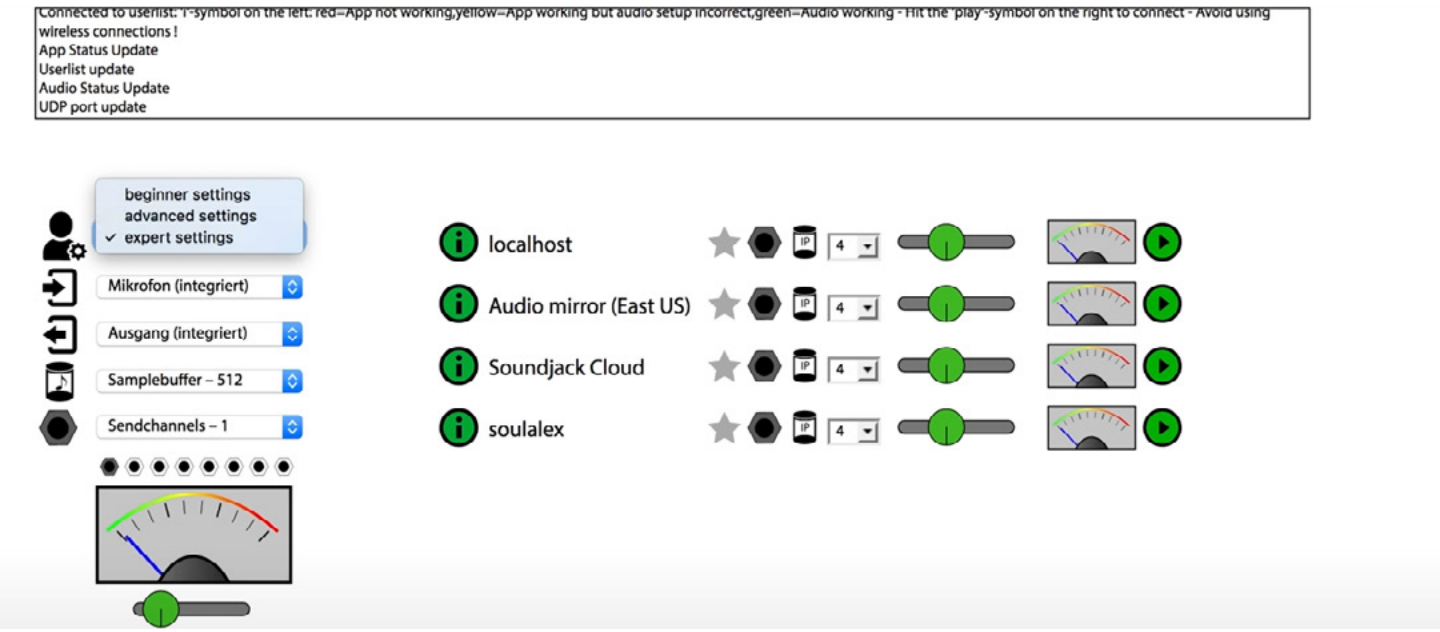
Developed by: Soundjack
soundjack.eu
Assessed by: Aaron Dawson
Collaborators: Marley Rosen

Soundjack allows for real-time communication by letting the user adjust the quality and latency settings to maximize the efficiency of the audio transmission. While affected by the physical distances and network of the collaborators, it is possible to adjust the program to minimize latency and achieve real-time online musical interaction and live jamming.

Our assessor's experience:

Getting Soundjack running was fairly easy and intuitive. Dialing in the latency settings was a bit more difficult and took some time. We were able to get a jam session happening fairly quickly. The latency wasn't terrible, but not good enough to get two matching BPM devices in sync. It felt fun to jam in general, providing only one person was doing anything rhythmically repetitive.

We would recommend Soundjack for online jamming, but not for serious applications or projects.



File next to: Syncspace, Jack Trip

Plays nice with: Mac OS, Windows

Browser based, or installed program? Requires both

Compatible browsers: Chrome, Firefox, Safari, Edge

Compatible OS: Windows, Mac, Linux

Minimum requirements: Wired internet connection, ASIO or ASIO4All drivers, faster the computer the better but no minimum requirements.

How it works: First create an account and log in to download the software. Install the package, then open the standalone program. Once open, return to your browser to start a new session. Go to your audio settings to select your audio input/outputs. Create a new session and invite your collaborators.

Overall ease of setup: Mildly difficult

Save presets? Needs to be set up every time

Ease of connection with DAW? Very difficult

Does this software facilitate real-time collaboration? Yes

Is the remote musical collaboration supposed to be synchronous or asynchronous? Synchronous

How was the latency? Some latency but still able to collaborate

If you know the amount of latency, list it here: 20ms. No issues with audio clarity

Does the software allow for high-quality audio? Yes (uses WAV, AIF, Ogg, FLAC, etc)

Recording capable? No

Bandwidth adaptable? Yes

Can you create your own audio mix within the software? No

Cost: Free and open source

Onboarding: There is a very comprehensive FAQ, documentation section and video section. The setup is fairly easy to get started

Chat functionality? No

Video communication? Yes

Maximum number of participants: As many as the bandwidth can handle

Works internationally between countries? Yes

Multilingual options? No, English only

How private is it? Very private

Any privacy concerns? No

Potential uses: Online jam sessions

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Other Solutions

There are now many different Remote Music Collaboration tools for digital collaborators to choose from, and individual musicians may find that some work better for them than others. The following were platforms tested for real-time collaboration capacity that our assessors found challenging to use, and for which we humbly suggest some improvements or enhancements:

JackTrip Core and Virtual Studios

Developed by: JackTrip Foundation
jacktrip.org

Assessed by: Andrew McAllister (invited by Jonathan Bunce)
Collaborator: Greg Chambers (Away Forward)

Our assessor's experience: *JackTrip requires highly technical knowledge of audio software and computers, and lacks basic user feedback on configuration and troubleshooting. Documentation is light and the community largely depends on one another for support. If you are a large university connected to a research network, or a user with a Fibre-to-the-home Internet connection and all your collaborators are in the same situation, your experience can be profoundly good. When it's good, it's great. Otherwise, it just drops packets and you get stuttering garbage. If you're lucky enough to have a good enough Internet connection, and you follow the instructions correctly and don't run into issues, JackTrip would be useful for collaboration with several musicians who are not too far apart geographically. The issue is when it doesn't work as expected and you are endlessly guessing why the latency is so terrible. If you are someone who is very technical, or has dedicated support, a lot of time and patience, and audio quality is your absolute number one requirement — and you are willing to upgrade your internet connection to Fibre-to-the-home or you are connected to a research network — then I would say, yes, JackTrip is for you.*

Jammr

Developed by: Jammr Ltd.
jammr.net

Assessed by: Aaron Dawson
Collaborators: Marley Rosen

Our assessor's experience: *The overall experience with Jammr was very frustrating. The program crashed often — when loading plugins, when starting, when looking at the Jam list. The user interface is very minimal, there is no meter. Any time you want to change any settings, you need to exit the jam, change the settings, and then rejoin. It took a while to get set up, about 30 minutes.*

There were numerous unexpected issues related to monitoring and the recording function. The user interface was not intuitive and there were challenges connecting to our DAW. In Mac OS the aggregator device was built-in and it was able to work with Ableton. Using DirectX we could get it working with Ableton, but there were major latency issues. Collaborators would randomly get ejected from the jam.

Soundtrap

Developed by: Spotify (parent company)
soundtrap.com
Assessed by: Sam Dharmasena
Collaborator: Manalang

Our assessor's experience: *Collaborating on Soundtrap was very difficult. Manalang and I were trying to create a blend in their DAW and we had to abandon the project because it was really hard to refresh everytime we wanted to change something. We didn't get very far in our collaboration because of this. Since this is a paid tool, my expectations were high and Soundtrap didn't meet them at all.*

Soundtrap could be a good tool if you are not collaborating in real time, and are working on a project with a collaborator at separate instances. Every time a collaborator changes something, the other users need to refresh the page to see the changes. This makes it impossible to work on the project at the same time.

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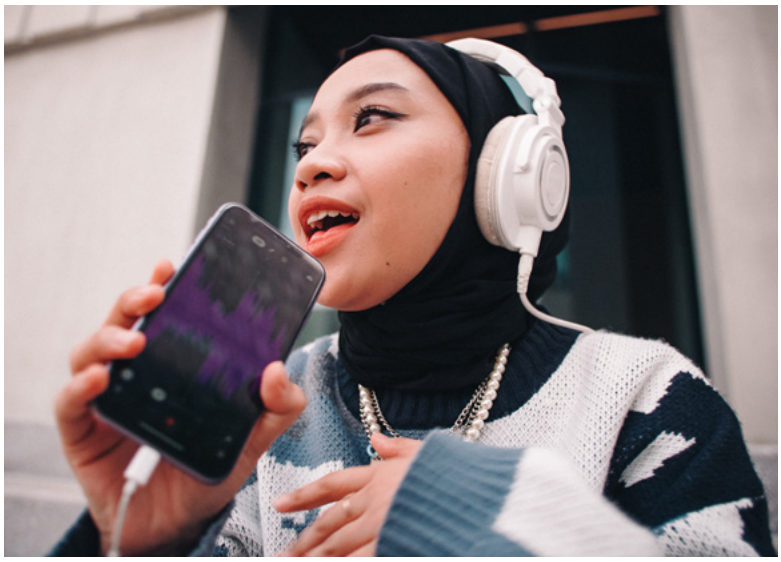
Conclusion



We've all been on quite a journey through the pandemic. It's hard to believe it's been three years of living with COVID-19 — as of this writing — and even though in-person events may have returned, some of the innocence of concerts in the Before Times has been lost, and online collaboration is here to stay.

Some musicians may never embrace Remote Music Collaboration, finding nothing can replace the feeling of making air molecules in the same room vibrate, while others have found it to have given them a new creative lease on life, connecting them to a larger world of potential collaborators. For those who choose to make use of RMC platforms, or those forced to by unexpected new lockdowns or other circumstances, there are many tools to help keep the band together.

We hope musicians find this report helpful as they undertake their own journeys into real-time Remote Music Collaboration. And we can't wait to see how this new digital culture will evolve in the years to come.

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Appendix

Collaborators' Tech Specs

Tool	Collab-orator	Operating system	Computer make + model used for testing	Computer processor type + speed	Webcam or video camera used	DAW used	Audio interface	Internet provider + connection speed	Latency
Syncspace	1	macOS Monterey	Laptop - Macbook Air (13-inch, 2018)	Intel® Core™ i5 Dual-Core 1.6 GHz	Laptop camera	N/A. We did not need to use a DAW to collaborate.	SSL 2+ USB Audio Interface	Rogers: 287.92 Mbps ↓, 21.93 Mbps ↑,	21ms, Jitter 1.3ms
	2	macOS Catalina	Laptop - Macbook Pro (15-inch, Mid 2014)	Intel® Core™ i7 Quad-Core 12.5 GHz	Laptop webcam	N/A.	Steinberg UR22mkII USB Audio Interface	Fibrestream: 51.07 Mbps ↓, 51.09 Mbps ↑	2.70ms, Jitter 0.17ms
	3	macOS High Sierra 10.13.6	Laptop - Macbook Pro (13-inch, Mid 2012)	Intel® Core™ i7 2.9GHz	Laptop webcam	N/A	RME Fireface UFX	Bell Fibe: 7.8 Mbps ↓, 0.58 Mbps, ↑	19.3ms, Jitter 5.93ms
Bandlab + Pedal	1	Windows 10 Home (64 Bit)	ASUS Vivobook	Intel® Core™ i5-8250U CPU @ 1.60GHz 1.80 GHz	AVerMedia Live Streamer CAM 313 1080p HD Webcam	N/A for Bandlab Serato Studio for Pedál	N/A	Fido, 150 mbps ↓, 15 mbps ↑	
	2	Catalina	Macbook Pro (Retina, 13-inch early 2015)	Intel® Core™ i5 Dual Core 2.7 GHz	2.7 GHz i5 Dual Core	N/A for Bandlab Serato Studio for Pedál	N/A	Bell Fibe: 8.17 Mbps ↓ 6.61 Mbps ↑	
Jam Stud.io	1	Mac OS 10.5, Windows 10 (64 bit)	MacBook Pro	M1 Max	Built-in webcam	Pro Tools, Studio One	Apollo 8p, UAD, Focusrite Scarlett 2i2	Rogers. 200 Mbps ↓, 50 ↑	
	2	Windows 10 (64 bit)	Dell XPS 15	3.2 Ghz	Built-in	Cubase	Focusrite 2i2	Telefonica, 300 Mbps ↓ + ↑	
	3	Mac OS 10.11	Mac mini	3.2 Ghz	Built-in	Logic Pro	Focusrite 2i2	TekSavvy 150 Mbps ↓, 30 Mbps ↑	
Soundjack	1	Windows 10 (64 bit)	Dell G5	Intel® Core™ i7 CPU @ 3.80GHz 3.79 GHz	N/A	Ableton Live	Native Instruments Komplete Audio 6	TekSavvy 100 Mbps ↓	
	2	Mac OS Big Sur	MacBook Pro (13-inch, 2017)	Intel® Core™ i5 Dual-Core 3.1 GHz	N/A	Ableton Live	Scarlet 18i8	TekSavvy 100 Mbps ↓	

RMC Evaluation Tool

Urg.	Functional Criteria	Nec.	TOOL 1	TOOL 2	TOOL 3
	User-friendly				
	Ease of set-up, explaining, not super tech heavy				
	Easy to synchronize audio equipment and/or DAWs				
	Compatible with Mac and Windows				
	Versatile - can work with many different audio interfaces, computer types, Operating Systems				
	Compatible with amateur gear or more advanced items				
	Not a steep learning curve				
	Easy on-boarding for guests, ie. Tutorial videos to reduce one-on-one explaining				
	Intuitive, plug-and-play				
	Ease of communication (notes)				
	Accessibility				
	Financially accessible				
	Max participants is acceptable (how many?)				
	Is the application available/compatible with an international group of collaborators?				
	Multilingual for intl collaborations				
	How well does it interact with wifi in cities vs rural areas				
	Password protected / security of platform/tool				
	Privacy--is everything public?				
	High Quality Output (audio/video)				
	Low latency				
	Audio clarity of multiple instruments streaming at the same time (ie. combo of electronic and acoustic instruments from different performers)				
	High-quality Audio				
	Video capability (participants can see each other)				
	Function/Design				
	Synchronous ability				
	Easy to lookup previous sessions (save presets and different configurations)				
	Able to record				
	Bandwidth adaptable				
	Can you create your own audio mix to hear your peers? (like your own monitor mix)				

Urg.	Financial Criteria	Nec.			
	Assess total cost over 5 years				
	Analysis costs				
	Implementation costs				
	Cost/user or subscription fees. Based on X number of users.				
	Any annual fees or overhead				
	Confirm Canadian Dollars and handling of GST				
	Added fees				
	Added costs for hardware				
	Server maintenance cost				
	Daily backup and disaster recover support				

URGENCY (urg.):

Mark each major area of functionally as an immediate or future need

I=immediate

F=Future

Mark each specific functionality as a must do, should do, or could do:

M=Must do (essential)

S=Should do (nice to have)

C=Could do (nice, but not essential)

Features:

probably

not sure yet

probably not

NECESSITY (nec.):

Must have (M): critical requirements without which the system cannot function. They are fundamental to the system. The Must haves define the minimum usable subset.

Should have (S): requirements that are important but not critical to the system. In a less time-constrained development, these requirements would be mandatory. The Should have requirements can be sacrificed if development of Must haves or Should haves takes more effort than estimated.

Could have (C): requirements that are desirable but which could be left out of the increment under development. More Could have requirements can be delivered if development of Must haves and Should haves takes less effort than estimated.

Won't have (w): requirements that are valuable but which will not be delivered by the increment under development. These requirements are out-of-scope.

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Glossary

Audio mix - The process of setting and combining sounds from different audio sources into one single audio signal. Parameters such as volume, EQ, sound quality, sound characteristics, panning, and more may or may not be available to control for an audio mix, depending on the software or hardware you are utilizing.

Beatpad - Also known as MIDI drum pads, beatpads are music creation devices that produce digital music to create your beats by triggering single shot samples quickly.

BPM (Beats Per Minute) - Standard method for measuring the tempo of a piece of music.

Cloud-based - Digital data stored, managed, and processed on a network of remote servers hosted on the internet, rather than on local servers or personal computers.

DAW (Digital Audio Workstation) - Software programs (i.e. Ableton Live, ProTools, Garage Band, etc) which allow for recording, processing, and editing analog, audio, and MIDI recordings and other sources of imported sound on a computer.

Decouple(d) - To separate, disengage, or dissociate (something) from something else.

Fork - Forking a song in BandLab is picking up where the original artist left off or, starting from where they stopped.

Latency - The delay before a transfer of data begins following an instruction for its transfer. Heard audibly as a lag or delay between the sending and receiving of a sound.

Livestream - A live transmission of an event or performance over the Internet.

MIDI (Musical Instrument Digital Interface) — A standard means of sending digitally encoded information about music between electronic devices, as between synthesizers and computers.

Monitoring (audio monitoring) - The ability or process to be able to listen to the audio being played, recorded, or processed throughout different parts of the music making process.

Open-source - Software for which the original source code is made freely available and may be redistributed and modified.

Operating System (OS) - The software that supports a computer's basic functions, such as scheduling tasks, executing applications, and controlling peripherals

Overdub - Recording additional sounds on an existing recording.

Plugin (audio plug-in) - An audio plug-in, in computer software, is a plug-in that can add or enhance audio-related functionality in a computer program. Such functionality may include digital signal processing or sound synthesis.

Synchronous - Two or more things existing or occurring at the same time. In this context, musicians playing "in sync" with each other, in real time, over the Internet, with minimal or no latency.

Telematic music -A live performance making use of information technology to distribute the long-distance transmission of music between two performers.

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