



MUSIANDRA

distance music making
based on RasPi 4 and Jamulus

Our Experiences and Learnings

18 February 2022
MUSIANDRA workshops

Presenter Matthias Krebs
Forschungsstelle Appmusik / RCAM
www.forschungsstelle.appmusik.de

Brief description

- In the Erasmus+ project MUSIANDRA, one sub-project focuses on developing approaches that enable people from different countries to make music together via the internet. During the first year of the project, we tried out different existing possibilities and then developed our own working approach that allowed piano students from Iceland, France, and Germany to rehearse and present a 4-hand concert program together online.
- Our approach uses the music software Jamulus and we agreed on a specific hardware setup to minimise technical problems at the different locations. We also thought about methodologies for networked music making.
- **Finally, on 22 January 2022, the project concert took place, where four-hand music pieces were performed together from different locations using Jamulus. The concert was a successful prelude to further steps for the project participants and the invited audience, who could participate via zoom.**
- In this presentation we want to present our experiences from this piano project and discuss learnings.

// Disclaimer



Co-funded by
the European Union

MUSIANDRA is funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.



MUSIANDRA -

distance music making based on RasPi 4 and Jamulus - experiences and learnings © 2022 by Matthias Krebs is licensed under CC BY-SA 4.0

Project partners

Oberstufenzentrum
Berufliches Gymnasium, Berufsoberschule,
Berufsfachschule, Fachoberschule und Berufsschule

TECHNISCHE
INFORMATIK
INDUSTRIE
ELEKTRONIK
ENERGIE
MANAGEMENT



mozarteum
university ●
Musikpädagogik Salzburg



scientific supervision
 Forschungsstelle
Appmusik

MUSIANDRA – What is this project about?

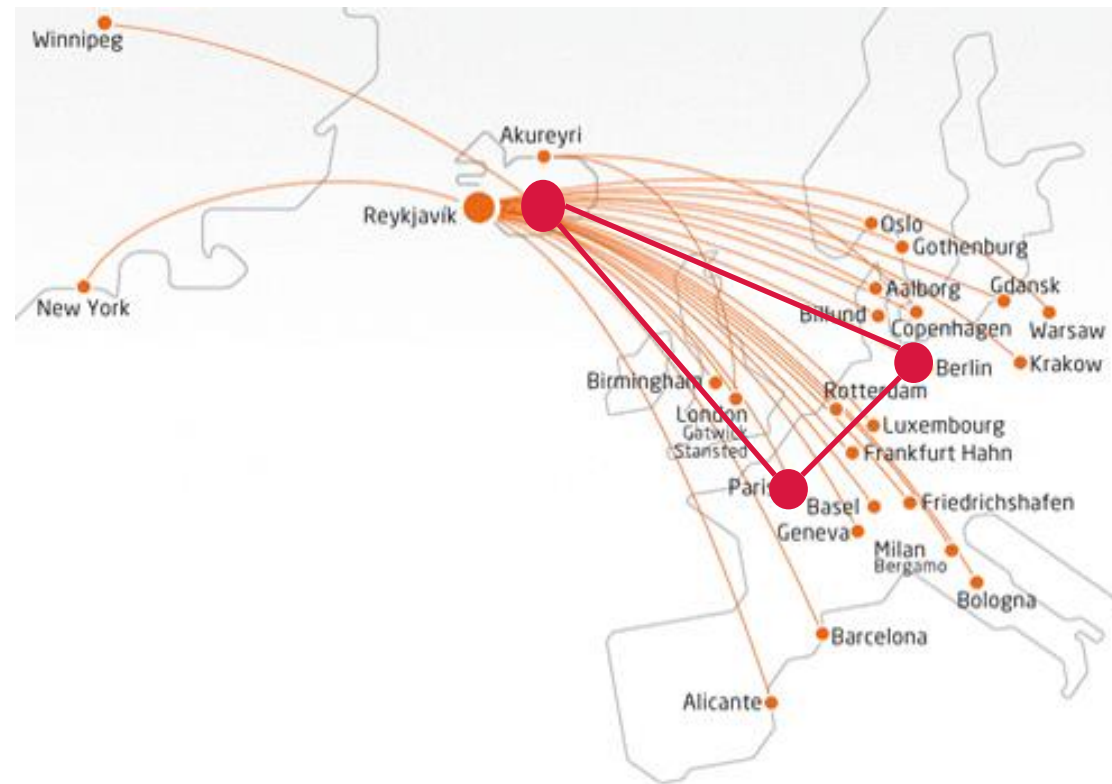
- As part of the Erasmus+ project MUSIANDRA, a subproject focuses on exploring approaches that enable people from different countries to make and rehearse music together via the Internet.
 - piano four hands (piano duets)
 - band music & drama
- In this context, the medium Internet will (merely) not be experienced exclusively as an information channel, but rather as a specific musical place with its own kind of „physics“. Therefore, it is not sufficient to simply transfer the experience from the rehearsal room to the Internet – specific skills are required, which must be explored in the project and methods developed for their acquisition.

Project leadership:
Dorlies Radike-Thiel



One of the first milestones

- We want to make a piano concerto for four hands online!



- Ísafjörður (Iceland)
- Berlin (Germany)
- Charenton-le-Pont, Paris (France)



Who plays?

- Margrét Gunnarsdottir (piano teacher in Ísafjörður (Iceland))
 - 6 piano students
- Alexander Munterjan, Jairo Geronymo, Elke Schrepel und Cordula Heiland (piano teachers in Berlin)
 - 6 piano students
- Vanessa Sanfilippo (piano teacher in Charenton-le-Pont, Paris)
 - 6 piano students



Pedagogical and technical support

- Matthias Krebs (researcher in Berlin)

How to connect?

Using a communication platform

- e.g. Zoom, Skype, WhatsApp, MS Teams

positive

- common – almost everyone knows how to handle it
- good audio & video connectivity for verbal com.
- file sharing
- for laptop and mobile use
- low cost

negative

- latency of more than 100ms
- intercom, no possibility for playing together

Using a specialized musical approach

- e.g. Jamulus, Sonobus



positive

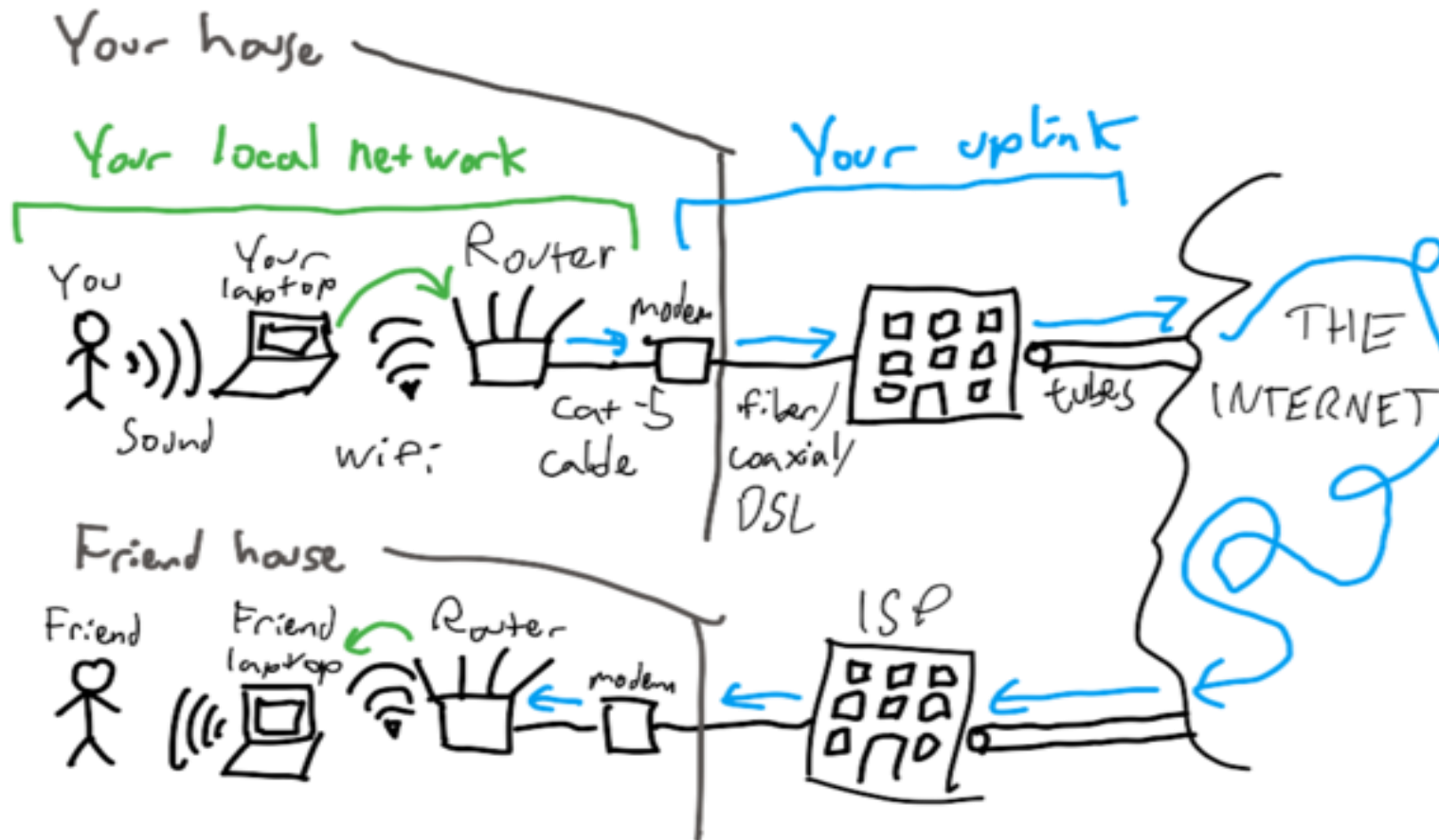
- good audio for instrumental sound and singing
- latency optimised connection (15ms and up)
- possibility for playing together in smaller and bigger groups

negative

- technically sophisticated
- no video connection, no file transfer

Why not combine those two?

Latency



<https://www.benkuhn.net/vcnet/>

Major difficulties

- non-wired connections
- great distance
- various individual technical ambiguities

Jamulus

All over the world Jamulus allows huge choirs to rehearse, loud rock bands to play, and brings folk and classical musicians together. It's being used for remote music lessons, in schools and universities, in private and in public.

- Have a look at the documentation: <https://jamulus.io/wiki/Getting-Started>
- Especially consider the troubleshooting section: <https://jamulus.io/wiki/Client-Troubleshooting>
- You can also ask on the forums:
<https://github.com/jamulussoftware/jamulus/discussions>

AND there are plenty of youtube tutorials !!!



scientific case study:

<https://jamulus.io/PerformingBandRehearsalsontheInternetWithJamulus.pdf>

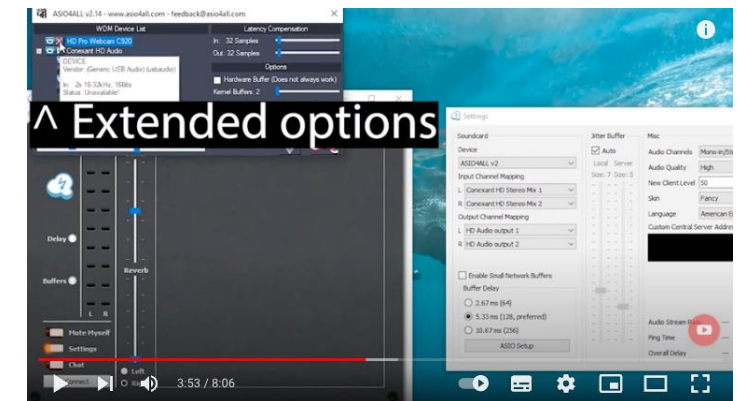
The common approach with Jamulus

- You need a laptop, a USB audio interface, a microphone and a headphone.
- Connect your laptop to the router using a cable.
- Download the jamulus software and install
 - Mac OS & Windows are different here!

You are ready to go!



<https://www.youtube.com/watch?v=FsiUpLi-nXI>



<https://www.youtube.com/watch?v=FoN5M-dLCnw>

The MUSIANDRA approach with Jamulus

- The MUSIANDRA kit contains a harmonized set of individual hardware, that was composed to minimize the broadcasting challenges with focus on making music together online.



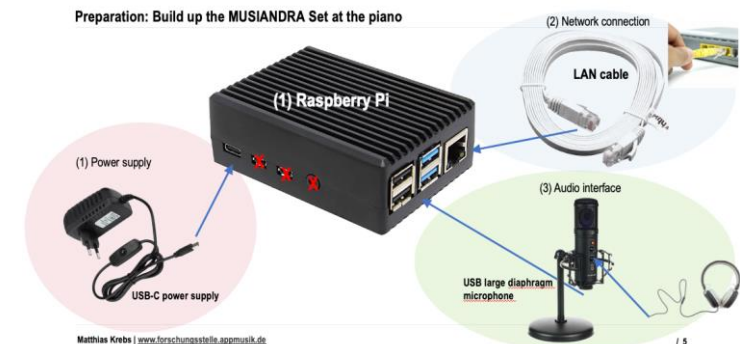
Why such an effort?

- We prefer a solution that is independent of the technical circumstances on site and the technical knowledge of those involved.

More info about the components in the following.

Preparations/Steps

- Research and testing of suitable hardware (June and July 2021)
 - preparing workshop materials
- We started to test the MUSIANDRA kit in Berlin with four piano teachers (3. September 2021)
- Workshops with our colleagues from Iceland and France (November and December 2021)
- Project Meet-Up in Berlin (November 2021)
- Weekly project meetings
- Decision to hold a concert in January 2022
- Decision to hold a workshop about the learnings from the concert

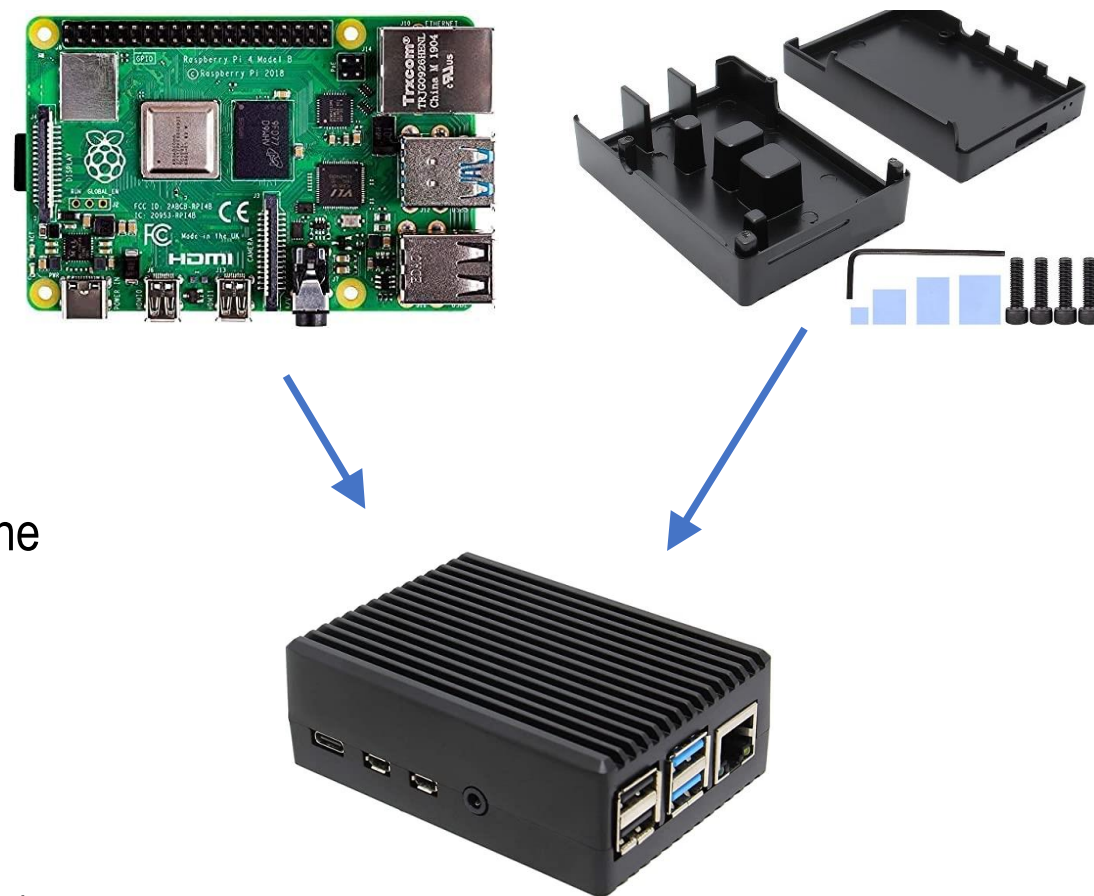


Technical preparations: The hardware components

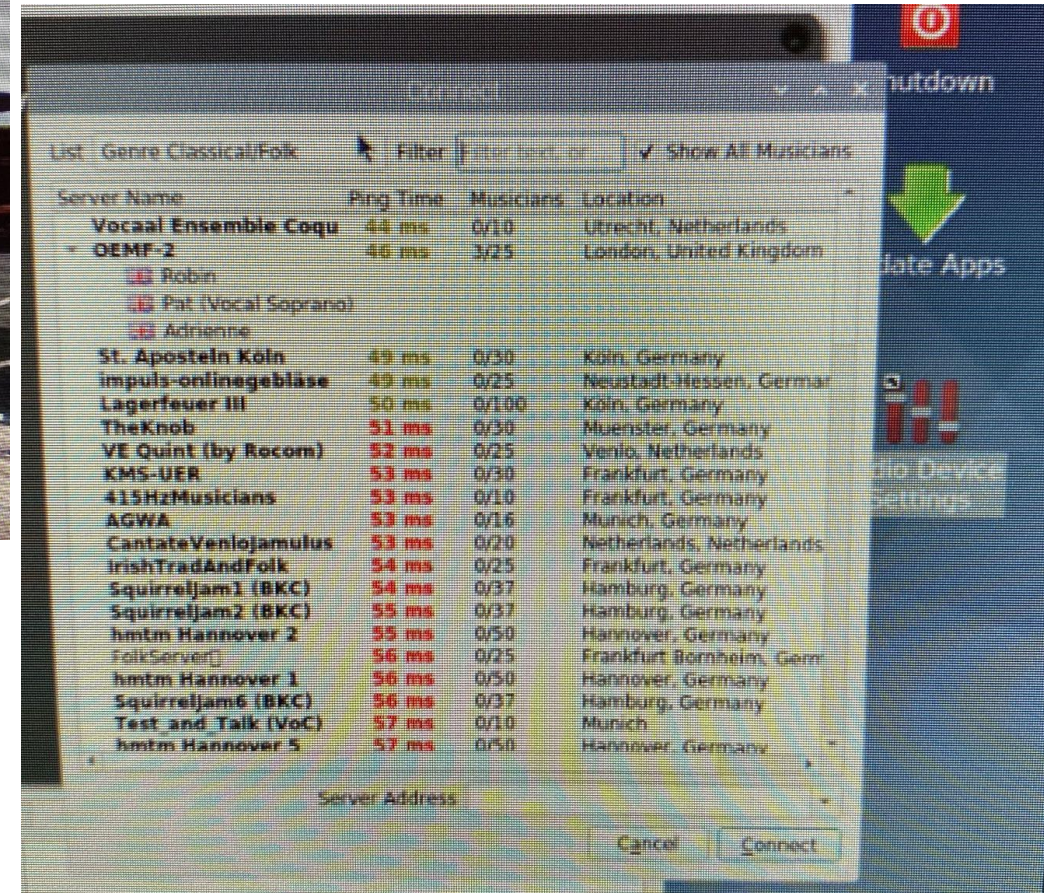
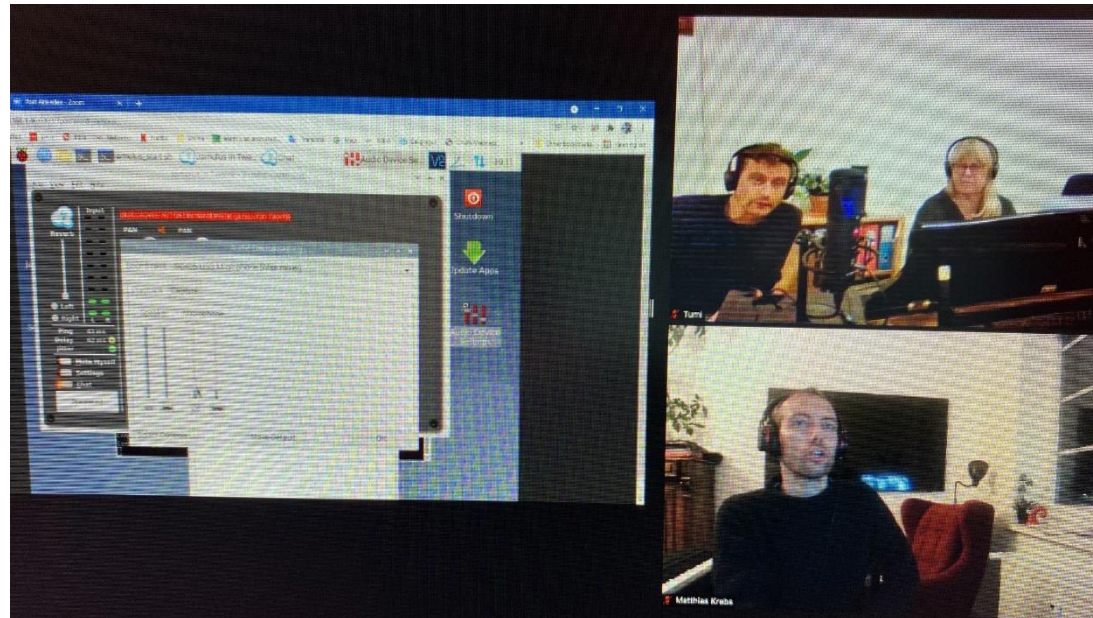
Object	Short explanation	Estimated expenses (German prices on June 2021)
Raspberry Pi 4b, 2 GB (RasPi4)	The small mini-computer as a circuit board	77 € https://www.amazon.de/dp/B07TD42S27/
Housing and power supply unit	Silent case without fan	15 € https://www.amazon.de/gp/product/B096RLQRV2
Memory card	For the specific operating system of the RasPi4 (Jamulus is included)	5 € https://www.amazon.de/gp/product/B00CBAUIEU
Network cable (5 meter)	To connect the RasPi4 to the internet router	10 € https://www.amazon.de/gp/product/B01MSWRHL2/
USB large diaphragm mic with cable, stand and case	This micro makes it possible to record the whole room with the instrument.	77 € https://www.thomann.de/de/the_t.bone_sc_425_usb_desktop_set.htm
Headphone(s)	The headphones should be comfortable and have a fairly long cable.	55 € https://www.thomann.de/de/akg_k_240_studio_kopfhoerer.htm
Headphone distributor	So that students and another person at the location (class or home) can listen together.	7,90 € https://www.amazon.de/dp/B071HX9NX6/

Technical preparations: The assembly

- Assembly is very clear and quickly done.
- Download of the operating system for the SD-card:
<https://github.com/kdoren/jambox-pi-gen/releases>
- German tutorial on how to install the operating system on the SD-card for the RasPi4:
<https://www.youtube.com/watch?v=cUcOt4SJczY>
- The rest is connected via USB and the network (as followed)



Try Outs with Team Iceland



Workshop Materials

HOW CAN YOU CONNECT TO JAMULUS WITH THE HELP OF THE MUSIANDRA KIT?

Preparation: This is what you will find in the case (*MUSIANDRA kit*)



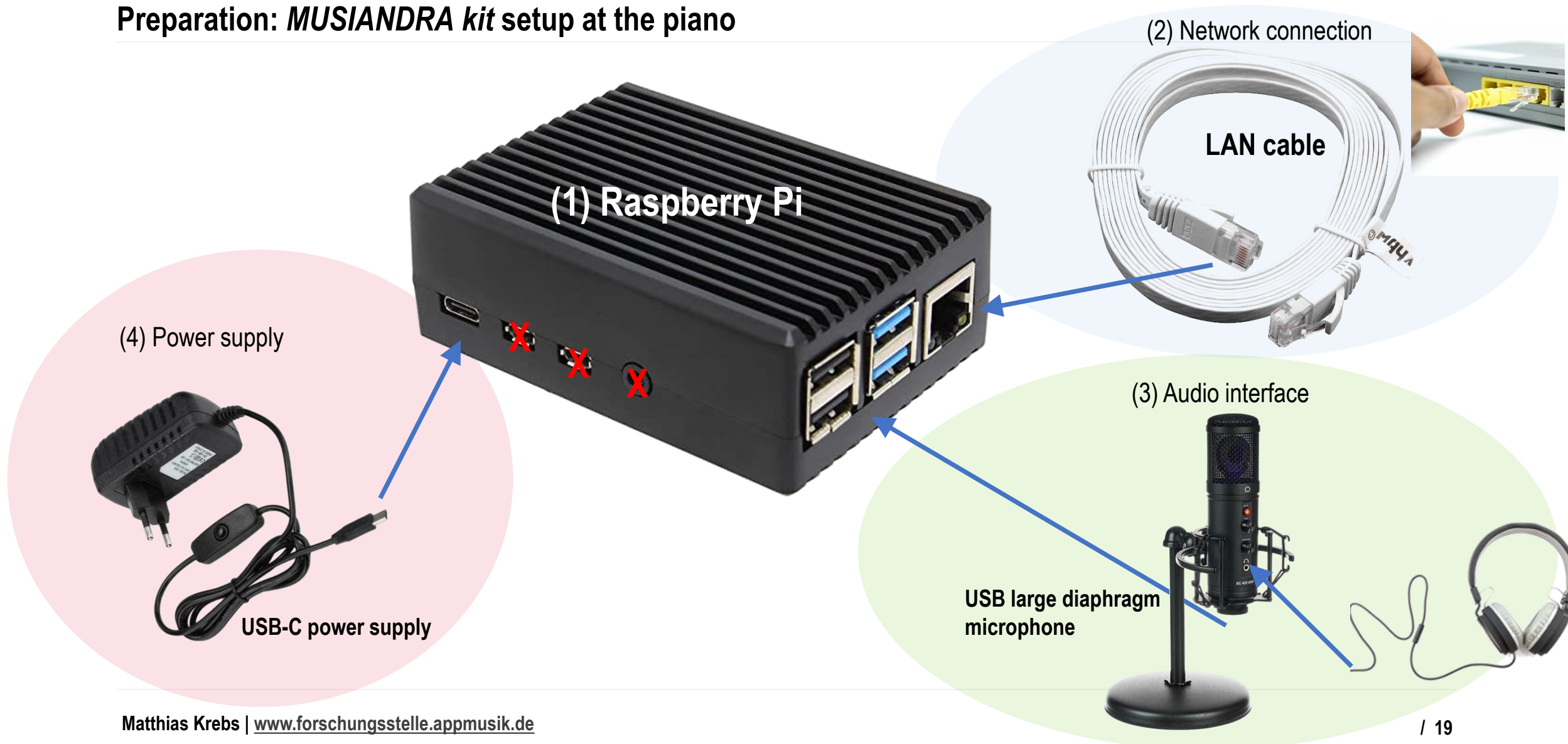
What to prepare for the introductory workshop?

- The "Raspberry Pi 4b" (RasPi4) is a small mini computer.
- 1. The RasPi4 must be connected directly to the router (e.g. Fritzbox) using the LAN cable (included in the set).
- 2. An illustrated manual shows how to connect the single components of the *MUSIANDRA kit* and can be found on the next pages.
- 3. You need a headphone with cable (do not connect directly to the RasPi4, but to the USB microphone).
- 4. You need a laptop or a tablet (without special software!) to control the RasPi4.
- It is worthwhile to use the laptop also (parallel) to facilitate the communication.
We are using Zoom or WhatsApp.

Raspberry Pi 4b



Preparation: *MUSIANDRA kit* setup at the piano



Preparation: This is how the assembled *MUSIANDRA kit* should look like

Headphones are required

The microphone-interface



Power plug

LAN cable must be plugged into a router

Every tablet or laptop in the same network can be used as control panel of the RasPi4. (wifi is ok)

Additionally a headphone distributor is a necessary component

The headphone distributor has to be plugged into the microphone-interface



teacher

student

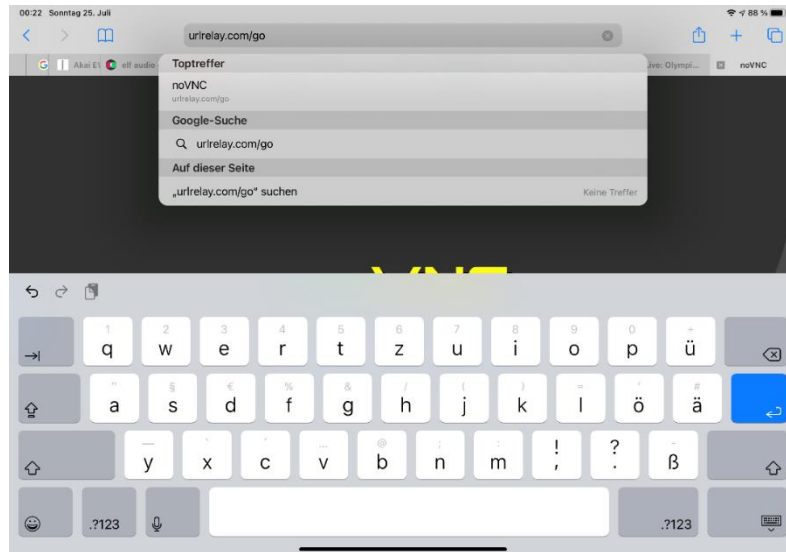
**Our favourite
headphone
distributor**



Establishing a connection: Starting Jamulus on the RasPi4

To connect to the RasPi4, it must be accessed via network. For this purpose, an Internet browser (e.g. Safari or Firefox) can be used on a laptop or tablet. Please enter the following in the address line:
urlrelay.com/go

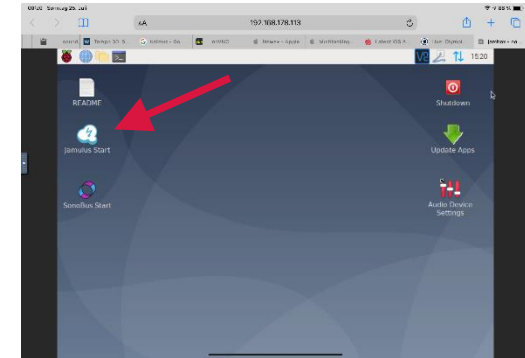
1



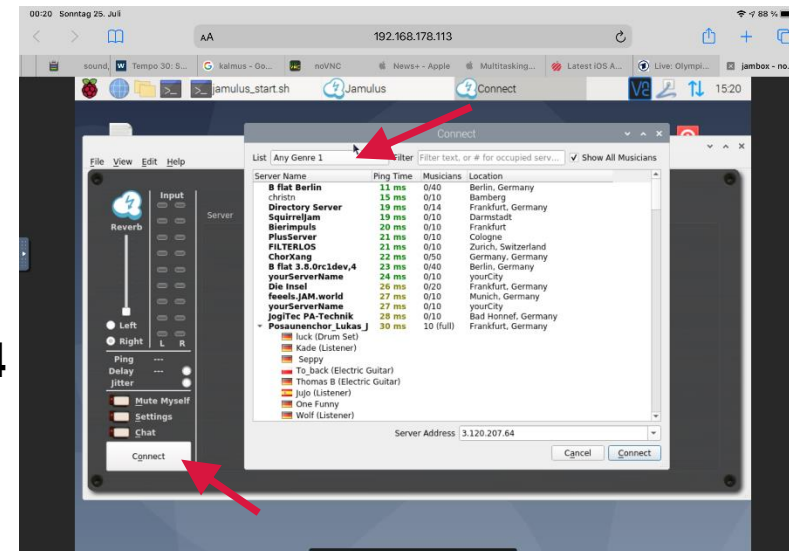
2



3



4



Live Demonstration

- In this demonstration, Alexander and I play to give you an insight.



MUSIANDRA
CONCERT REVIEW

Our concert ...

- The concert was our first try. We got it up and running within a few rehearsals together.
- That is why we only informed the families involved and colleagues.
- As far as we know, this was the first concert in the world to take place in this form.
- The concert lasted 45 minutes.
- All in all, it went well and there were 38 Zoom participants for the most part. From France, Germany, Iceland and also from Turkey.

Thank you very much - it was a great concert! Good luck for the next activities!

Hello to the Berliners and Icelanders! It was a pleasure to see and hear you again! :)

MUSIANDRA

22. Jan. 2022



four hand piano concerto

0, Seiber, Walz, Unnur and Alexander

1, Seiber, Tango, Emma and Lukas

2, Seiber, Blues, Massimo and Gudridur

3, fantasy in f minor Schubert, First part, Adelina and Ilan

4, Seiber, Tango habanera, Élisabeth and Marzi

5, Seiber, Ragtime, Adelina and Basti

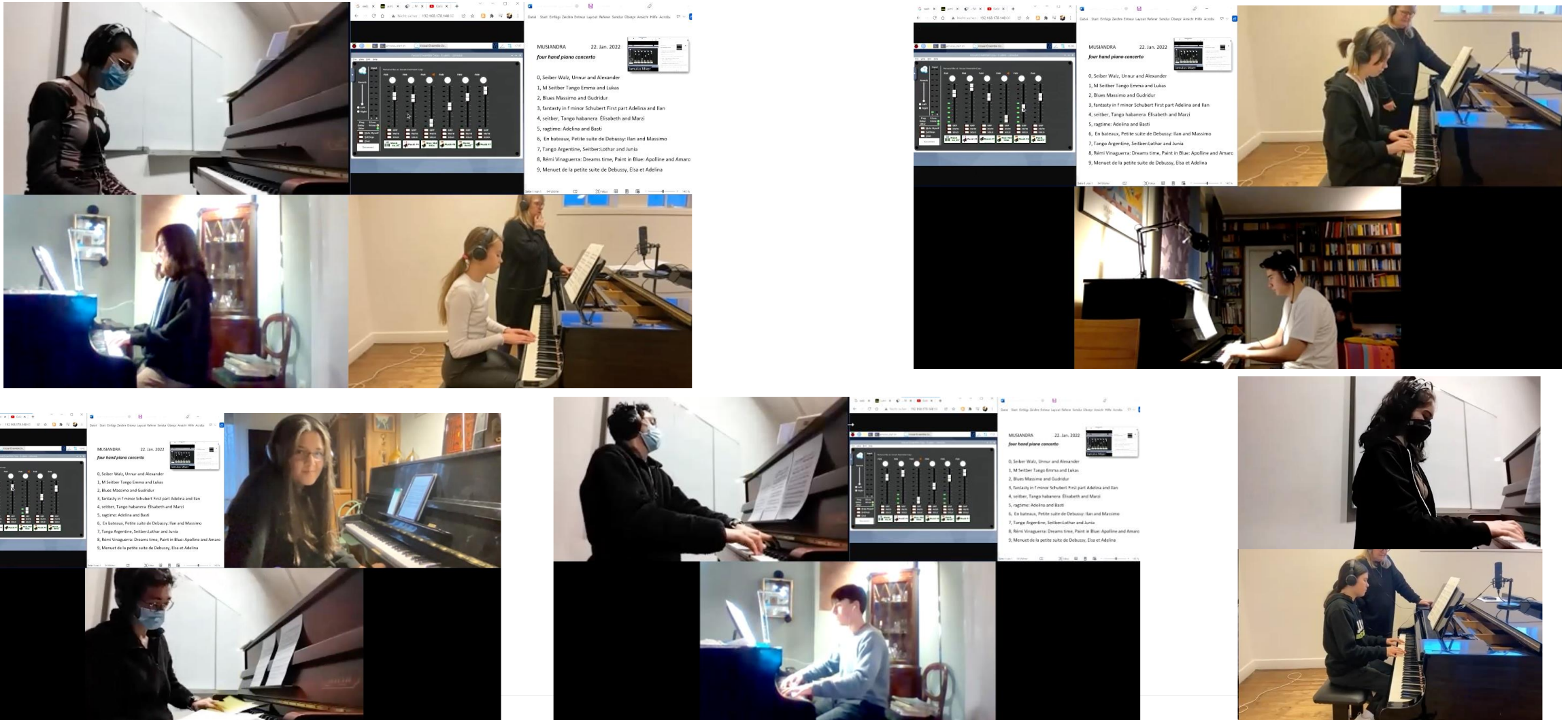
6, En bateaux, Petite suite de Debussy, Ilan and Massimo

7, Seiber, Tango Argentine, Lothar and Junia

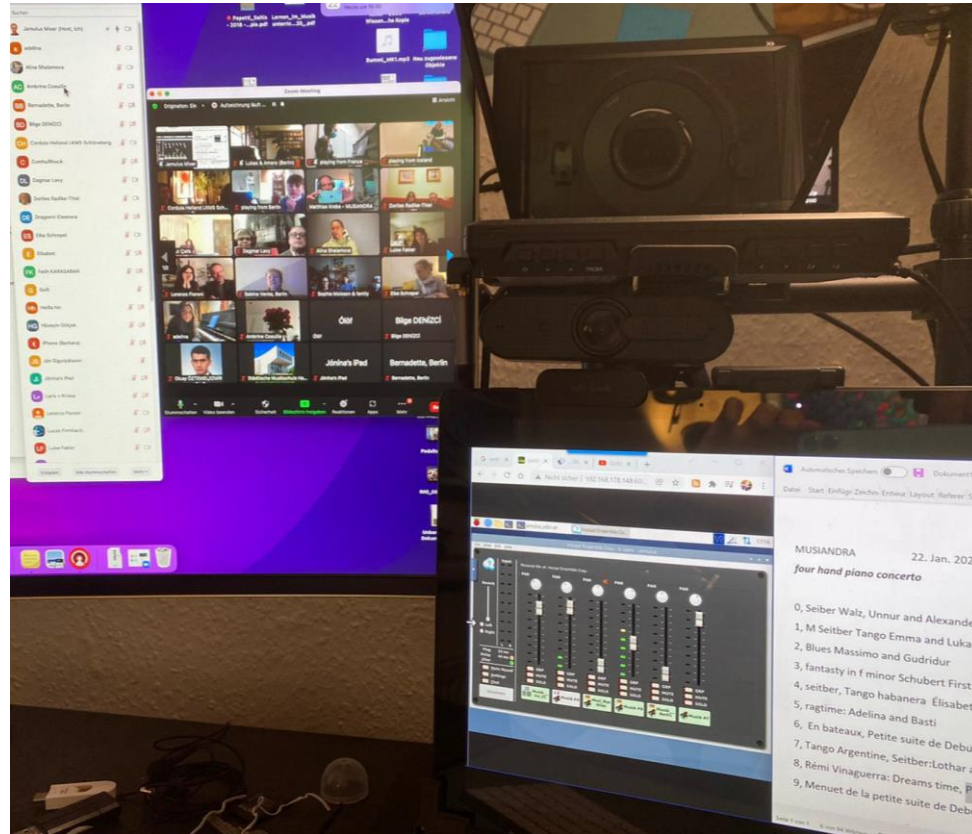
8, Rémi Vinaguerra: Dreams time & Paint in Blue: Apolline and Amaro

9, Menuet de la petite suite de Debussy, Elsa and Adelina

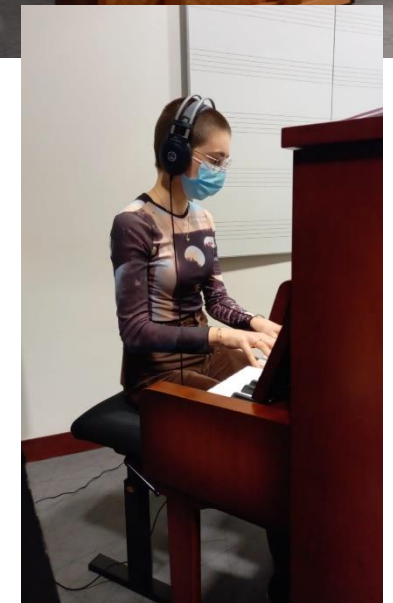
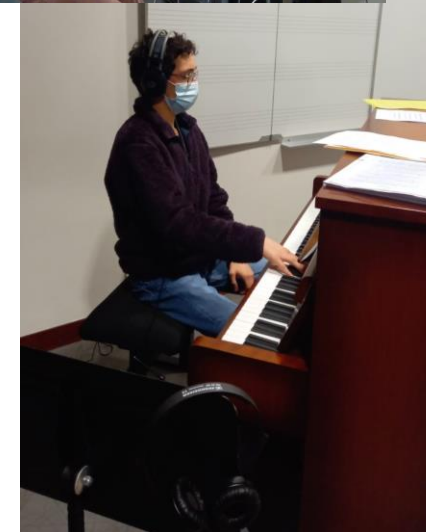
Photos from the concert (screenshots)



Photos from the concert



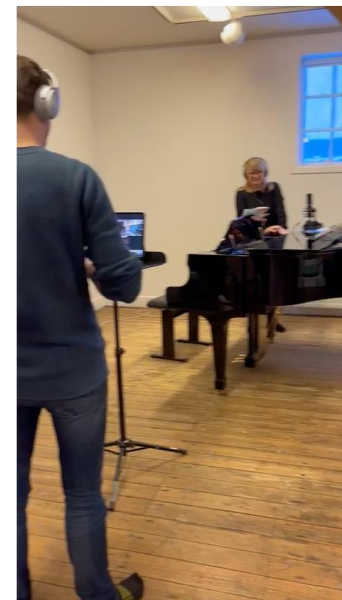
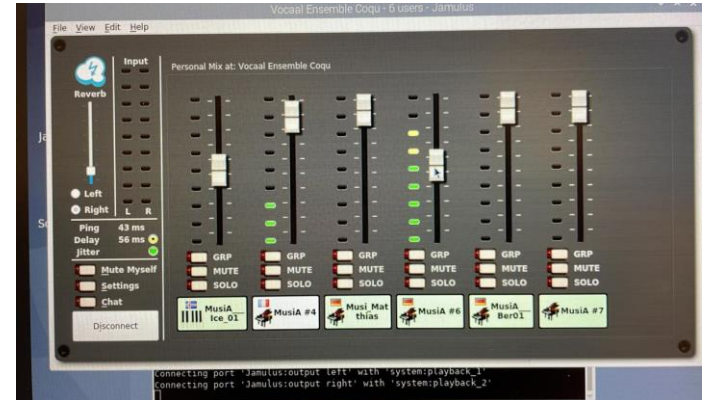
Paris



Photos from the concert



Berlin



Iceland



MUSIANDRA

LEARNINGS / REFLECTION

Learnings from the preparations

- **Communication via Jamulus**

- The common rehearsals with many students made it difficult to establish a differentiated communication.
 - New teaching situation: two teachers present. Who makes the announcements? How is criticism carried out?
 - Which bar to start at again? – It was especially difficult that the teachers could not simply show in the notes where to go next.
- It is worthwhile if there is some kind of moderation that one teacher takes over. Rehearsing with duos only are more productive.

- **Interplay via Jamulus**

- In pieces with a joint beginning, either agree on whether to count in (who will do this) and who should be the leader, since it is not possible to hear the joint breathing well (improving the interplay during entries).
- Also in digital music making it seems possible to have the perception for differentiated playing (dynamics, agogics...). It is necessary to practice, even without the physical presence of the other, to dare and implement expressive playing.

Learnings from the preparations

- **Statements on the motivation of the students by their teachers**
 - “There was no grumbling about the additional dates for rehearsals and the concert. On the contrary, they found it exciting to be there, even in the presence of their parents via zoom.”
 - “The joy and pleasure of making music and playing together was palpable and audible. Great motivation to practice. The joint meeting of the German participants was also very motivating.”
 - “My pupil had a lot of fun and it was a highlight in her daily Corona life.”



Learnings from the preparations

- **Technical problems**

- Since there are no or only a few rooms at music schools with cable connection, the effort to create a possibility in the music school is high.
- In Paris, Vanessa had to organize an internet expert to make sure there was a LAN cable in a particular room. This took several months.
- A suitable server must be clear beforehand. Otherwise, there can be long waiting times until a server is found spontaneously.
- Some students had the set at their homes: there were problems with the microphones not being set up very well and probably the levels were not optimal either. Workshops should have been offered for students as well.

Learnings from the concert

- **Responsibility**

- It was not clear who is actually responsible for the concert. Who takes care of the program? Who does the moderation? Who keeps an eye on the technology?

- **Soundcheck**

- The soundcheck went quite well. One hour was enough.
- Besides Jamulus, there should also be a common chat for organizational concerns: e.g. WhatsApp.
- The audience of the concert could be present via Zoom. The Jamulus sound was fed into Zoom with a mixer.

- **Concert moderation**

- About the student (age, place of residence, how long they have been teaching) and something about the piece
- Visualization from where the current musicians are playing.
- It would be good to pay attention to the background design on the stages.



Learnings from the concert

- **Technical equipment at the performance venue:**
 - A laptop/iPad as a camera pointed at the pianist.
 - A headphone distributor at the mic so the pianist and teacher can listen together. The headphones should be half-open and have a longer cable.
 - When not playing the piano, the microphone can be muted.
 - A laptop/iPad for watching when not playing, with headphone distributor and headphones.
- Multiple *MUSIANDRA kits* create independence, but this also increases the complexity in the concert. The different locations should have been tested beforehand. The students should have practiced the technique during the rehearsal phase (leveling and microphoning).

Central learnings


- “Great opportunity, very inspiring in terms of expanding the possibilities for exchange, togetherness, expanding the (musical) horizon.”
- “For the low-contact corona time absolutely helpful not to forget the togetherness!!!”
- “Digital togetherness requires different attentions than in presence play - thus expands alertness, attention, listening goals...”
 - “The teachers should just try the pieces via Jamulus, then they know how it is. Was only partially tried out.”
- Rehearsals should be better in small groups, while the concert can be played together (i.e. music school).
- Equipment can be lent to students so they can connect directly from home.
- There was no exchange between the piano teachers involved. It was prepared individually and then the students had to come spontaneously. About Jamulus was not actually worked musically in detail.



MUSIANDRA

Q & A

Links / Sources

- www.musiandra.org 
- <https://jamulus.io> (en, de, fr & es)
- <http://forschungsstelle.appmusik.de/musikpraxis-online-im-ensemble-proben-mit-jamulus/> (de)



- <http://forschungsstelle.appmusik.de/gemeinsam-online-musizieren/> (de)
- <https://soundzeug.united-hosting.eu/jamulus/index.php> (de & en)



Author

Matthias Krebs is working as a research assistant at the **Berlin University of the Arts**, where he heads the Research Center for Mobile Music Making & App Music (Institute for Digital Music Technologies in Research and Practice). His research addresses the educational potential arising from the changes in musical practices in the context of the development of mobile technology. Starting in 2009, Matthias Krebs is dealing with the systematic investigation of forms of musical practice with digital music technologies, in particular the phenomenon of mobile music making as well as the resulting pedagogic and artistic implications of this changed musical practice. Furthermore, Matthias Krebs is the author of numerous specialist articles on the topic of technology-mediated music making and is regularly active as a speaker at conferences, as a moderator and as a passionate blogger.

