

REACTIVE ENVIRONMENT FOR NETWORK MUSICAL PERFORMANCE USER MANUAL

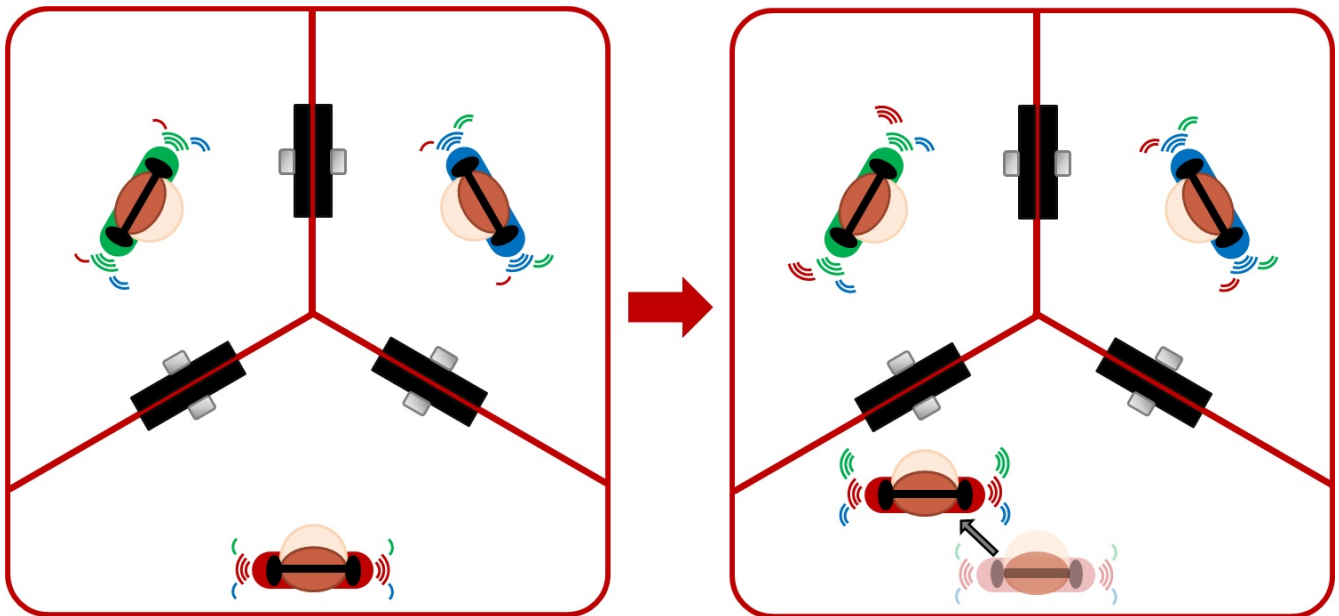
Part 1: Overview

Welcome to the Reactive Environment for Network Music Performance!

Our system allows you to perform with two other remote performers, while taking advantage of our five special features: Dynamic Volume, Dynamic Reverb, Musician Spatialization, Mix Control and Track Panning.

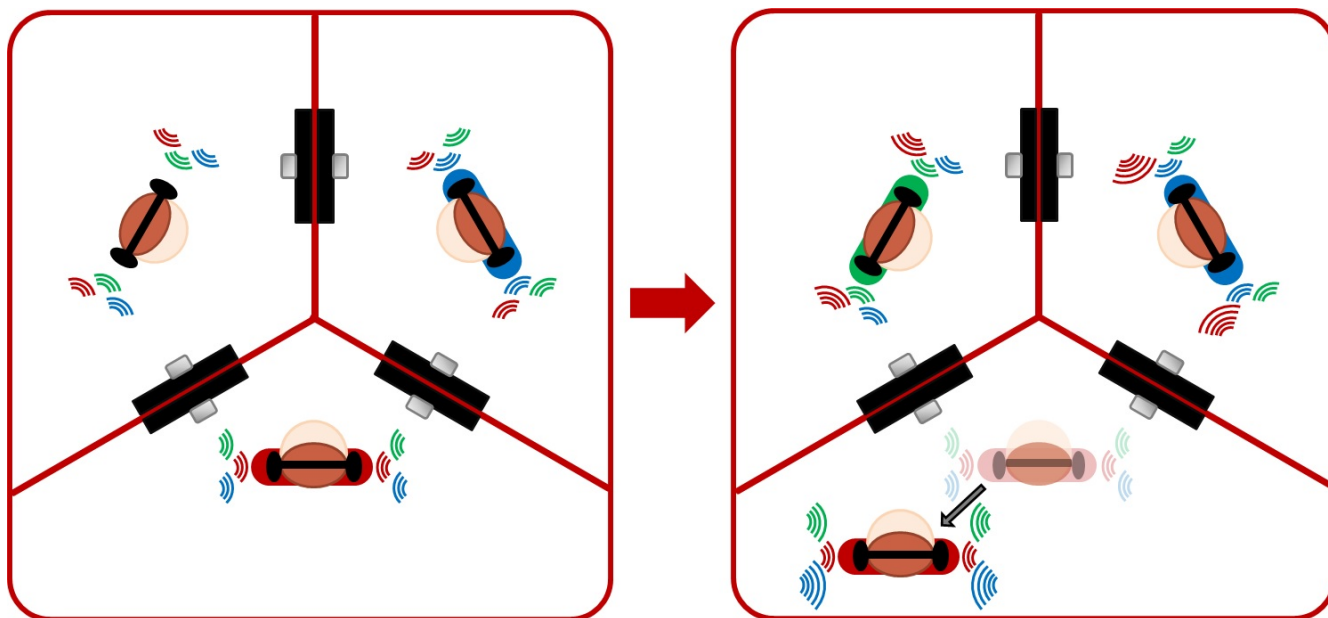
Dynamic Volume

Imagine a distributed performance setting where you can hear the other musicians via headphones, and see each of them on a separate monitor. As you approach the monitor on which you can see one of the remote musicians, you will be able to hear the volume of their instrument and/or vocals as gradually getting louder. They will also hear the volume of your instrument and/or vocals as getting louder. The converse holds true: as you move away from that monitor, both of you will experience each other's volumes as getting quieter. This feature not only allows you to interact with the remote musicians and affect their sound, but also to create your individual mix based on your position in the room.



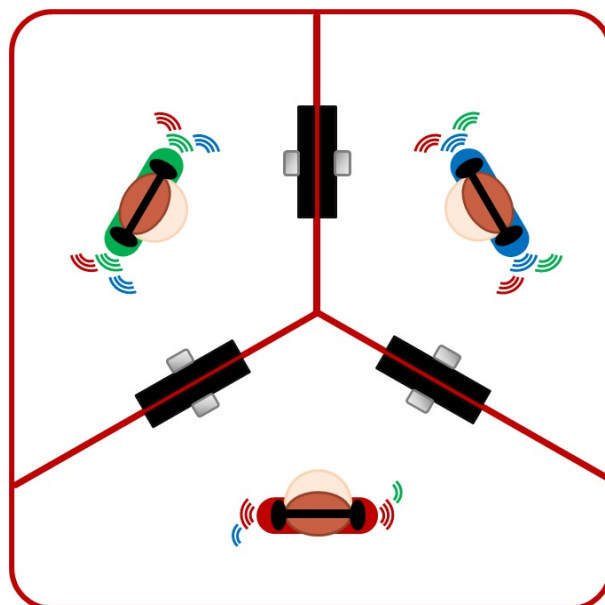
Dynamic Reverb

The Dynamic Reverb feature allows you and the other musicians to affect each other's reverb levels by moving about your local spaces. As you move away from the monitor on which you can see one of the remote musicians, you will be able to hear the reverb levels of their instrument and/or vocals gradually increase. They will also hear your reverb levels increase. The converse holds true: as you move towards that monitor, both of you will experience each other's reverb levels as decreasing. This feature helps you gain a sense of the dimension of the virtual space you and the remote musicians share together.



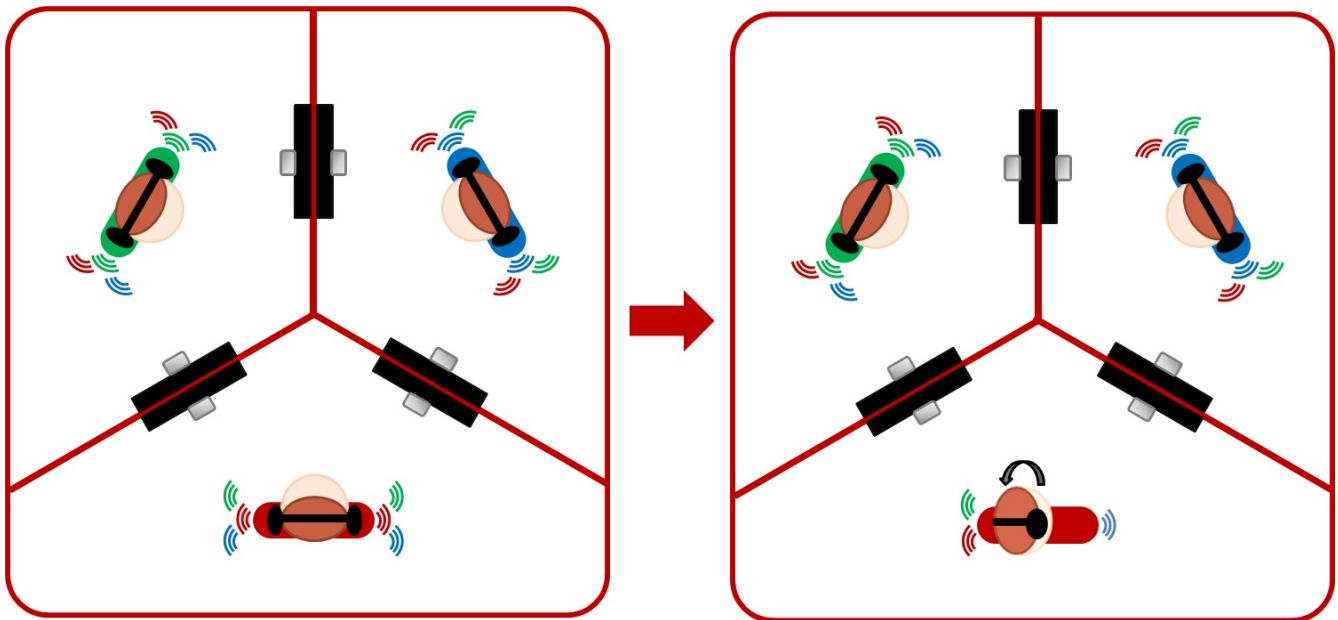
Musician Spatialization

The Musician Spatialization feature allows you to experience the remote musicians' instruments as spatialized sound sources within his own, local space. For instance, when facing straight ahead, you will hear the musician whose monitor is on your left mostly through your left headphone, and the musician whose monitor is on your right mostly through your right headphone. This spatialization effect follows your head orientation, and changes accordingly. This feature helps you gain a sense of the remote musicians' positions in relation to you within the virtual space you all share.



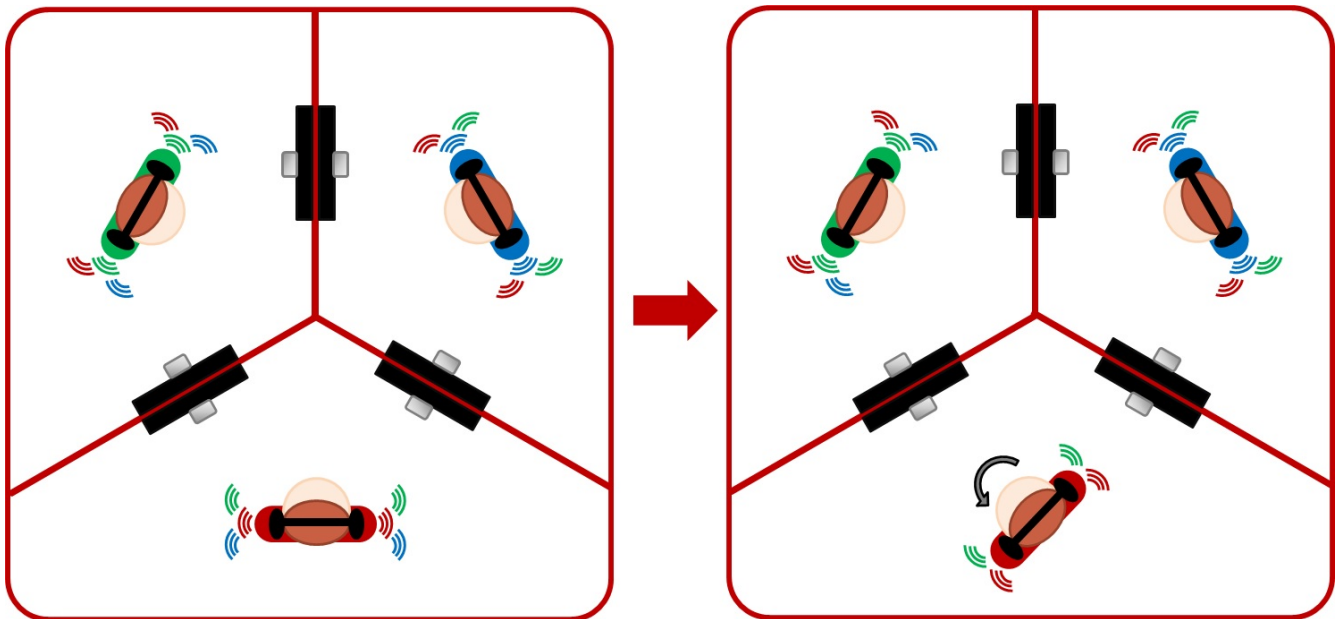
Mix Control

The mix control feature allows you to change the mix of your instrument and/or vocals with those of the remote musicians by tilting your head in the direction where you want to concentrate the sound of his own instrument. For instance, when you tilt your head to the left, you will be able to hear what your instrument and/or vocals sound like when mixed only with those of the musician whose monitor is to your left, coming through your left headphone. The instrument and/or vocals of the musician whose monitor is to your right will continue to play unaccompanied through your right headphone. The converse holds true if you tilt your head to the right. This musician allows you to hear what your instrument and/or vocals sound like when mixed with those of the remote musicians', one at a time.



Track Panning

The Track Panning feature allows you to pan between the tracks of the two remote musicians by turning your body towards each of the monitors. When you turn your body towards the monitor to your left, you will be able to hear that musician's instrument and/or vocals solely through your left headphone. The instrument and/or vocals of the musician whose monitor is to your right will then go quiet in both headphones. The converse holds true when you turn your body to the right. Your instrument and/or vocals will continue to sound the same through both headphones throughout.



PART 2: Requirements

Software Requirements

Here is a list of packages required to run our Reactive Environment for Network Music Performance:

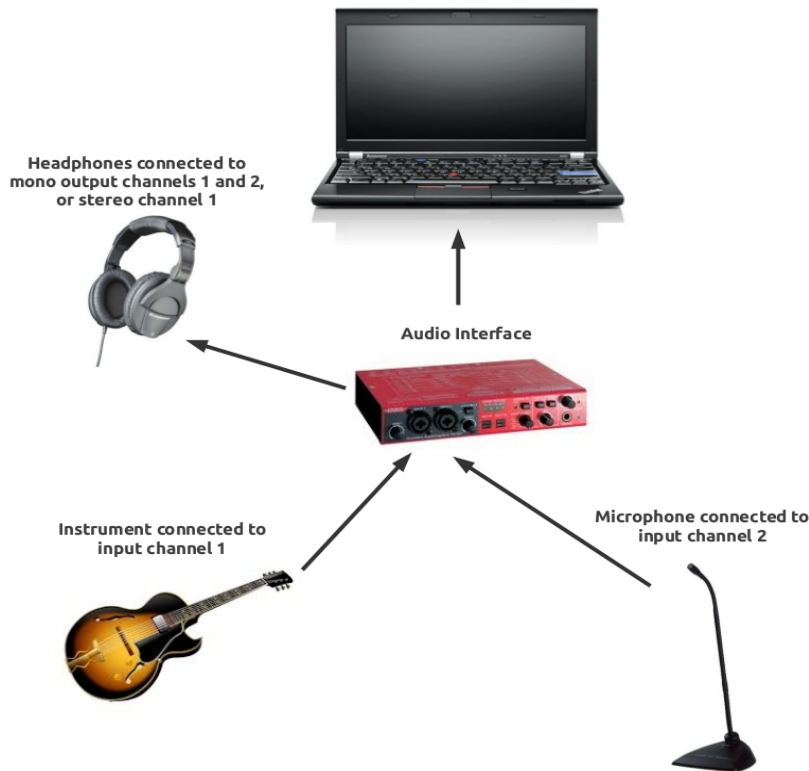
- linux-lowlatency
- jackd, qjackctl, libjack-dev
- jacktrip
- jmess (requires: libasound2-dev, g++, qt4-dev-tools)
- supercollider, supercollider-gedit, supercollider-dev, libsclang1
- java-8-oracle (or equivalent Java Runtime Environment, such as openjdk-6-jre or openjdk-7-jre)
- SwingOSC
- OpenNI (requires: git, freeglut3-dev, libusb-1.0-0-dev, doxygen, graphviz)

To install any of these packages, please refer to the instructions in '**Step by Step Installation Instructions.pdf**'. Alternatively, to install all of them at once, please refer to the instructions in '**Automatic Installation Instructions**'.

Hardware Requirements

Here is a list of hardware required by **each musician** to set up and use our Reactive Environment for Network Music Performance

- **Instruments:** At the moment, our system only supports electric or electronic instruments. This is because the sound of an acoustic instrument can easily drown the mix coming through the headphones, which can in turn prevent you from optimally experiencing the effects of the system's features.
- **Closed headphones:** Allow each musician to hear their own audio mix.
- **Microphone:** Allows the musicians to verbally communicate with one another.
- **Audio Interface:** Although you technically can try to plug an instrument directly into your computer's input channel, we strongly recommend using an external audio interface, as they significantly improve overall quality and reduce latency. Your interface should have at least 2 inputs, and 1 stereo or 2 mono outputs. If you only have mono outputs, you will need to combine them to experience a stereo effect. This can be done using a stereo female to two male Y-cable. Please follow the audio hardware configuration seen in the figure below.



- **Microsoft Kinect:** If you want to use the system's special features, you will need a Microsoft Kinect for position and orientation tracking. Without a Kinect, you can still use our system without the features, for a more traditional distributed performance.
- **Cameras and Monitors:** Our Reactive Environment for Network Music Performance package does not provide the means for video streaming. You can choose your own method for doing so (e.g. Skype, iChat, Google Hangout). Ideally, each musician will need two monitors and two webcams, each mounted on top of a monitor. Each of the monitors will display one of the remote musicians, and the webcam mounted on it will send a video stream of the local musician back to that remote musician.

In order to correctly experience the Dynamic Volume Mixing and Enhanced Stereo Panning features, we strongly recommend you follow the hardware configuration illustrated in the image below.

PART 3: Getting started

1. Boot your computer and choose the linux-lowlatency kernel from the GRUB menu.
2. Launch JACK by typing the following command in a terminal:

```
# qjackctl
```

3. Click on 'Setup' and set the following options:

- Select 'Realtime'
- Select 'No Memory Lock'
- Frames/Period: 256
- Sample Rate: 44100
- Periods/Buffer: 2

Note: It is very important for ALL musicians to choose the same settings in order for jacktrip to work correctly. If you prefer to change the settings listed here, please make sure all the other musicians do so as well.

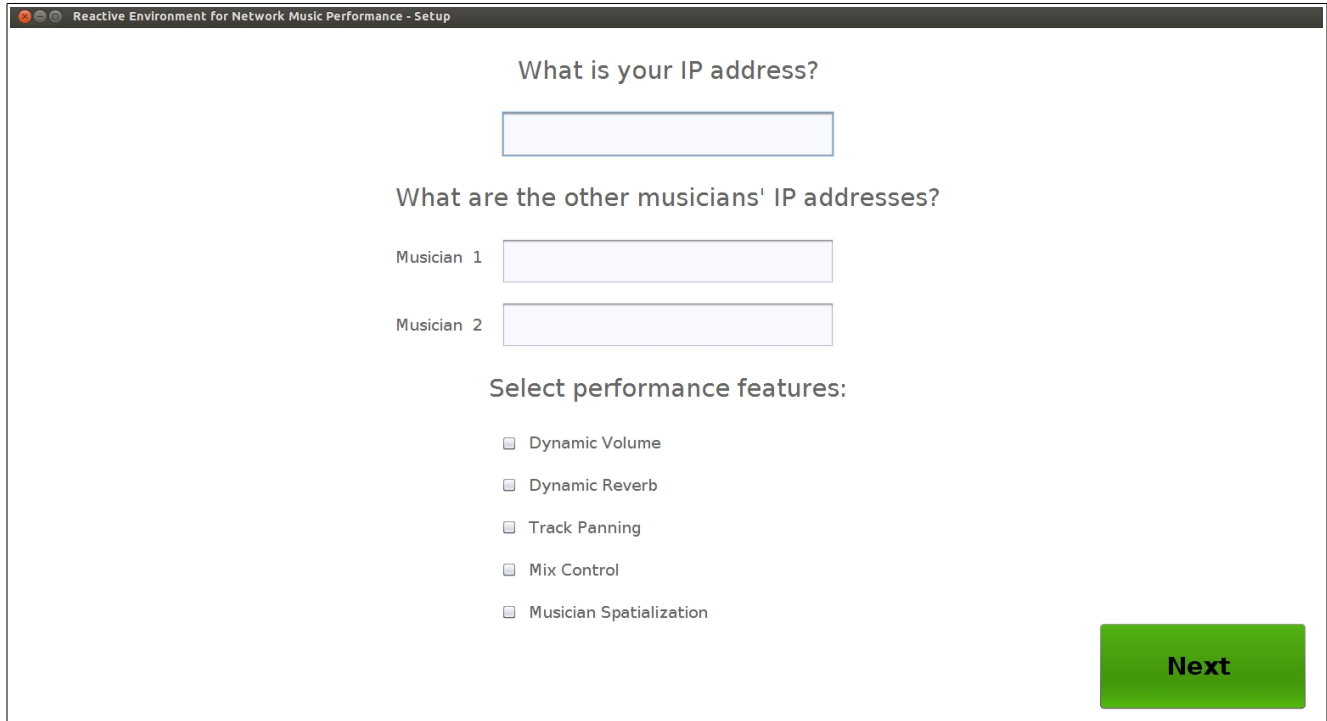
4. In a terminal, go to your '**RENMP**' folder (where you cloned our git repository) and type the following command:

```
# ./reactive_environment_for_NMP.scd
```

This will launch our application.

PART 4: Settings

1. When the application first launches, you will see the following screen:



Reactive Environment for Network Music Performance - Setup

What is your IP address?

What are the other musicians' IP addresses?

Musician 1

Musician 2

Select performance features:

- ☐ Dynamic Volume
- ☐ Dynamic Reverb
- ☐ Track Panning
- ☐ Mix Control
- ☐ Musician Spatialization

Next

2. Enter your IP address and those of the other participating musicians in the appropriate text boxes.

Note: You must press enter after typing in each IP address. In addition, the IP addresses you enter will be saved, and automatically loaded next time you start the program.

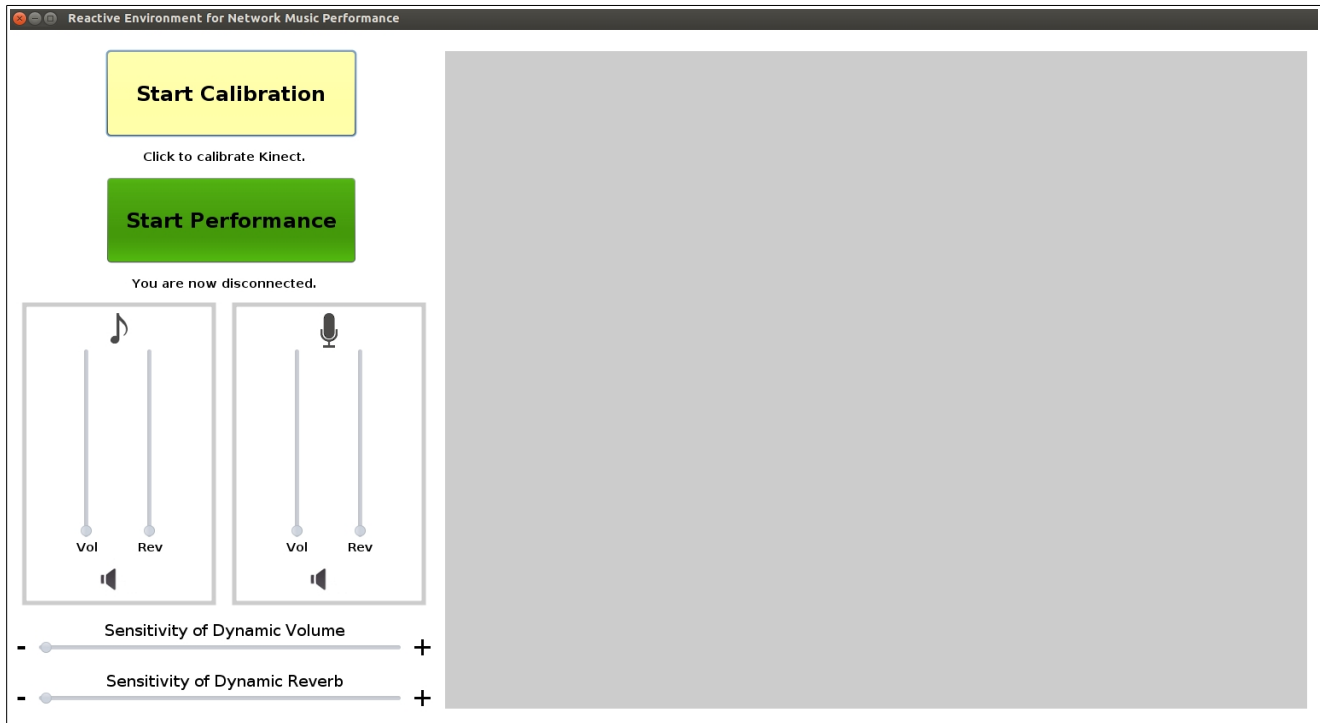
3. Select the features you would like to use by clicking on their corresponding check boxes.

Note: You cannot use Track Isolation and Musician Spatialization at the same time, as they are both dependent on your body orientation.

4. When you are done, click the 'Next' button to move on to the main screen.

PART 5: Calibrating the Kinect

1. To calibrate the Kinect, click the 'Start Calibration' button on the main screen.



2. A depth view window will be activated. Move around your entire performance area, making sure to cover its extremities.



3. While we collect samples, the completion status of calibration will be displayed as a percentage. Continue to move until it reaches 100%.

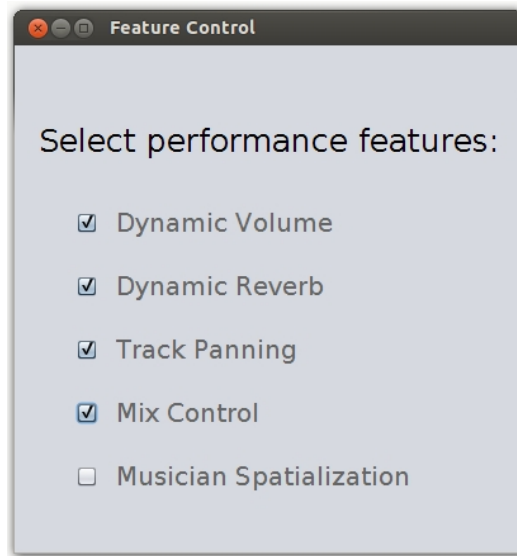


Note: Your calibration results are saved. You do not need to perform a calibration before each performance, unless you have moved the Kinect.

PART 6: Performing!

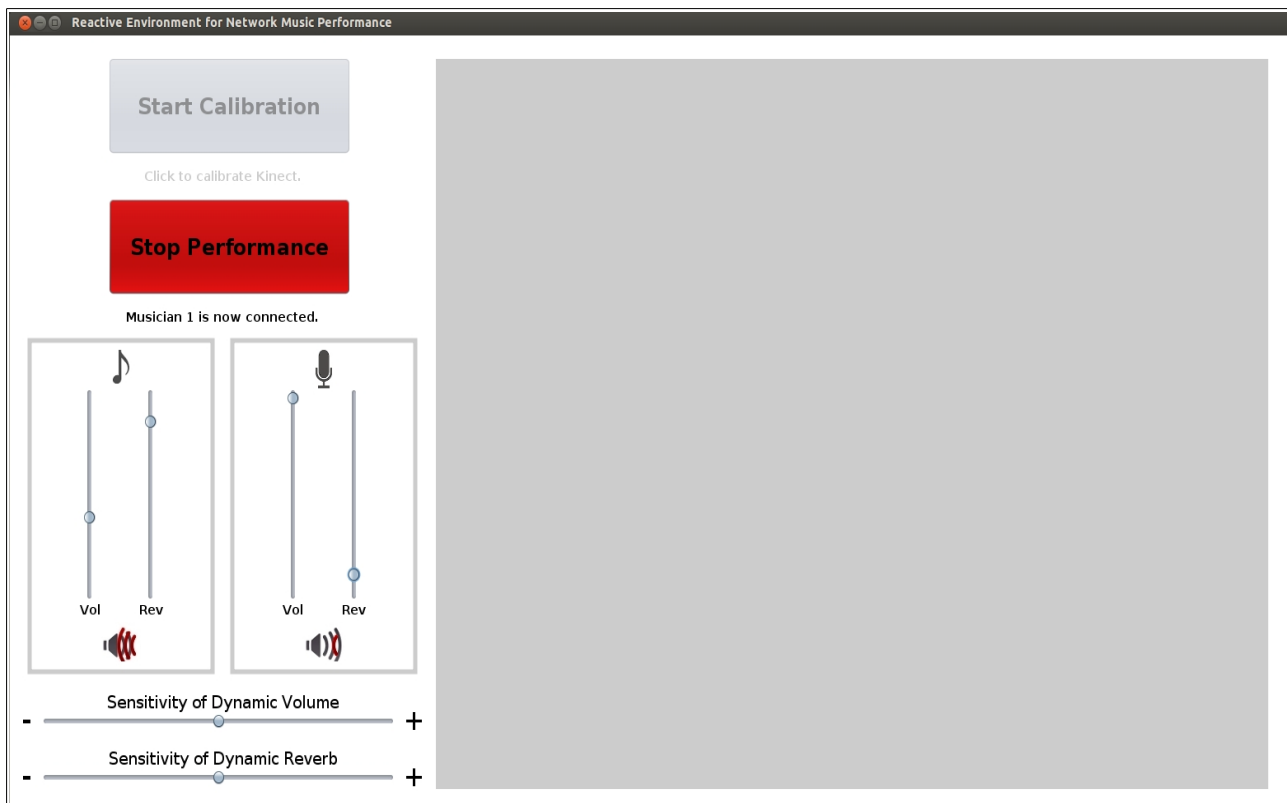
1. To begin, click on the 'Start Performance' button. This will also connect you to the other musicians. At this point, you should be able to hear any of the other musicians who are also connected.

2. After you press the 'Start Performance' button, another smaller window, depicted in the figure below will pop up. This window shows which features you selected on the introductory screen, and also allows you to select and deselect features throughout the performance.



3. You will be informed as each of the other two musicians are connected. As each of the other musicians connects, you will be able to hear their instruments.

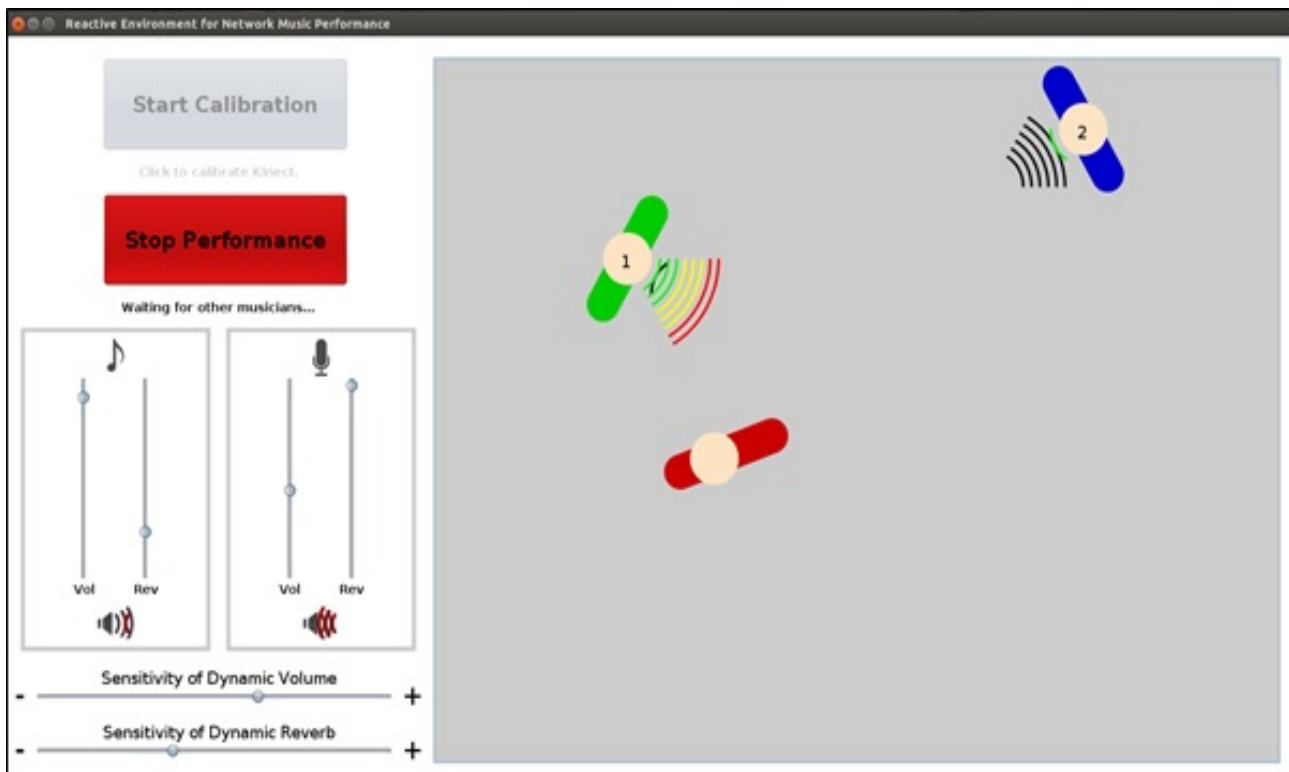
In the figure below, for example, only Musician 1 (as defined according to the IP address that you entered on the introductory screen) is connected. When both remote musicians are connected, this prompt will change to 'All musicians are now connected.'



4. You can adjust your instrument's volume and reverb levels using the corresponding sliders within the box labelled with a music note. Similarly, you can adjust your vocal volume and reverb levels using the corresponding sliders within the box labelled with a microphone. This is how the other musicians will also experience your instrument and vocal levels when none of the features are active.

5. As you and the other musicians move around, you will be able to see 'avatars', or graphically animated representations of each other on the screen, as illustrated in the Figure below. The avatars represent bodies as seen from the top down. Your avatar is red and has no label, whereas the other two musicians' avatars have the labels '1' and '2' (corresponding to Musician 1 and Musician 2, as defined when you entered the IP addresses at the start).

6. Each avatar's direction represents its corresponding musician's body orientation.



7. If you are using the Dynamic Volume feature, each of the other musicians' volumes will be represented as a number of coloured 'sound waves' emanating from their avatars. The louder the volume, the larger the number of crests.

8. If you are using the Dynamic Reverb feature, each of the other musicians' reverb levels will be represented as a number of black 'echo waves' moving towards their avatars. The greater the reverb, the larger the number of crests.

For example, suppose you are using both Dynamic Volume and Dynamic Reverb in the figure above. Musician 2 is standing closer to you than Musician 1. As a result, you hear Musician 2's volume as being much louder than that of Musician 1. This is illustrated through the number of crests in each musician's sound waves (coloured), with Musician 2 having a larger number. Similarly, you hear Musician 2's reverb level as being lower than that of Musician 1. This is illustrated through the number of crests in each musician's echo waves (in black), with Musician 1 having a larger number.

9. If you are using Mix Control, the head of each musician's avatar will move to the left or the right as they tilt their heads. This helps illustrate the level of mixing experienced by each musician, and is meant to graphically resemble a cross-fader.

For example, suppose you are using Mix Control in the figure above. You have tilted your

head to the right, to better hear yourself when mixed only with Musician 2. As a result, your avatar's head has moved to the right shoulder.

10. You can also change the sensitivity of the Dynamic Volume feature using the corresponding slider. A larger sensitivity means that you will experience a greater change in volume when moving smaller distances. Each musician sets their own sensitivity independently, and it does not affect the other musicians' Dynamic Volume sensitivity.

11. Similarly, you can change the sensitivity of the Dynamic Reverb feature using the corresponding slider. A larger sensitivity means that you will experience a greater change in reverb when moving smaller distances. Each musician sets their own sensitivity independently, and it does not affect the other musicians' Dynamic Reverb sensitivity.

12. At the end of the performance, click the 'Stop Performance' button. This will disconnect you from the other musicians and stop the audio.

That is all!

**If you have any questions or comments, please contact Dalia El-Shimy at
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