

O M S L O

NUN

Sarah Nemtsov

Electronics Documentation

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General description of the electronic part

The electronics of Sarah Nemtsov's "NUN" consist of two main parts

Each instrument is processed by one or more effects, some with different presets that are changed during the piece. The effects are (de-)activated by the musicians on stage by pressing a pedal. The switch pedal enables or disables the effects on the corresponding instrument. Furthermore the four instrument groups (strings, percussion, piano and winds) are switched to the speaker positioned behind or above the musicians or to an exciter attached to a percussion instrument set in the front. All the instruments should be fully amplified independent from the patch, the sound should be powerful and full.

There is an optional wii controller that can be worn by the conductor that modulates some of the instruments' effects.

I very much recommend to divide the work between two persons, one doing only the electronics and another one doing the sound direction, not only during the rehearsals but on the show.

Please read this document carefully, I tried to make the documentation as clear and complete as possible to make your life easier. If you notwithstanding have questions you can contact me at:

maximiliano@omslo.com

Have fun with the piece!

Equipment

In order to perform the piece you will need the following equipment:

MIDI

6x Switch Pedals (Like the sustain pedal used for Keyboards)

6x long 6.3mm extension Jack cables (one side male and the other female)

6x Footswitch to MIDI (or one where you can plug 6, I recommend the F8 Footswitch / MIDI Converter from MIDI Solutions)

MIDI → USB Interface with at least 8 Inputs and 2 Outputs (and if possible a couple of USB Inputs, I recommend the ESI M8U eX)

MIDI Controller, with 20 buttons (optional but recommended)

Optional

Wii Controller + Nunchuk

Bluetooth 4.0 USB Dongle

USB extension cable

Computer

1x MacBookPro (Stage) with PureData und (optional) Oscillator.

This computer must have at least 2x USB ports and 1x network port (RJ45).

1x Laptop (FOH) with Puredata + Audiointerface with at least 8x Input and 16x Output. At the time of writing is possible to use the Dante Virtual Soundcard.

This computer must have at least 1x USB port and 1x network port (RJ45).

I strongly recommend to use a backup for at least the computer at the front of house, ideally for both.

Network

1x gigabit switches
1x long RJ45 cat5 cables (stage to foh)
10x RJ45 patch cables

Audio

8x full range loudspeakers on stage (on stands or hanging behind/above the musicians)
2x full range loudspeakers in front of the stage (like normal PA position) + subwoofers
4x audio exciter + amplifiers (I used the DAEX32EP-4 Thruster 32mm Exciter 40W 4 Ohm from Dayton Audio)
12x clip microphones with clips for Violin, Viola, Cello, 2x Piano, Sax, Clarinet, Oboe, Drums [Snare and 3x Toms] (I recommend dpa4099) + 1x Microphone for the Bass Drum, and two Overheads for the cymbals
4x small membrane condenser microphones, for the instruments that are excited by the transducers
1x audio interface (one with 2x outputs and the other with at least 8x inputs, 16x outputs) (already listed on the computer part)
Mixing desk with at least 36 inputs and 24 outputs

Software

PureData 0.50 or later - <http://msp.ucsd.edu/software.html>
Osculator 3.0 – <https://osculator.net/> (optional, only needed if the wii controller is used)

Setting up

Audio setup

All instruments are to be miced very close, ideally with clip microphones. The microphones are first plugged into the mixing console and each signal outputted as direct out into the audio interface, with the exception of percussion and piano, who first need to be summed into a bus and then outputted, because the patch takes only one input per instrument. For the drum bus some testing and experimentation with the individual signal levels might be needed, to best find a balance that works for all the effects. I recommend to start sending the toms and snare only, and then maybe add some of the bass drum. The overheads tend to have too much leakage from all the other instruments (and speakers) on stage, so they will be probably not needed on the FX bus that goes into the computer.

The patch returns 14 channels of audio in total. One for each processed instrument, four for the exciters and two for the soundtracks that go to the main PA. The sound director then needs to route this signals to the corresponding output.

A note regarding the exciter's output: after performing the patch with another setup I decided to add all the outputs that go to each transducer inside the patch. This means that for example if the strings are routed to the transducer the patch outputs a sum of all three strings. So it is not possible to change the balance between the strings that go into the exciter. This doesn't really matter, as when the instruments are sent to the exciters the resulting sound is more like an effect than anything. It is not possible to distinguish between the single instruments in this case, so a very precise balance control is not needed. This reduces the amount of needed outputs by 8, which I found to be a big benefit for a piece that already needs a lot signal exchange between the mixer and the computer.

MIDI Setup

The computer on stage also acts as a midi central station. All switch pedals need to be plugged to this computer. For that you will need a switch to midi converter and an external MIDI interface with preferably four Inputs and four outputs. It is better if the MIDI converters are configurable; if not you will need to change the CC values in the patch. A detailed documentation about the MIDI CC notes and channels used can be found in [Appendix](#).

A note on the Midi Solutions products (at least the ones I had to use): all the pedal/switch to midi converters are powered via the input/thru midi port on the device. The company sells some adapters for midi/dc power supply, but this is actually not needed. All you need to do is plug some device to the midi converter's input and **send them a midi note or command**. On the stage patch sends a midi cc and note on startup to initialize the converters.

Network setup

This part is actually quite straight forward, it is important only important to open the FOH patch first, because if the stage patch is opened first and tries to open the connection will fail. Then you only need to check that the stage patch has the correct ip address configured on the [stage-osc-out] object and everything should work. You can turn on the autockeck on the stage patch to send all parameters automatically to see if you have a connection. You can also click the [print network messages] box to see the incoming messages on the console. The patches use Pd's native "[FUDI Protocol](#)" to communicate using a tcp connection. A complete documentation of the strings structure used by the patch can be found on the [Appendix](#)

Notes for the electronics director

it is important to know the piece very well and being able to “interfere” and correct some mistake that the performers may make. Performers have a lot to take care of when playing and often need assistance not only with the equipment but in understanding how the electronics works. You need to be able to understand and explain the behaviours of the patch and the pedals to the performers.

The switch pedals work as momentary buttons, the effects are on as long as they are pressed. If the pedal is released the effect is bypassed (I also tried a version where they acted as toggle switches, but it was difficult for the performers to know when the effects are on, particularly in the tutti parts). I would recommend not to change the pedals between the performers as the mechanics always a little different and musicians tend to struggle with that.

The optional midi controller can be helpful, but is not really necessary. In my opinion a computer keyboard (maybe with some stickers on the keys) is a better choice for the task, but you should speak with the electronics performer about it. A complete documentation about the MIDI mapping in the patch can be found in the [Appendix](#)

Each instrument (group) has two different “effect states”, wet and dry, and to “output routing states”, speaker and transducer. In order to have some independence between the amplification and the electronics, the patch behaves differently depending on the combination. The following table illustrates the concept using the violin as an example, but it is the same for all instruments.

Signal	FX	Routing	Result
violine	on	speaker	comes out of the output 1 and should be routed to the speaker
violine	off (bypassed)	speaker	nothing comes out of the patch (should only be directly amplified)

violine	on	transducer	comes out of output 11 and goes to the donnerblech
violine	of (bypassed)	transducer	comes out of output 11 and goes to the donnerblech

This can be somewhat confusing but without this behavior the slightly delayed dry signal going to the speakers would mix with the already present dry amplification and cause comb filtering.

The drum set and piano pedals are not “connected” because the players don’t have a pedal, their effects are always on.

Notes for the sound director

Nun is a powerful piece with a very direct (or close-up) sound. Nevertheless is important to create some localisation for the instruments on stage. It is important to have one speaker for each instrument, directly behind of the player. Depending on the room characteristics it may be necessary to also send some of the instruments to the main PA, but the localisation should remain on the performer’s position on stage.

I strongly recommend the use of clip microphones on all the instruments, including the piano and the drum set toms. Because of the effects, some of the playbacks and the general sound of the piece there are some similarities to pop music, those are desired and part of the piece.

The main PA system needs to be powerful enough with good coverage in the bass frequencies.

Some stretches of the piece sound very overwhelming and chaotic, enjoy them!

The conductor must have a monitor to hear the electronics. Depending on the stage setup, the pianist and drum set player might also need monitors to hear each other because they play a lot together.

Notes for the electronics performer

You have a variety of different jobs during this piece. On one side you change the routing of the instrument groups from the speakers to the transducers and back. You also start the soundtracks that are reproduced and change all the effects' presets in the piece. There is no extra part for you, is important that you play from the score to get some context and understand what is going on.

Your instrument is the computer with an optional midi controller. Please read the documentation about the [patch](#) to learn how to use it.

The Patches

There are two patches that belong to the piece.

It is very important that you **don't** change the folder structure, or move the patches somewhere else. If you need a fast access to the patches make a shortcut or alias but **don't** move them.

NUN_STAGE.pd (Stage Patch)

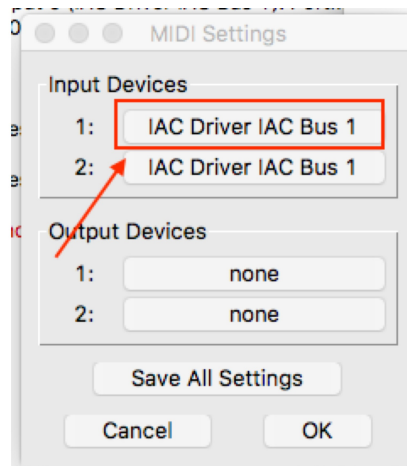
This is the patch that the electronics performer 1 plays with the computer on stage. With the help of a MIDI controller or the computer keyboard the performer can route the different instrument groups to the speakers or the exciter and play the audio files for the PA and transducers.

In the background, this patch also functions as a translator between MIDI and osc, and also sends all the translated information to the FOH patch. This is done in the background, the interface is hidden to the performer.

Setup

Before opening the patch (or PD) check that you have all the peripherals plugged to the computer. Then open the patch by double click or if you already have opened PureData, *file* → *Open* and search for the file with the file manager.

Then you need to configure the MIDI and Audio settings. For MIDI you click *media* → *MIDI Settings...* and you should see something like this:

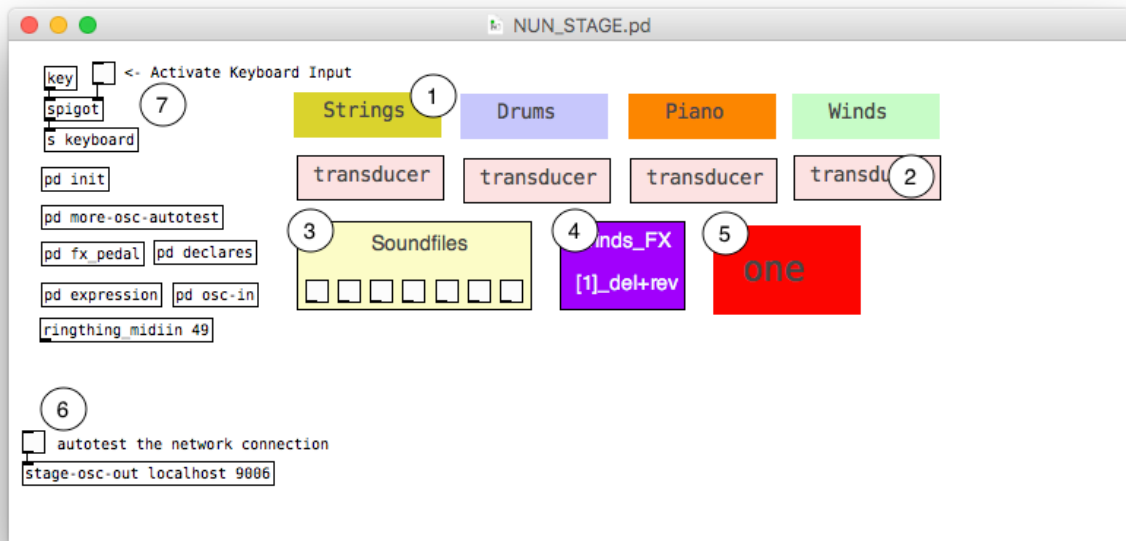


By clicking on the device's name you get a drop down menu where you can choose which devices you want to get MIDI from (Input) and to which devices you want to send MIDI to (output). You need to set your MIDI interface and controller as input and your interface only as output. Make sure to put your MIDI interface in the first slot. PureData interprets the MIDI channel of the controller in the 2nd slot as being 16 channels higher than the controller really is (so if your controller sends to channel one, PureData will interpret it to be sending on channel 17). Each higher slot adds than 16 channels to the controller.

Network

The object `stage-osc-out` manages the network connection in the patch. You need to change the first argument (`localhost` in the photo) and input the ip address of the computer at the FoH. Remember to open the FoH patch first.

Usage



1. Label to identify the instrument groups
2. Displays the actual routing of the instrument group
3. Displays the which soundtrack is being played
4. Displays the current effect for the winds
5. Displays the current preset for the piano effects
6. Turn on the auto test (sends all the parameters to the other patch to test the network connection)
7. Activates the computer keyboard input

By pressing INIT you initialize the patch and are ready to start the piece.

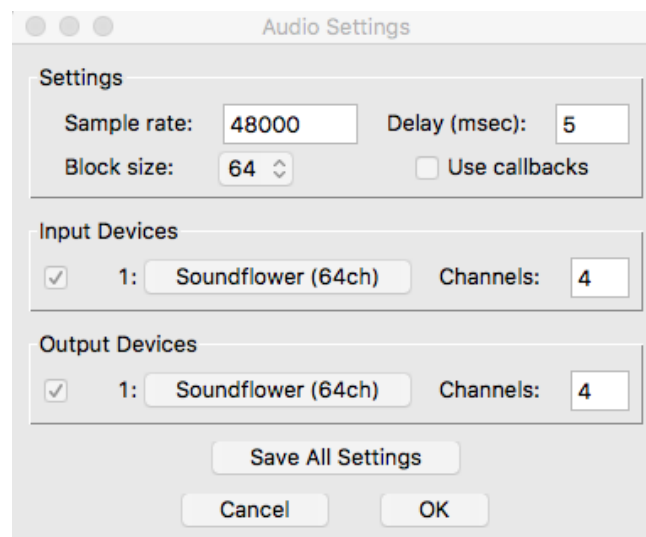
4.2 NUN_FOH.pd (FOH Patch)

This patch does all the audio processing for the piece. It takes one input per instrument (see the [Appendix 1](#) below) and outputs one channel for each instrument fx, four outputs for the exciters and two for the main PA.

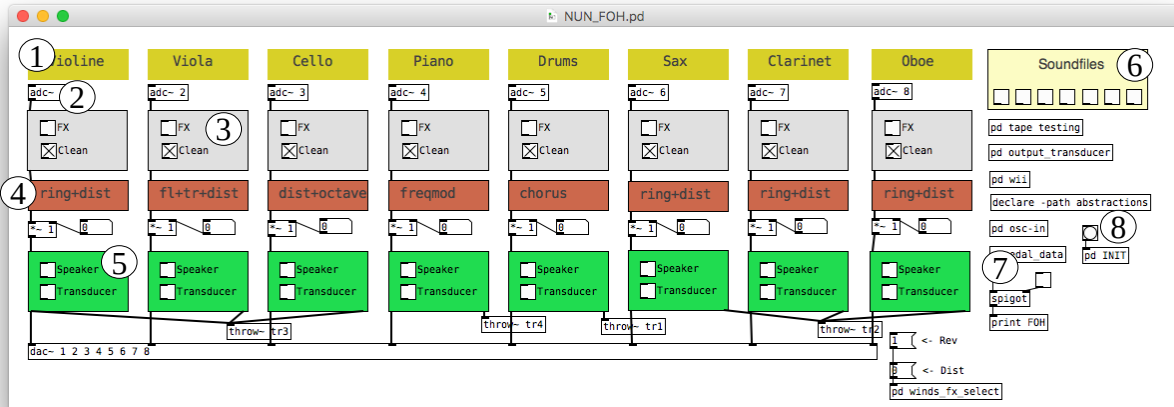
Setup

The audio and MIDI setups are the same as with the stage patch, but of course you need to select the right interface plugged to your computer.

The Audio setup dialog is very similar. You go to *media* → *Audio Settings...* and select your external sound card as input and output. Here you also need to make sure that the sampling rate is set to 48000. If you click the “save all settings” button, the configuration will be saved even if you close the program.



Usage



1. Label showing the instrument channels
2. The [adc~] object is the actual audio input with the corresponding input number
3. Displays the current state of the effect. You can manually change the state by clicking on the fx box
4. Displays the current fx preset
5. Displays the current state of the output routing. You can manually change the state by clicking on the speaker box
6. Displays the current soundtrack that is being played. The object [pd tape testing] can be used to trigger the soundtracks manually (for example during the set up to check that everything is plugged correctly). You have to double-click the object and then click on the tape messages
7. The box connected to the spigot object en- or disables printing the incoming network messages to the console. It is there for debugging purposes.
8. Button to initialize the patch before beginning the piece.

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It is important to always open the FoH patch first. The stage patch tries to establish a tcp connection with the FoH patch and if the latest is not open the attempt will fail.

Appendix 1 : Audio – Midi – Network

4.2.1 Patch IO

Audio

Patch Input	Expects Signal...
1	Violine
2	Viola
3	Cello
4	Percussion
5	Piano
6	Sax
7	Clarinet
8	Oboe

Patch output	Outputs Signal...
1	Violin wet speaker
2	Viola wet speaker
3	Cello wet speaker
4	Piano wet speaker
5	Drums wet speaker
6	Sax wet speaker
7	Clarinet wet speaker
8	Oboe wet speaker
9	Transducer 1

10	Transducer 2
11	Transducer 3
12	Transducer 4
13	Soundtrack PA L
14	Soundtrack PA R

MIDI

Control Number	Channel	Parameter in Patch	Device
1	1	Violine FX On/Off	Switch Pedal Violine
1	2	Viola FX On/Off	Switch Pedal Viola
1	3	Cello FX On/Off	Switch Pedal Cello
1	4	Percussion FX On/Off	Switch Pedal Drums
1	5	Piano FX On/Off	Switch Pedal Piano
1	6	Sax FX On/Off	Switch Pedal Sax
1	7	Oboe FX On/Off	Switch Pedal Oboe
1	8	Clarinet FX On/Off	Switch Pedal Clarinet
3	1	strings output routing	MIDI Controller
3	2	percussion output routing	MIDI Controller
3	3	piano output routing	MIDI Controller
3	4	winds output routing	MIDI Controller

Network

As stated above the patches use the fudi protocol to communicate. The string construction is similar to osc, so I'll use the same notation to document the messages

String construction	Action	Variables
fx_pedal/[instrument_name]/bang	changes between the dry and fx state	[instrument_names] = violine, viola, cello, piano, drums, sax, oboe, clarinet

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output_routing/ [instrument_group]/[output]	change between transducer und speaker outputs	[instrument_group] = strings, piano, drums, winds [output] = speaker, transducer
soundfile/[0-9]	trigger a sound file	[0-9] = 1 to 11
winds_fx/[0-1]	change wind fx preset	0-1
ringthing/preset/[1-4][0-1]	change piano fx preset	

Appendix 2 : Setup Schematic

