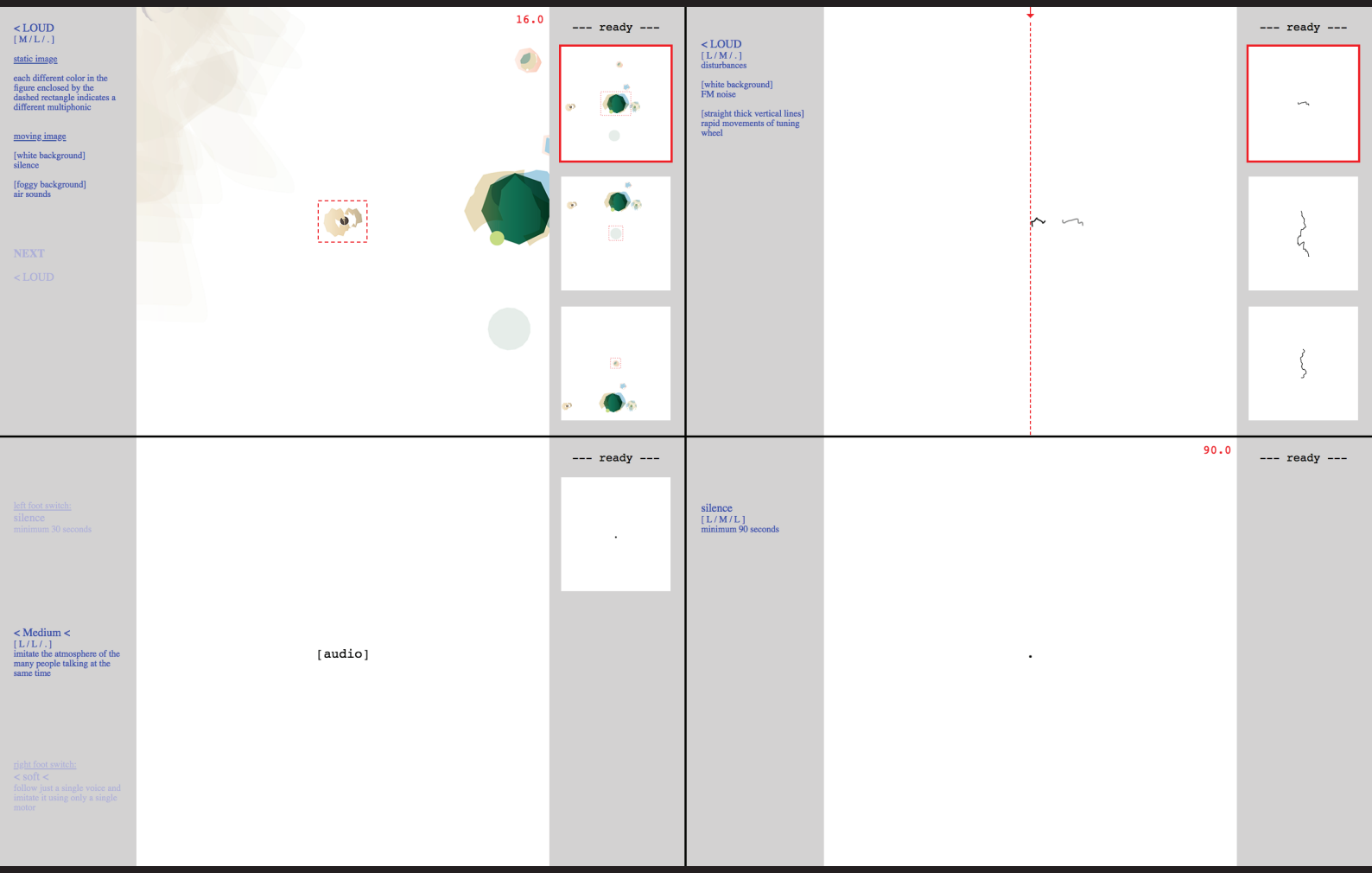
Goni Peles



ccloudlab 1

On the front cover is a screenshot of the video *170519_ ccloudlab1-3*.

Contents

Introduction

ccloudlab1 was the first laboratory of *CompositionCloud*[1]. It served as a framework for the development of a 45-minute performance for the 2017 edition of Happy New Ears, the new music marathon of the Hochschule für Musik Basel, experimenting with self-made musical instruments and exploring nontraditional forms of notation.

I collaborated on it with four performers: Amit Dubester, Daniel More, Francesca Naibo, and Oded Geizhals. Each was provided with a playing setup consisting of self-made musical instruments and with five different scores to be interpreted on it. (Most of the playing setups and scores were already part of *CompositionCloud* before *ccloudlab1*. The playing setups were selected — and to a certain extent also developed further — together with the performers, and the scores were selected by me with the playing setups in mind.)

The development process consisted of three stages:

1. Individual rehearsals. I worked with each performer individually on interpreting the scores on the playing setup she/he was provided with.
2. Duo rehearsals. I created dynamic and interactive, computer-based versions of the scores, and we explored different combinations of them.
3. Quartet (tutti) rehearsals. I combined the scores, linking their different parts to one another and creating a network in which choices made by one performer influence the options given to another. (This combined version of the scores was eventually performed at Happy New Ears.)

This development process, as well as those of three additional performances developed within the frameworks of *ccloudlab1*'s two extracts, *ccloudlab1x1* and *ccloudlab1x2*, is documented in this book, which comprises six chapters.

[1] *CompositionCloud* is a work in progress that can be briefly described as an abstract rhizomatic space containing different ideas to be used in modular ways to create art, mostly in the realms of sound and music, but not necessarily. See also *ccloudblog*, a blog about *CompositionCloud* at https://ccloudblog.com.

The first chapter, *ccloudlab1-1* (the first stage of the development process), introduces the playing setups and the scores and documents the interpretations (of the scores on the playing setups) that we recorded during the individual rehearsals. The second chapter, *ccloudlab1x1* (the first extract of *ccloudlab1*), describes the first dynamic and interactive, computer-based version of a score and discusses Oded's solo performance of it. The third chapter, *ccloudlab1-2* (the second stage of the development process), describes the dynamic and interactive, computer-based versions of the other scores and documents the combinations that we recorded during six duo and two tutti rehearsals. The fourth chapter, *ccloudlab1-3* (the third stage of the development process), describes a combined version of the scores and discusses its performance at Happy New Ears. The fifth chapter, *ccloudlab1x2* (the second extract of *ccloudlab1*), describes a multiplayer music game titled *stuckJunk-v1* and the process of developing two performances of it. And lastly, the six chapter, *ccloudlab1*'s future, discusses the future of *ccloudlab1*, speculating on how it could be developed further and what it might become in the long term.

Note that while I did plan the outline of the development process in advance, that is, I knew that it would begin with individual rehearsals and end with tutti rehearsals, and that networked computer-based versions of page-based scores would be created, most of the details were left to be filled in in collaboration with the performers. In that regard, my aim with this documentation is not only to provide a description of *ccloudlab1*, but also to show how the different decisions we made throughout its development process influenced what it turned out to be, as well as, hopefully, to suggest the possibility that given a different context, it could have also turned out to be something rather different.

Chapter 1

ccloudlab1-1

The first stage of the development process spanned from November 2016 to February 2017. I provided each performer with a playing setup consisting of self-made musical instruments (with the exception of Daniel, with whom I collaborated on a new playing setup) and with five different scores to be interpreted on it. We then held a series of individual rehearsals, during which I worked with each performer on interpreting the scores on the playing setup she/he was provided with.

The following chapter is divided into three sections: the first consists of a detailed description of each playing setup; the second consists of the scores; and the third consists of transcriptions of the interpretations of the scores that we recorded during the individual rehearsals as well as comments on them.

1.1 The playing setups

1.1.1 The *saxoschlauch*

Amit played the *saxoschlauch*, a hybrid musical instrument made up of a saxophone mouthpiece and a corrugated insulation tube. A compilation of video examples recorded by Amit, demonstrating the sounds that the *saxoschlauch* can produce, is available on *CompositionCloud*'s YouTube channel (titled *saxoschlauch-examples*)[1]. Figure 1.1 is a screenshot of this compilation of video examples, and on the next pages is a list of the examples (including time stamps and additional comments).[2]

[1] Note that we recorded these video examples after *ccloudlab1*.

[2] A short history of the instrument and building instructions can be found on *ccloudblog*.

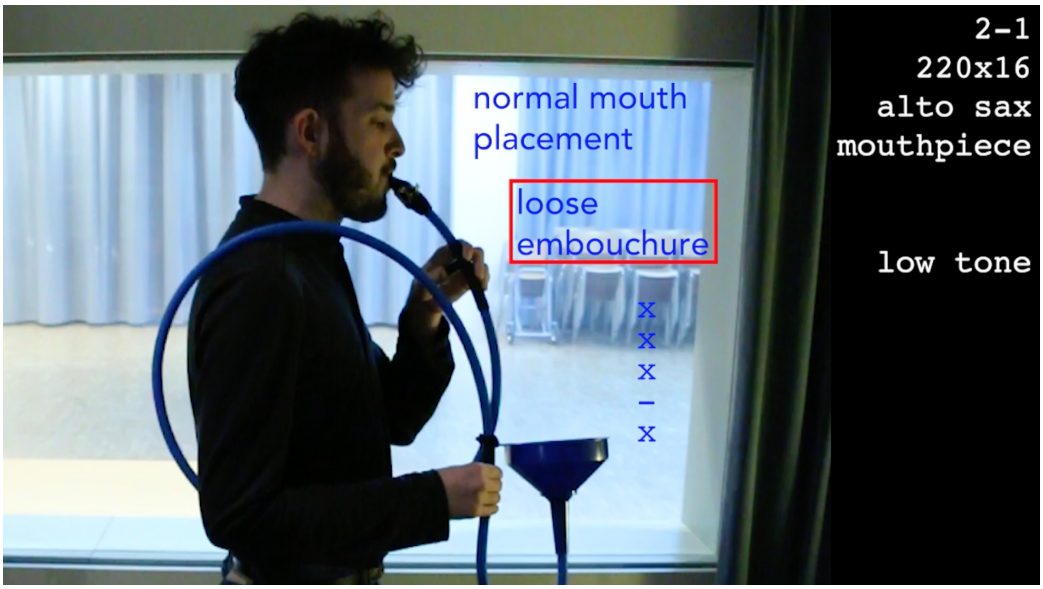


Figure 1.1: A screenshot of *saxoschlauch-examples*.

1. whistles and squeaks

[saxoschlauch220x16: 220 cm in length, 16 mm in diameter]
1-1 0:09 whistle
1-2 0:32 whistle ("flute" embouchure)
1-3 0:56 whistle (trills)
1-4 1:11 whistle (with alto sax mouthpiece)
1-5 1:20 whistle + squeak
1-6 1:27 whistle + squeak + teeth on reed
1-7 1:34 whistle + squeak + teeth on reed (free)
1-8 1:47 teeth on reed

Air sounds, without a whistle or with only a slight whistle, are possible with the mouthpiece attached, normal mouth placement, and without puffing the cheeks.

2. low tones

2-1 2:02 low tone
2-2 2:15 low tone (glissandi)
2-3 2:26 low tone (normal mouth placement vs. a lot of mouthpiece)
2-4 2:35 low tone + very high chirping
2-5 3:00 low tone + higher overtone
2-6 3:24 low tone + higher overtone (a lot of mouthpiece)

Soft reeds are highly recommended. In the video examples, D'Addario 3.0+ reeds were used, however, softer reeds could work even better.

3. melodies

```
[saxoschlauch180x16:  180 cm in length, 16 mm in diameter]
3-1 3:44 melody 1
[saxoschlauch220x16:  220 cm in length, 16 mm in diameter]
3-2 3:59 melody 2
[saxoschlauch80x25:  80 cm in length, 25 mm in diameter]
3-3 4:17 melody 3
```

Figure 1.2 is a transcription of melody 1 (without the rhythm). Melody 2 is what comes out when the same fingerings are played on *saxoschlauch220x16* rather than on *saxoschlauch180x16*. (The intervals are different because of deviations in the making of the finger holes.)

The first part of melody 3 is also based on the same fingerings, however, because of the enlarged diameter of the tube of *saxoschlauch80x25*, opening and closing the finger holes changes the pitch only very slightly. The second part (starting from 4:25) demonstrates a variation in the building of *saxoschlauch80x25*: three finger holes were made on both the upper part and the lower part of the tube.

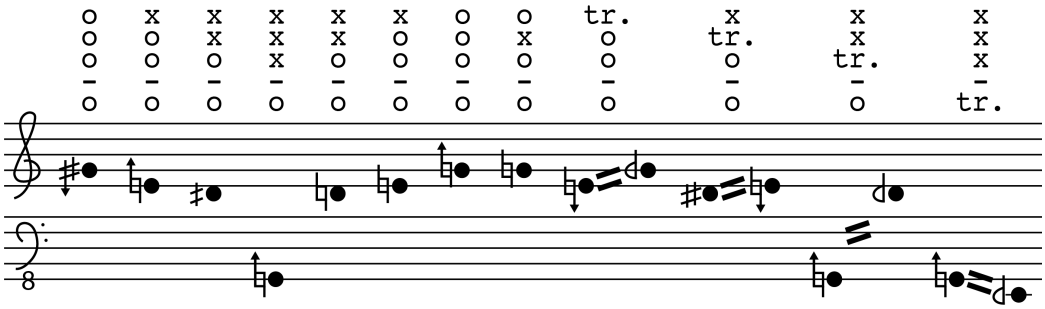


Figure 1.2: A transcription of melody 1.

4. multiphonics

```
[saxoschlauch220x16:  220 cm in length, 16 mm in diameter]
4-1 4:39 low tone + higher overtone
4-2 4:50 middle-range tone + higher tone
[saxoschlauch80x25:  80 cm in length, 25 mm in diameter]
4-3 5:26 simple intervals (up to an octave)
[saxoschlauch220x16:  220 cm in length, 16 mm in diameter]
4-4 6:03 singing and playing
```

The *saxoschlauch* does not seem to produce multiphonics that are not also possible on the saxophone (although some of them are easier on the *saxoschlauch*). That being said, further experimentation is required.

5. percussive sounds

```
5-1 6:47 slap tongues
5-2 6:59 tapping on finger holes
5-3 7:10 rubbing tube with plastic card
```

Other objects can also be used (for example, different thimbles and plectrums). A lavalier microphone is also very effective.

In *ccloudlab1*, Amit played *saxoschlauch220x16* and *saxoschlauch80x25*,[3] amplified with an AKG CK99 L (a lavalier microphone), and used a volume pedal to control the volume.[4]

1.1.2 *electric_motors*

Daniel was interested in collaborating with me on a new playing setup for *ccloudlab1*. As a starting point, I proposed ideas from the eighth and tenth brainstorming sessions I had for *CompositionCloud*:[5] idea 31, "plastic boxes"; idea 34, "rubber bands"; idea 35, "strawberry tray"; idea 37, "ceramic jar"; and idea 40, "electric motors".

We then collected several objects that fit to these descriptions and explored the sounds we could produce with them. Note that we decided not to limit ourselves to "plastic boxes", "strawberry tray", and "ceramic jar", and incorporated also other resonators.

We used the following objects:

- four different models of electric toothbrushes (Oral-B CrossAction, Oral-B BRAUN, SensiDent, and Trisa Sonicpower)
- three electric frothing wands (two GEFU and one Xavas)
- one nose trimmer (CIATRONIC NE 3595)
- several rubber bands
- a wooden box (40x30x23 cm3)

[3] During the second stage of the development process, we also experimented with *saxoschlauch180x25*, an instrument 180 cm in length and 25 mm in diameter. Later, however, we decided that the two instruments mentioned above were enough.

[4] We used the following loudspeakers: a Genelec 8040 during the rehearsals and a Meyersound UPJ during the performance.

[5] See "new_ideas-March2015" on *ccloudblog*.

- a large ceramic jar
- a thin wooden strawberry tray
- glass jars
- beer cans
- a large plastic bowl
- various plastic packages

We also bent the stick of one of the GEFU frothing wands, significantly lowering the motor's speed, and experimented with controlling the speed of the Trisa Sonicpower's motor with a fader.[6]

In addition, Daniel brought a contrabass bridge and tied it to the wooden box with several rubber bands, making it possible to hang motors and beer cans. This displacement of the bridge gave the setup a somewhat defiant meaning, as Daniel intended to perform with this playing setup also at his master's recital as a contrabass player (see chapter 5). Figure 1.3 is a photo of it.

Figure 1.3: Daniel More's playing setup.

[6]To do so, I hacked the toothbrush and connected the motor to an audio cable, which was then connected in series to an AA battery and a 15A 5kΩ logarithmic slide potentiometer (a 22Ω resistor was connected in parallel to the potentiometer to reduce its resistance). Unfortunately, however, this was only partly effective as the change in speed was not really gradual.

1.1.3 *SRF18-cb_ 2tpc-lt*

Francesca played *SRF18-cb_ 2tpc-lt*, the circuit board of a Sony SRF-18, a small radio/external speaker, which produces CrackleBox-like sounds when touched with bare fingertips, and to which two telephone pickup coils are connected, "sniffing" the electromagnetic waves produced by a laptop and translating them into sound. The following is a guide to *SRF18-cb_ 2tpc-lt*.[7]

Sniffing a laptop

A telephone pickup coil is, basically, a long and thin copper wire wrapped around an iron slug and connected to an audio cable. It is sensitive to changes in the electromagnetic field around it, enabling therefore the recording/monitoring (picking up) of telephone conversations. Rather than picking up the electromagnetic waves produced by a telephone, however, in *SRF18-cb_ 2tpc-lt*, the two telephone pickup coils pick up ("sniff") the electromagnetic waves produced by a laptop.

Examples of the sounds that can be produced by sniffing a MacBookPro (13-inch, 2012) can be found in the playlist *tpc-MBP12-examples* on *CompositionCloud*'s YouTube Channel, accompanied by images specifying the locations on the surface of the laptop at which the telephone pickup coil was placed (including its battery, CD player, hard drive, trackpad, and several different keys). They were recorded while the laptop was on and in sleep mode, as well as while it was turned on and off, while it was put to sleep and woken up, and while a program (Adobe Illustrator) was opened and closed. Figure 1.4 is a photo of two telephone pickup coils sniffing Francesca's laptop.

The circuit board of a Sony SRF-18

Figure 1.5 is a map of the solder side of the circuit board of a Sony SRF-18. The original package was removed and the board was mounted on a wooden support built by scenographer and technician Jonas Vogel. Because of the conductivity of human flesh, touching the circuit board with bare fingertips bridges between different components and adds to the existing circuit free-range resistors and capacitors, whose values depend on the amount of pressure that is being applied and the dampness of the fingertips (a small glass of water and a towel should therefore be part of the setup as well). The letters on the map indicate specific locations on the circuit board to be touched. Touching the locations indicated with the letter X (in red) with

[7] *SRF18-cb_ 2tpc-lt* was inspired by chapters 3 and 11 from the book *Handmade Electronic Music* by Nicolas Collins.

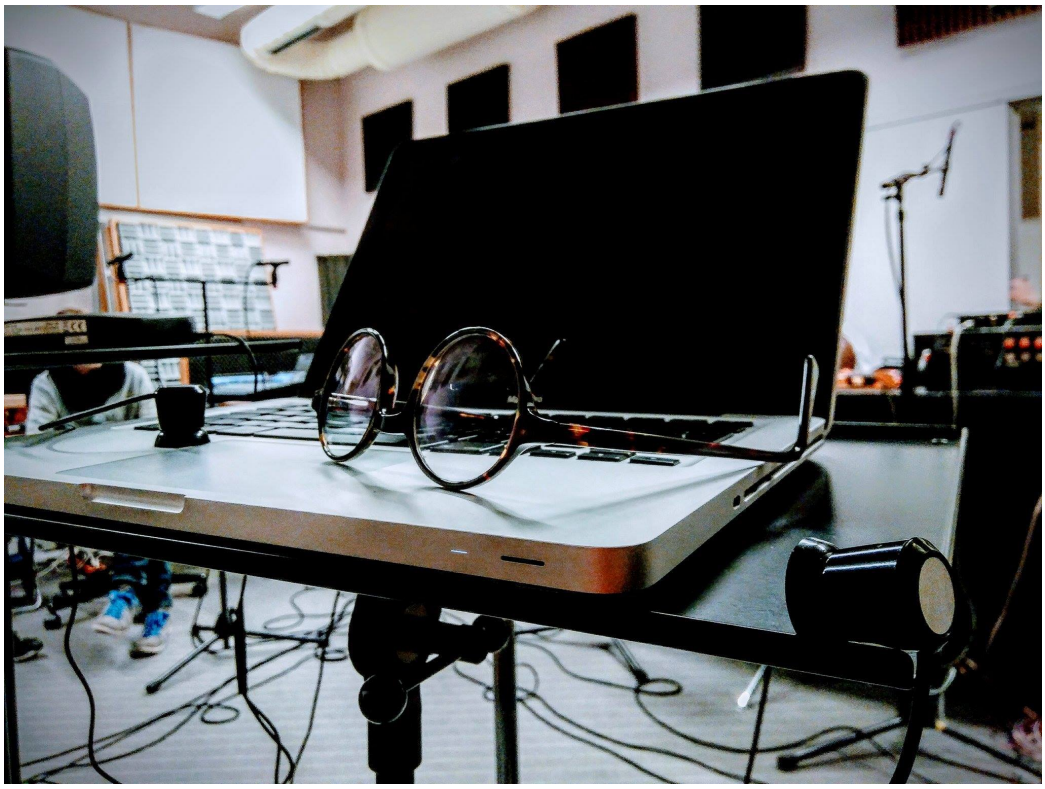


Figure 1.4: Two telephone pickup coils sniffing Francesca's laptop (photo by Kostas Tataroglou).

wet fingertips should be avoided, as it could mute the signal for a long, indefinable duration of time (it is recommended to cover these locations with pieces of electrical tape)[8].

A compilation of video examples, demonstrating the sounds that the circuit board of a Sony SRF-18 can produce, is available on *CompositionCloud*'s YouTube channel (titled *SRF18-cb-examples*). Figure 1.6 is a screenshot of this compilation of video examples, and below is a list of the examples (including time stamps and additional comments).

```
1.  AUDIO IN (no input)

[dry fingertips]
1-1 0:09 electric hum
1-2 0:18 noisy rustles
1-3 0:22 electric hum (very soft)
```

[8]We found this solution to the problem during the second stage of the development process (see section 3.2.4).

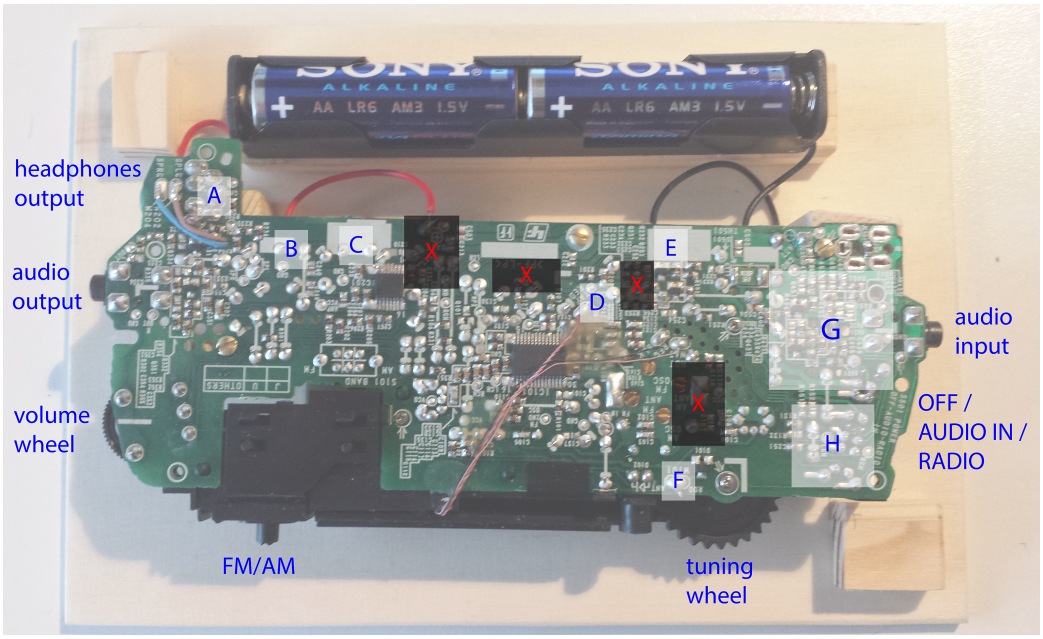


Figure 1.5: A map fo the solder side of the circuit board of a Sony SRF-18.

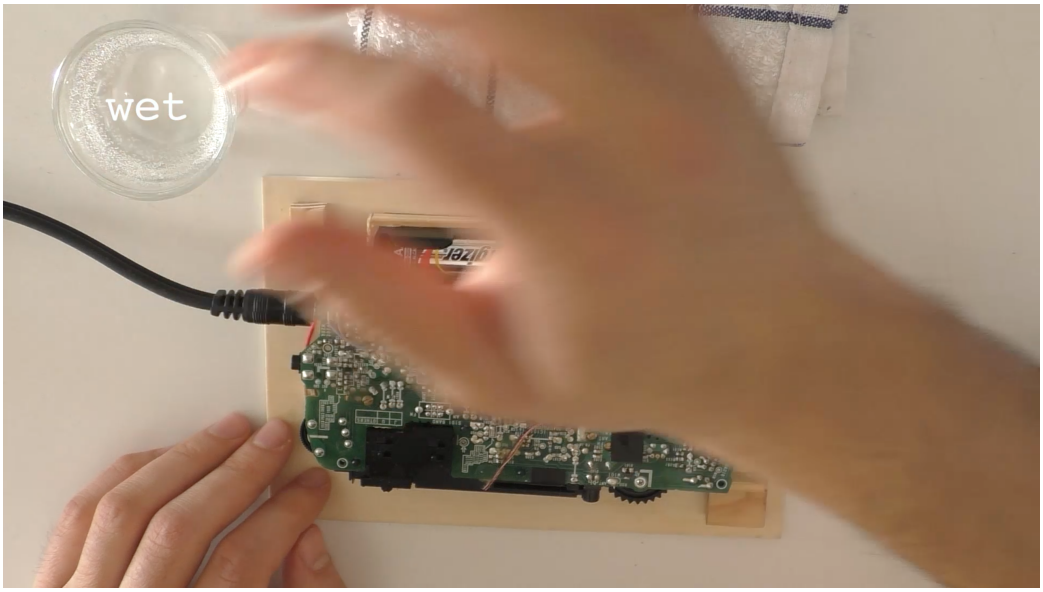


Figure 1.6: A screenshot of *SRF18-cb-examples*.

```
1-4 0:27 electric hum (filtered)
[wet fingertips]
1-5 0:54 electric hum
1-6 1:00 a few drops of water flowing around the board
1-5b 1:11 electric hum (continued)
1-7 1:20 noisy rustles
1-8 1:24 electric hum (filtered)
1-9 1:45 low feedback
1-10 1:52 "birdsong"
1-11 2:00 + harsh feedback
1-12 2:10 + high feedback
```

Feedback in AUDIO IN mode is not always very responsive and controllable. More predictable feedback (but not as varied) is possible in RADIO mode (see below).

2. AUDIO IN (hard drive chord)

```
[dry fingertips]
2-1 2:32 hard drive chord
[wet fingertips]
2-2 2:36 + electric hum
2-3 2:46 + noisy rustles
2-4 2:50 + electric hum (filtered)
2-5 3:15 + feedback (distorted)
```

Different inputs respond differently. Electric hum and noisy rustles can also be produced with dry fingertips (as they were in the previous section).

3. RADIO (FM)

```
[dry fingertips]
3-1 3:45 radio stations
[wet fingertips]
3-2 4:07 feedback (high, low, medium)
3-3 4:29 feedback + radio stations
3-4 4:44 feedback glissandi
3-5 4:56 feedback glissandi (+ "birdsong")
```

Electric hum and noisy rustles can also be produced in RADIO mode by touching locations E and H. Feedback is more responsive in RADIO mode than in AUDIO IN mode and can be produced also by touching E + A, B, or C.

```
4. RADIO (AM)
[dry fingertips]
4-1 5:17 radio stations
4-2 5:33 + iPhone 4
4-3 6:04 + electric toothbrush (Oral-B BRAUN)
4-4 6:28 + electric frothing wand 1 (GEFU)
4-5 6:37 + electric frothing wand 2 (GEFU, slightly bent)
[wet fingertips]
4-6 6:45 feedback (high*, low, medium**) (*sounds more like filtered
noise **filtered noise with medium to high resonance)
4-7 7:05 feedback glissandi
4-8 7:20 feedback glissandi (+ "birdsong")
```

When set to AM, also the radio — like the telephone pickup coils — translates electromagnetic waves into sound (this is why AM generally sounds rougher than FM, as in addition to the desired station, the radio also picks up the electromagnetic waves produced by the electric devices around it). The translation of the electromagnetic waves produced by an iPhone 4, an electric toothbrush, and two electric frothing wands is demonstrated in examples 4–2 to 4–5.[9]

1.1.4 *psNLr25kE-sub-ALPKnLKACK99L_sw*

Oded played *psNLr25kE-sub-ALPKnLKACK99L_sw*, that is, *psNLr25kE-sub*, a Max patch producing extremely low sine waves and low-pass-filtered noise; an AKAI LPK25 (a MIDI keyboard), a novation LAUNCHCONTROL (a MIDI controller), and an AKG CK99 L (a lavalier microphone), with which *psNLr25kE-sub* was controlled; and a self-made subwoofer with which *psNLr25kE-sub* was played, as well as various objects, including plastic boxes, a slinky, aluminum foil, and coins, that were placed on the subwoofer's speaker cone to produce different rattling sounds.[10]

psNLr25kE-sub is an extract of *2sinNoiseLPFrLFO-sub-Ws*, focusing on the synth part of the Max patch that animated the installation *Wechselstrom*,[11] which also incorporated the self-made subwoofer. (In fact, the subwoofer was originally built for *Wechselstrom* by my collaborator on the installation, scenographer and technician Jonas Vogel, who also built the wooden support for the circuit board played by Francesca).[12] Figure 1.7 is a

[9] Like Amit, Francesca also used a volume pedal to control the volume and a Genelec 8040 during the rehearsals and a Meyersound UPJ during the performance.

[10] This was inspired by chapter 5 from Nicolas Collins' *Handmade Electronic Music*.

[11] See "Wechselstrom" and "2sinNoiseLPFrLFO-sub-Ws" on *ccloudblog*.

[12] See "self-made subwoofer" on *ccloudblog*.

screenshot of *psNLr25kE-sub*, figure 1.8 is the subwoofer's scheme, and figure 1.9 is a photo taken by Jonas during its construction. Below is a guide to *psNLr25kE-sub*.[13]

psNLr25kE-sub

psNLr25kE-sub is made up of 25 sine wave oscillators, a noise generator whose output passes through a low-pass filter, a random LFO, and an envelope follower.

The 25 sine wave oscillators are controlled with an onscreen keyboard. Each key corresponds to a different oscillator, and each oscillator sounds 1.6 Hz above the other, ranging all together from 21.6 Hz to 60 Hz. The leftmost dial, "freq shift", sets the value of a constant that is added to the frequency of each oscillator, shifting the keyboard either upward or downward and extending the range of the oscillators down to 1.6 Hz and up to 80 Hz.

Note that the keyboard of *psNLr25kE-sub* is fixed to latch mode, and there is always at least one key that is pressed. When the patch is controlled with a MIDI keyboard, even after the keys are released they will continue to be played until new ones are played. Clicking on an unpressed key on the onscreen keyboard will add the corresponding oscillator to the ones already sounding, and clicking on a pressed key will remove it. In that regard, the keyboard should be thought of more as a set of switches, as it has no influence on the volume and the articulation of the sound, but only on which oscillators are to be played.

The three dials to the right of "freq shift" control the low-pass filter through which the output of the noise generator passes. "noise mix" controls the mix between the sine waves and the filter's output. "LPF cutoff" controls the filter's cutoff (in MIDI notes, ranging from 12 to 72, that is, from C0 to C5). "LPF res" controls the filter's resonance.

"rLFO rate" and "rLFO glide" control an LFO that produces a random signal of a controllable rate ("rLFO rate") and smoothness ("rLFO glide"), which can be used to modulate all the parameters mentioned above (as well as its own). To modulate a parameter, set the blue number to the right of the parameter's dial to a value other than 0. For example, set the one next to "freq shift" to 20 and the dial will start moving. The blue needle will still point to the stationary value before the modulation, but an additional gray needle will monitor the actual, constantly changing value. This value is equal to the blue number next to the modulated dial, multiplied by the signal produced by the random LFO, and added to the dial's stationary value.

[13]The Max patch can be found in *CompositionCloud*'s GitHub repositories.

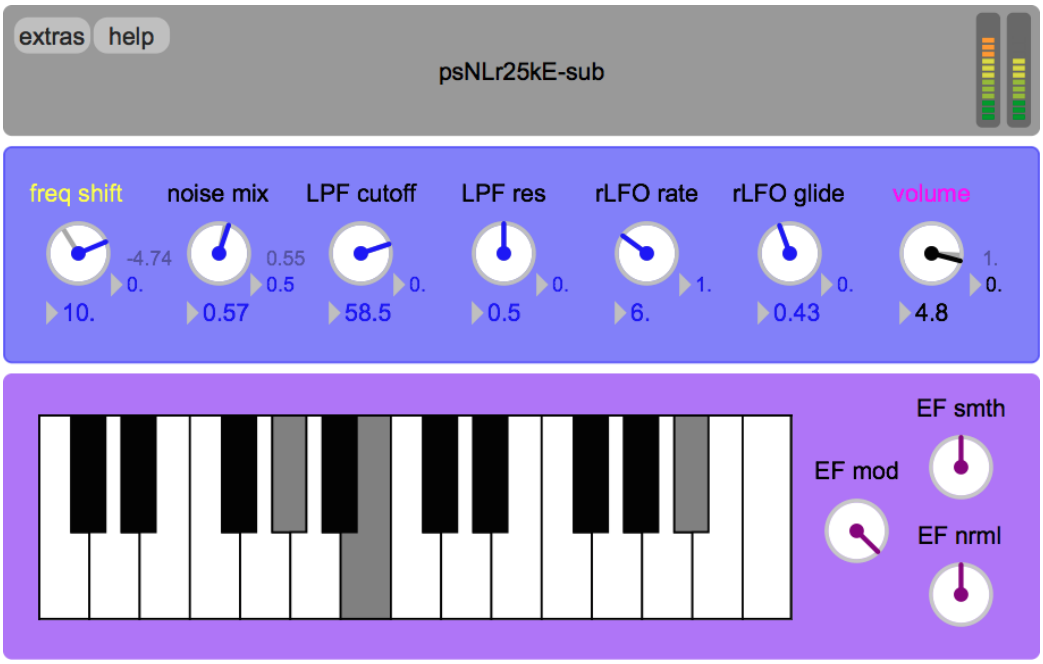


Figure 1.7: A screenshot of *psNLr25kE-sub*.

Note that the modulation can be either positive or negative (the random LFO produces a signal between -1 and 1). "rLFO rate" is the only exception, as the modulation is not added to the dial's value but multiplied by it. For this reason, it cannot be negative and ranges from 0.1 to 10 (its zero-point is 1).

The rightmost dial in this panel ("volume") controls the master volume. It cannot be modulated by the random LFO; instead, the number to its right provides an additional control over the gain, ranging from -18 to +18 dB. (Note that even though *psNLr25kE-sub* is designed so that enough headroom will be available, clipping is still possible. This may be dangerous for amplifiers and loudspeakers, but could also be used safely and artistically to enrich the sometimes too "pure" sine waves.)

In the right part of the lower panel are three dials that control the envelope follower. An envelope follower detects the amplitude variations of an incoming signal to produce a control signal that resembles those variations. This control signal can then be used to modulate other signals (or parameters). *psNLr25kE-sub*'s envelope follower is set by default to modulate the master volume (to prevent feedback, it is designed to be particularly sensitive to frequencies above 2 kHz). The black needle of the "volume" dial sets the maximum volume and the gray needle shows the actual position based on the volume of the audio input. The louder the audio input, the louder the out-

put of *psNLr25kE-sub*. Note that the envelope follower can also be inverted: hold the Alt key and click on "volume" (the title of the dial, that is, the text above it), and the title's color will change from purple, which indicates that the master volume is modulated by the envelope follower, to yellow, which indicates that the master volume is still modulated by the envelope follower, but inversely. This means that louder inputs will decrease the master volume rather than increase it.

Other parameters can also be modulated by the envelope follower. Click on a title of a dial and the title will become purple, indicating that the parameter is modulated by the envelope follower; hold the Alt key and click on a title of a dial and the title will become yellow, indicating that the modulation is inverted; hold the Shift key and click on a title of a dial and the dial will become purple, indicating that the degree to which the parameter is modulated by the random LFO is modulated by the envelope follower; hold both the Shift and the Alt keys and click on a title of a dial and the dial will become yellow, indicating that the degree to which the parameter is modulated by the random LFO is modulated by the envelope follower inversely; hold the Cmd key and click on a title of a dial and the title will be black again, indicating that the parameter is no longer modulated by the envelope follower; hold both the Shift and the Cmd keys and click on a title of a dial and the dial will be gray again, indicating that the degree to which the parameter is modulated by the random LFO is no longer modulated by the envelope follower.

Note that it is also possible to control the degree to which the envelope follower modulates the different parameters. Press "r" to reset the envelope follower, and all the titles and dials should be black/gray again except for the title of the "volume" dial, which should be purple. Then, gradually turn "EF mod" anti-clockwise and the gray needle of the "volume" dial will rise until it merges with the black one. When "EF mod" is turned fully to the left, the master volume is completely independent of the envelope follower. If other parameters were also modulated by the envelope follower, however, "EF mod" would have also affected them. To control specifically the degree to which the envelope follower modulates the master volume, click on "EF mod" and a small window will appear, in which it is possible to set the degree to which the envelope follower modulates each of the parameters and the degree to which it influences the degree to which they are modulated by the random LFO (ranging from -1 to 1). This can also be done by holding the Ctrl key and clicking on a tile of a dial, which will increase the degree to which the envelope follower modulates the parameter by 0.25; holding both the Ctrl and the Alt keys and clicking on a title of a dial will decrease the degree to which the envelope follower modulates the parameter by 0.25; holding both

the Ctrl and the Shift keys, or the Ctrl, the Shift, and the Alt keys and clicking on a title of a dial, will change the degree to which the envelope follower modulates the degree to which the parameter is modulated by the random LFO by 0.25.

In addition, the two dials to the right of "EF mod" determine how the envelope follower detects the amplitude variations of the audio input. "EF smth" determines the extent to which the envelope follower ignores small variations. "EF nrml" determines how normalized the input signal will be, making quiet inputs as effective as louder inputs.

Setting the audio driver and the input and output devices, as well as the MIDI input, is to be done by clicking on "extras" and selecting the desired driver, inputs, and outputs from the drop-down menus. Clicking on the texts to the left of the menus will refresh their content. (The keyboard is mapped by default to AKAI LPK25 and the dials to novation LAUNCHCONTROL.)

It is also possible to make a mono recording of the output of *psNLR25kE-sub*. To do so, double-click on "recMONO" in the "extras" window, click on "open" to save the file, and turn on the toggle to start recording (do not forget to turn it off when you are done).

Finally, placing different objects on the speaker cone of the loudspeaker (ideally, a subwoofer) with which *psNLR25kE-sub* is played, can create various rattling sounds. Experiment with slinkies, plastic boxes, broken plastic cups, plastic bottles, disposable (and nondisposable) cutlery, aluminum foil, coins, etc.

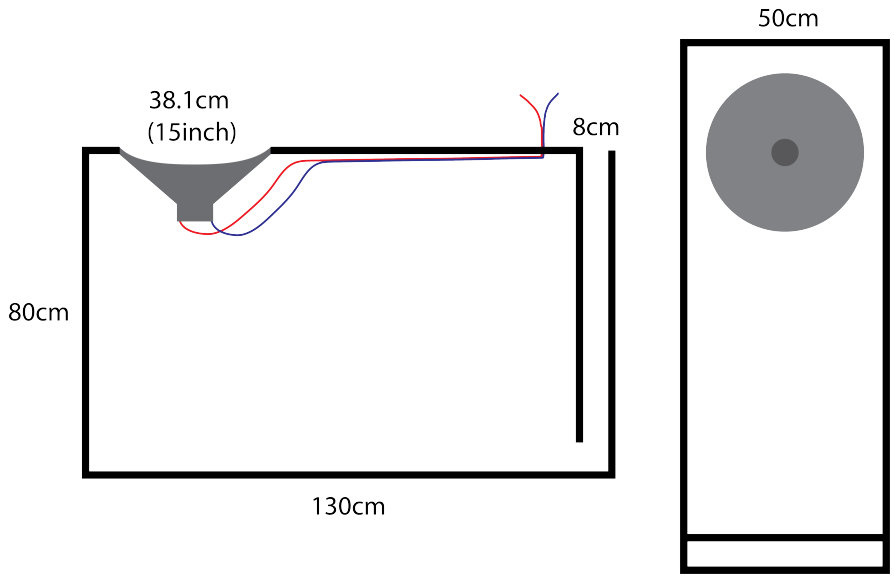


Figure 1.8: The subwoofer's scheme.

Figure 1.9: Building the subwoofer (photo by Jonas Vogel).

1.2 The scores

The five scores that each performer was provided with, consisted of two diagrams, two imaginary sounds, and one audio recording. Here is what is meant by these terms.

In *CompositionCloud*, *diagrams* are graphic representations of abstract information that can be interpreted as sound and music; *imaginary sounds* are texts that describe sounds using verbal metaphors, inviting readers to an imagined musical experience in which they are to use their own musical imagery to interpret the texts.[14] Before the first rehearsal, I annotated for each performer one diagram and one imaginary sound.[15] The other diagram and the other imaginary sound were to be annotated in collaboration with the performer (except for Amit, who unfortunately had limited time for rehearsal during the first stage of the development process, which we spent on exploring further the *saxoschlauch*). As far as reading the diagrams and imaginary sounds in time is concerned, their durations remained unspecified, and there were no limitations on where to begin and where to end. The order in which the different parts of each of them were to be read, however, did have to correspond to the order in which they were placed on the page (but not necessarily left to right or top to bottom, or without going backward, changing direction, etc.). Lastly, the audio recordings were to be imitated by the performers on their playing setups in real-time (they heard them with headphones).

The scores are presented on the next pages (of course, with the exception of the audio recordings, which are described below), and the following is a list of them.[16]

Amit

- *diagram10-2v1-ann-sxsch*
- *polygon1v1-ann-sxsch*
- *iS1iS2_x1iS6iS5-ann-sxsch*
- *iS1iS2iS3-ann-sxsch-v1*
- *tMs3*

Daniel

- *pencil2*
- *type1v1v1-ann-em*
- *iS4v1-ann-em*
- *iS1iS2v1*
- *3lbclpf7*

[14] Note that in *ccloudlab1* the imaginary sounds were to be interpreted on musical instruments, not just be imagined.

[15] By annotating, I mean defining in advance how the abstract information represented in the diagrams and the verbal metaphors that form the imaginary sounds are to be interpreted.

[16] Note that "ann" stands for annotated; "sxsch" stands for *saxoschlauch*; "em" stands for *electric_motors*; "Sc2tl" stands for *SRF18-cb_2tpc-lt*; and "psAs" stands for *psNLr25kE-sub-ALPKnLKACK99L_sw*.

Francesca

- *diagram9-8-ann-Sc2tl*
- *pen1v1v1v1x1x2pencil1*
- *iS1*
- *iS3x2-ann-Sc2tl*
- *1lnnsib*

Oded

- *diagram3x1*
- *polygon1-ann-psAs*
- *iS1v2iS2*
- *iS5-ann-psAs*
- *zr1tS*

Five of the scores — *iS1iS2_x1iS6iS5-ann-sxsch*, *diagram9-8-ann-Sc2tl*, *iS3x2-ann-Sc2tl*, *polygon1-ann-psAs*, and *iS5-ann-psAs* — were extracted from *24d24iS_esO4bsPSpbVRssS2-EPB*, a complex of scores and musical instruments I shared with Ensemble Phoenix Basel with the intention of developing a performance for the 2016 edition of the yearly gala series of the Hochschule für Musik Basel, Schlusskonzerte,[17] and *iS1iS2iS3-ann-sxsch-v1* is a variation of a score that Amit performed (with saxophonist Valentine Michaud) at the 2016 VIENNA INTERNATIONAL SAXFEST.[18] (Also note that *polygon1v1-ann-sxsch* was created and provided to Amit only before the third stage of the development process, see section 3.3.2.)

The titles given to the audio recordings — *tMs3*, *3lbclpf7*, *1lnnsib*, and *zr1tS* — are acronyms of their original filenames. *3lbclpf7* (the acronym of *31487__lonemonk__bar-crowd-logans-pub-feb-2007*) and *1lnnsib* (the acronym of *15851__laurent__natural-night-sounds-in-boquete*) were downloaded from https://freesound.org,[19] where they were given the following descriptions: "Live at Logans Pub; Victoria BC, Canada. End of the evening, approximately 50 people remain of the original crowd. Ambient bar noise; People talking, finishing their drinks, and generally being drunk. Sounds of the bar staff cleaning up, bottles and glasses clinking, bands packing up their stuff. Gear: iRiver HP120 (Rockbox) - Sony ECM719." and "Digital recording of a series of sound during the night in Boquete using a AT 895 mic." *tMs3* (the acronym of *tpc-MBP12-put_to_sleep_and_woken_up-key-3*) is a recording of the electromagnetic waves produced by a MacBook Pro (13-inch, 2012) while put to sleep and woken up translated into sound (see section 1.1.3), and *zr1tS* (the acronym of *zH5pB-rwf-1-666timesSlower*) is a slowed-down version of a recording of me rubbing with my fingertips the plastic box in which my Zoom H5 was packed.[20]

[17] See "24d24iS_esO4bsPSpbVRssS2-EPB" on *ccloudblog*.

[18] Amit has already played the *saxoschlauch* before *ccloudlab1*. See "iS1iS2iS3_sxsch90a180a220-ADaVM" on *ccloudblog*.

[19] These recordings were also used in the performance/installation *"Just Representations?"* (see "Just Representations?" on *ccloudblog*).

[20] See *zH5pB-rwf-1-666timesSlower* on *CompositionCloud*'s YouTube channel.

diagram10-2v1-ann-sxsch

polygon1v1-ann-sxsch

iS1iS2_ x1iS6iS5-ann-sxsch

dots, dashes, underscores, slashes, and brackets indicate the inclusion of different percussive sounds

] 3 & [{ }
many
, entangled very active and complicated passages with many notes

{an irritating hassle that will disappear when screeching sounds
a lot of threads very active passages again
[
-

just the flatness of some dust left in a big closed box long air sounds, with mouthpiece (into and a bit away from mouthpiece) and without mouthpiece (a bit away from mouthpiece) (no whistles), incorporating flutter-tongue and trills, and shaking tube
. /
[trying to dissolve into, . 123 ^^ ^ . ^

^ fade out interrupted by pauses, several accents in the end

a babble in the background fast, incomprehensible speaking into mouthpiece/tube
. - - / // / (& the excess of things percussive sounds, more and more active is just some light long high tones, slightly fluctuating in pitch
.
.
_- - - - -
nothing more than a wide, stagnant long low tones, steady pitch
.

iS1iS2iS3-ann-sxsch-v1

playing in the junkyard… m \\ scattered
45g xc without mouthpiece, whistle sounds, rubbing tube with plastic card

qwk0-0,
mU, gzoO; wqappPQ?U0O + . s S >>
mn786”@$% $l aqwqp Ö Ü ´´´´
. .. . cN ; / a O
§:” 1] $
] } without mouthpiece, syllables

[small, even tiny IN
{0,”in its
“complexity, relative” significance” with sax mouthpiece, soft long tones and multiphonics
\\\ \\ \\ 1,
\\
\\\\\ //// / // \\\ \\\\\\\\\
\\
\\\ \\\ // \\\\\/\/\\\\\\
/ ****
\ **********
********** I / // **
/ \ \\\\
/
* { / / /could be
with trumpet mouthpiece, percussive sounds

muted agitation - some light but with sax mouthpiece, very soft high tone, constantly changing intonation, timbre, and dynamics (within very soft), a
cre-
-eaaeaeaaeekkkkk
== creakingly with sax mouthpiece, low tone, beating with voice

maybe ** */ //
2:
?
with sax mouthpiece, percussive sounds

crawling like a without mouthpiece, whistle sounds, plastic card, slowly fading

type1v1v1-ann-em

pencil2

iS4v1-ann-em

this,
as if in a garage loud low motor sounds
~ ZZJH high motor sounds
XUO soft high motor sounds
(PPP { noisy, soft motor sounds of unclear pitches almost a pulse, but still irregular,
rubber band expanding. crescendo of motors

trying to interact with, high, short (p l . .. . . k p^
{
J only rubber band

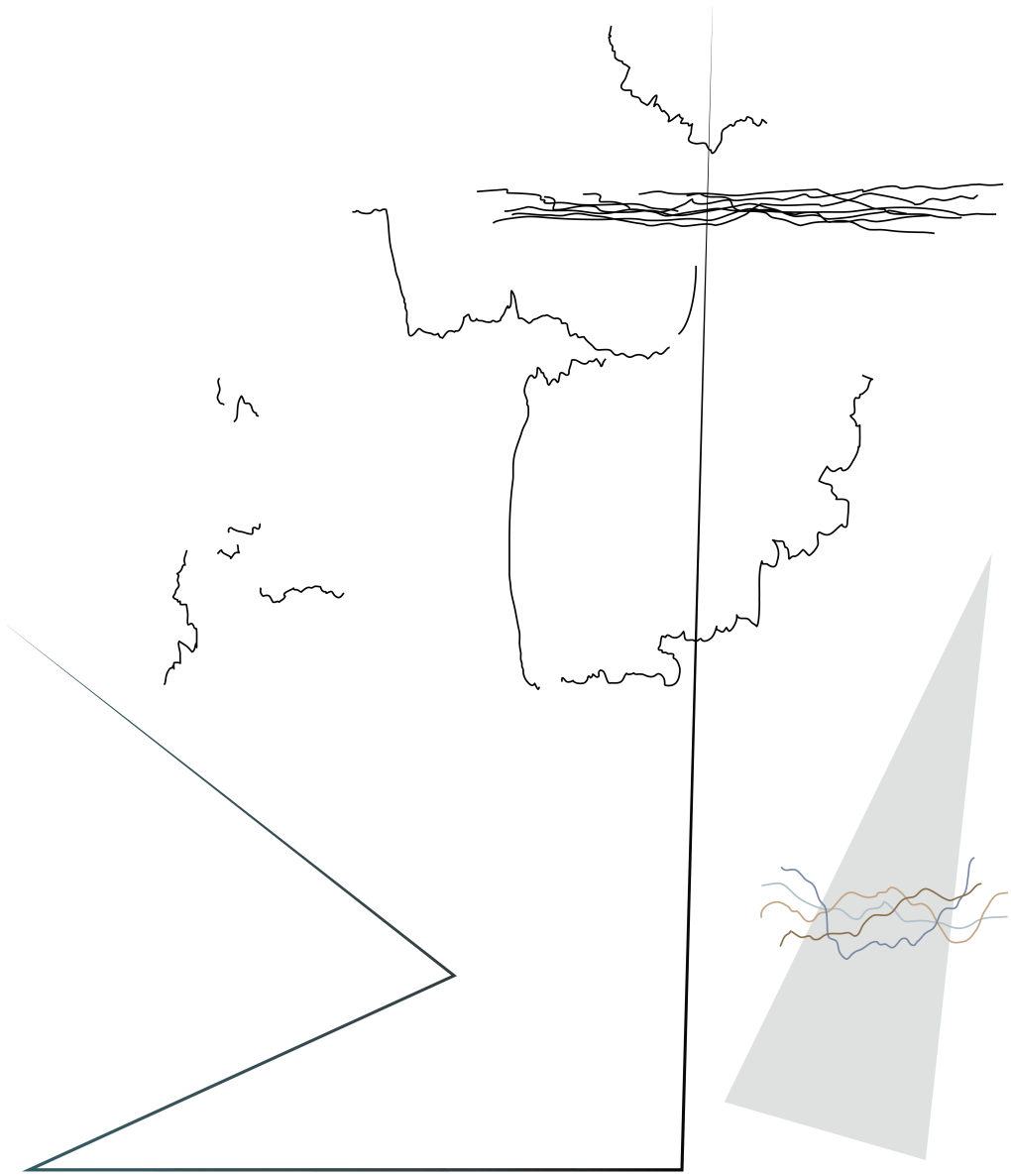
iS1iS2v1

the shortest creak
once in a while
muted agitation - some
creakingly crawling like [small, even tiny

sh

diagram9-8-ann-Sc2tl

pen1v1v1v1x1x2pencil1



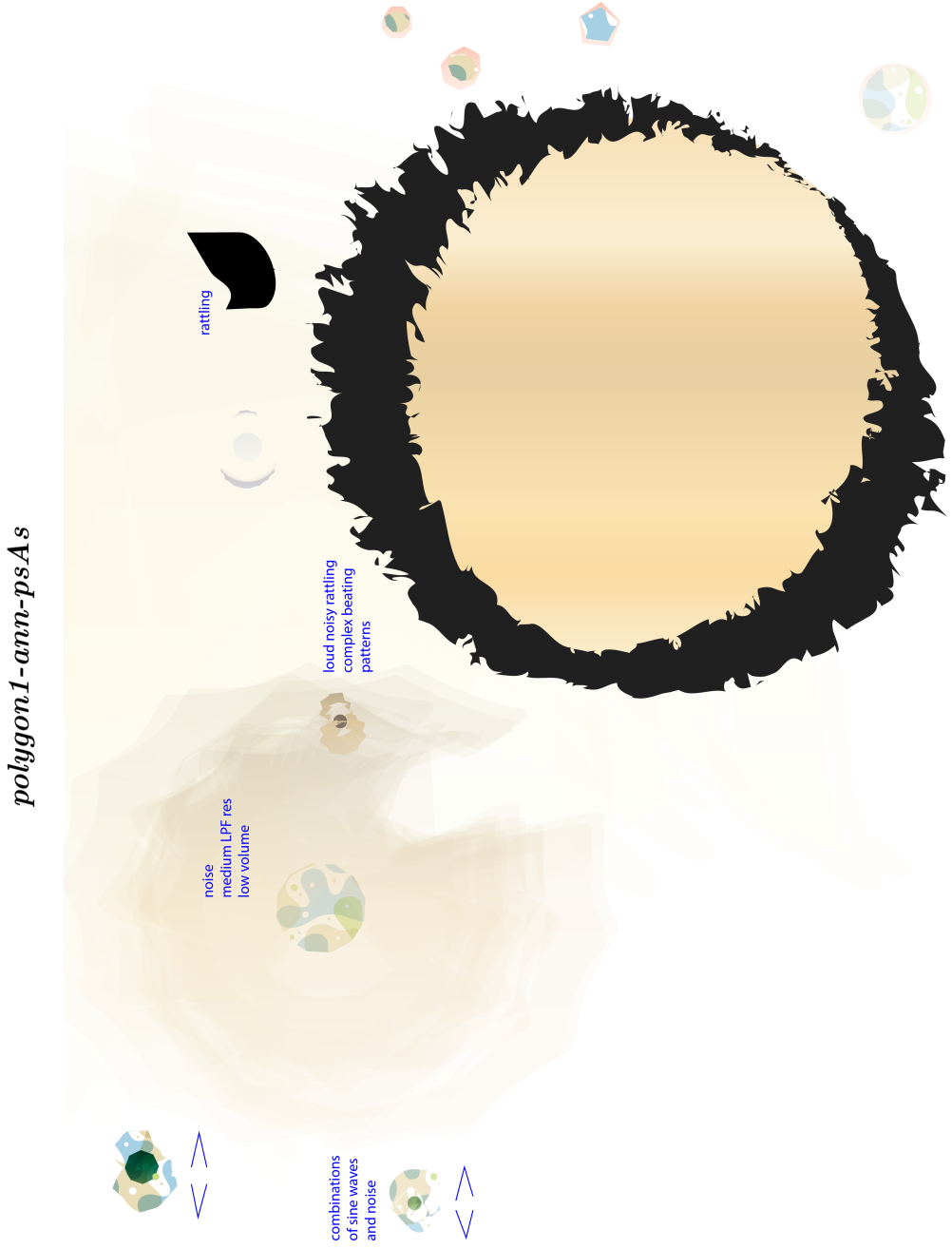
iS3x2-ann-Sc2tl

"/" and "\" indicate noisy rustles
"*" indicates electric hum

"co soft radio sound // x y key T
\\\ \\ \\ 1,
key 6, altered by touching circuit board
\\
\\\\\ //// / // \\\ \\\\\\\\\
\\
\\\ \\\ // \\\\\/\/\\\\\\
. trackpad, soft / ****
\ ******************
****
l battery, disconnecting power cable / // ** - between
trackpad and hard drive
/) very short radio sound ////
/
* { opening and
closing programs / / /
** */ //
2:
key 3
?
high radio feedback
[switching between tabs

iS1

muted agitation - some light


polygon1-ann-psAs
rattling
loud noisy rattling
complex beating
patterns
noise
medium LPF res
low volume
combinations
of sine waves
and noise

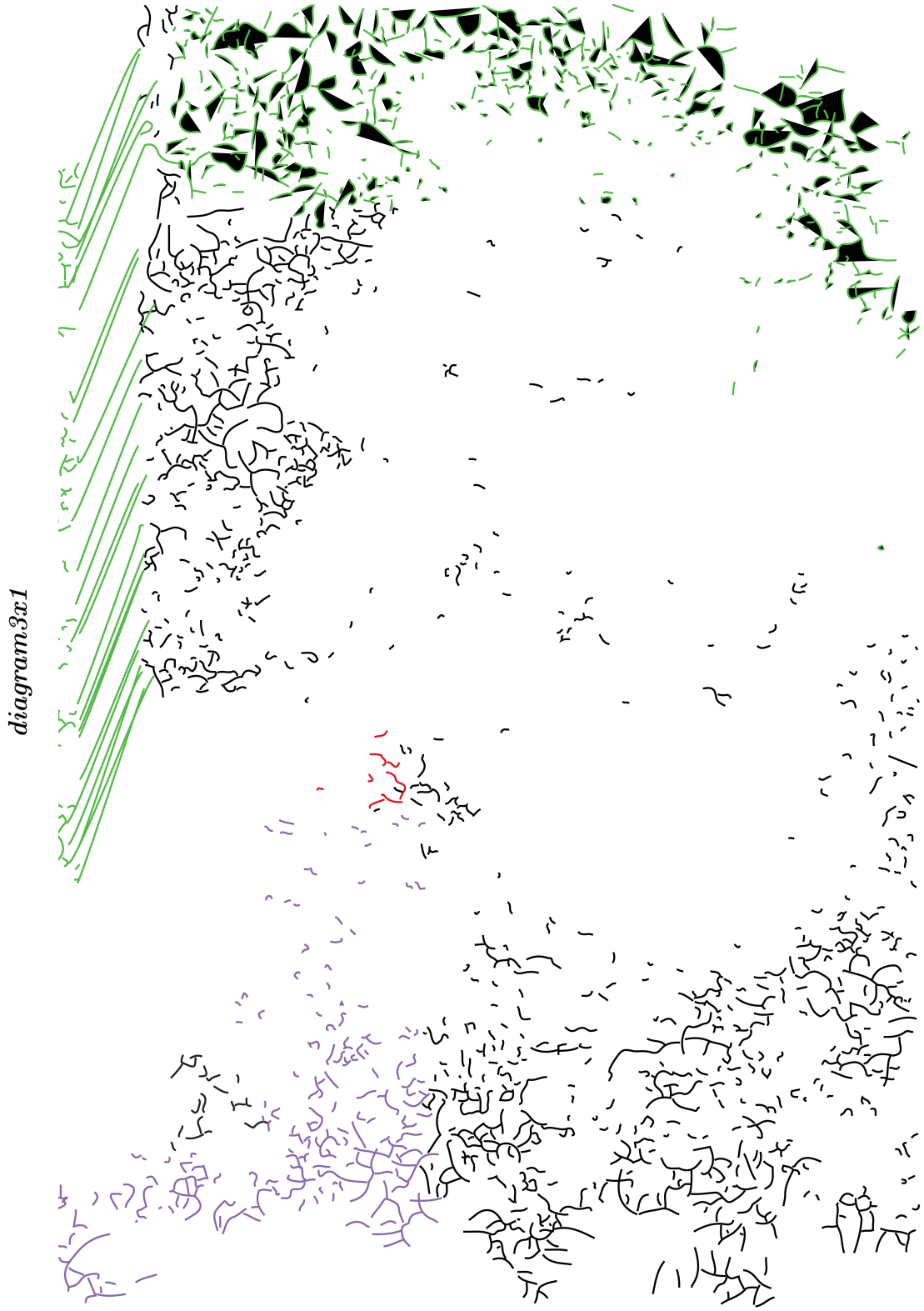


diagram3x1

iS5-ann-psAs

plenty, entangled
many (are) noise, full modulation of LPF cutoff, high to maximum LPF res, very fast to maximum rLFO rate
[trying to dissolve, . 1 ^^ ^ reducing noise mix, modulation of LPF cutoff, and rLFO rate, but in the end accents (high values of all these parameters) (although not very often)
but threads, a lot of them sine waves, full modulation of freq shift, very fast to maximum rLFO rate, low to medium rLFO glide, complex beating patterns
{an irritating hassle that will disappear when loud rattling

[abrupt silence
not without some dust left in a big closed box rattling aluminum foil, low volume
] 2& { } complex texture of the rattling aluminum foil, occasionally louder

iS1v2iS2

muted aggregates of, -
{dark
, long creaks
creakingly crawling
scattered
\\ m
0

like a giant being [tiny
IN {0

1.3 The interpretations

The following section consists of transcriptions of the interpretations we recorded during the individual rehearsals. These transcriptions specify the order in which the different parts of the scores were interpreted, using the same wording as the annotations in the case of the annotated scores or simply describing what the performers played in the case of the other scores. In both cases, the transcriptions are followed by several comments (a few comments were added in square brackets directly to the transcriptions).

The title of each interpretation is a combination of the date on which it was recorded (in yymmdd format), the score's title, the performer's initials, and a serial number if the score was interpreted more than once on the same date. Recordings of the interpretations (only audio and the scores as static images) can be found in the playlist *ccloudlab1-1* on *CompositionCloud*'s YouTube channel.

1.3.1 With Daniel

161127_ type1v1v1-ann-em-DM_ 1

```
0:00 motor 1 on resonator 1
1:53 motor 1 on resonator 1 and motor 3 on resonator 1.2
2:34 motor 1 and 2 on resonator 1 and motor 3 on resonator 1.2
3:58 motor 1 and 2 on resonator 1 and motor 3 on resonator 2
4:12 motor 1 and 2 on resonator 1 and motor 3 on resonator 1.1 and 2
4:28 change motor 3 (normal).
5:09 motor 1 and 2 on resonator 1 (motor 3 off)
5:51 motor 1 and 2 on resonator 1 and rubber band on resonator 2
7:03 motor 1 and 2 on resonator 1 and motor 3 (bent) on resonator
1.1 and 2
7:39 motor 1 and 2 on resonator 1(motor 3 off)
8:36 motor 1 on resonator 1 (motor 2 off)
10:02 motor 1 off
10:04 the end
```

161127_ type1v1v1-ann-em-DM_ 2

```
0:00 motor 1 on resonator 1
0:49 motor 1 and 2 on resonator 1
1:12 motor 1 and 2 on resonator 1 and motor 3 on resonator 1.1 and 2
1:30 motor 1 on resonator 1 and motor 3 on resonator 1.1 and 2
(motor 2 off)
```

```
1:49 motor 1 on resonator 1 and motor 3 on resonator 2
1:58 motor 3 on resonator 2 (motor 1 off)
2:28 rubber band (very short)
2:54 motor 3 on resonator 1.1 and 2
3:01 motor 1 on resonator 1 and motor 3 on resonator 2
3.17 motor 1 on resonator 1 and motor 3 on resonator 1.1 and 2
3:22 motor 1 on resonator 1 (motor 3 off)
3:41 motor 1 and motor 2 on resonator 1
3:56 motor 1 and motor 2 on resonator 1 and motor 3 on resonator 1.1
and 2
4:09 motor 1 and motor 2 on resonator 1 and motor 3 on resonator 2
4:47 motor 1 and motor 2 on resonator 1 and motor 3 on resonator 1.2
5:04 motor 1 and motor 2 on resonator 1 (motor 3 off)
5:14 motor 1 on resonator 1 (motor 2 off)
5:21 motor 1 off
5:22 the end
```

In both interpretations, "resonator 1" was the wooden box (including the contrabass bridge that was tied to it and a hung beer can),[21] "resonator 2" was the large ceramic jar, "motor 1" was the Oral-B CrossAction, "motor 2" was the Oral-BRAUN, and "motor 3" was the (two) GEFU frothing wand(s) (in the first interpretation Daniel used both the bent and the normal frothing wands).

The patterns suggested by the dashed lines and the greater-than signs were interpreted rather freely (in Daniel's words: "like motives") by touching and not touching a resonator with a motor, by shaking a motor in the air, and by turning a motor on and off.

In addition, in both interpretations Daniel had mixed feelings about incorporating the rubber band. After the first interpretation, he said: "I am not sure about the rubber band, it was a bit covered", and in the second interpretation, the rubber band was only heard for a couple of seconds: Daniel tried to play it while he was holding the bent GEFU frothing wand on the large ceramic jar, but it did not work, and he did not try again. The reason for that is possibly related to the fact that throughout both interpretations there was always at least one motor turned on (note that Daniel could also

[21] In a way, these three objects (the wooden box, the contrabass bridge, and the hung beer can) also followed the resonator-structure suggested by *type1v1v1-ann-em*. Therefore, in the transcriptions above, the wooden box is occasionally referred to as "resonator 1.1" and the hung beer as "resonator 1.2". (The contrabass bridge, which connected the hung beer to the wooden box, corresponded to the vertical line of the letter "p", which connects it in the diagram to the letter "D".) In this sense, the diagram was not only a representation of the music, but also of the playing setup.

turn all the motors off and play only the rubber band): in the first interpretation, "motor 1" was always on (and accordingly, also "resonator 1") (Daniel said that he was afraid that turning it off might sound like an ending), and in the second interpretation, although Daniel did turn "motor 1" off, it was only as part of a gradual change from "motor 1" (on "resonator 1") to "motor 3" (on "resonator 2").

Also, Daniel decided to set the duration of the second interpretation to five minutes in advance, and intended to follow the score "more strictly" (Daniel's words). Consequently, in the second interpretation there were more events (in less time) than in the first interpretation (at least in terms of the score): 17 events in 5 minutes compared with 11 events in 10 minutes.

161127_pencil2-em-DM_1

```
0:01 Oral-B BRAUN on wooden box
0:21 Oral-B BRAUN on wooden box and Oral-B CrossAction on wooden box
and beer can
0:53 Oral-B BRAUN on wooden box, Oral-B CrossAction on wooden box
and beer can, and plucking beer can
1:05 Oral-B BRAUN on wooden box (Oral-B CrossAction off)
1:33 silence (Oral-B BRAUN off)
1:39 GEFU frothing wand (bent) on large ceramic jar
1:49 GEFU frothing wand (bent) on large ceramic jar and Oral-B BRAUN
on wooden box
1:58 GEFU frothing wand (bent) on large ceramic jar (Oral-B BRAUN
off)
2:05 GEFU frothing wand (bent) on large ceramic jar and Oral-B BRAUN
on wooden box
2:16 GEFU frothing wand (bent) on large ceramic jar (Oral-B BRAUN
off)
2:24 silence (GEFU frothing wand (bent) off)
2:29 rubber band on large ceramic jar
2:55 the end
```

161127_pencil2-em-DM_2

```
0:00 Oral-B BRAUN on wooden box
0:21 Oral-B BRAUN on wooden box and Oral-B CrossAction on, hitting
and moving beer can
0:35 Oral-B BRAUN on wooden box (Oral-B CrossAction off)
0:45 [bridge falls]
```

```
1:11 silence (Oral-B BRAUN off)
1:17 GEFU frothing wand (bent) on large ceramic jar
1:31 GEFU frothing wand (bent) on large ceramic jar and Oral-B BRAUN
on wooden box
1:42 GEFU frothing wand (bent) on large ceramic jar (Oral-B BRAUN
off)
1:53 GEFU frothing wand (bent) on large ceramic jar and Oral-B BRAUN
on wooden box
2:01 silence (GEFU frothing wand (bent) and Oral-B BRAUN off)
2:09 rubber band on large ceramic jar
2:39 the end
```

161127_pencil2-em-DM_3

```
0:01 Oral-B CrossAction on wooden box
0:25 Oral-B CrossAction and Oral-B BRAUN on wooden box
0:40 Oral-B CrossAction on wooden box (Oral-B BRAUN off)
0:47 Oral-B CrossAction on wooden box and beer can
0:59 Oral-B CrossAction on wooden box
1:17 silence (Oral-B CrossAction off)
1:31 GEFU frothing wand (bent) on large ceramic jar
1:51 GEFU frothing wand (bent) on large ceramic jar and Oral-B BRAUN
on wooden box
2:02 GEFU frothing wand (bent) on large ceramic jar (Oral-B BRAUN
off)
2:16 GEFU frothing wand (bent) on large ceramic jar and Oral-B BRAUN
on wooden box
2:23 silence (GEFU frothing wand (bent) and Oral-B BRAUN off)
2:32 rubber band on large ceramic jar
3:00 the end
```

The second score, *pencil2*, served as a contrast to *type1v1v1-ann-em*, in the sense that it encouraged Daniel to play the motors more "melodically" (rather than producing drones).

Each of the three interpretations consisted of three parts separated with silence (the white background).[22] The first part consisted of the long black line, interpreted as "Oral-B BRAUN on wooden box", and the colorful and black chaotic figures, interpreted as "Oral-B CrossAction on wooden box" and "plucking" or "hitting and moving" the beer can or just using it as a resonator. (In the third interpretation, this was reversed: the Oral-B CrossAction was

[22]Note that Daniel interpreted the score in landscape orientation.

used to interpret the long black line, and the Oral-B BRAUN was used to interpret the chaotic figures.) The second part consisted of the thin brown line, interpreted as "GEFU frothing wand (bent) on large ceramic jar", and the two thicker brown lines, interpreted (also) as "Oral-B BRAUN on wooden box". (Note that in the first interpretation, the GEFU frothing wand lasted after the second Oral-B BRAUN "line" was ended; in the second and third interpretations both motors were turned off simultaneously). Lastly, the third part consisted of the blue lines, interpreted as "rubber band on large ceramic jar".

While interpreting *pencil2*, Daniel also discovered that the pitch of the Oral-B BRAUN can be lowered by pressing the toothbrush's head on the wooden box. He used that in the first part (for a relatively short duration in the first two interpretations, and to interpret the chaotic figures in the third interpretation) and in the second part (to interpret the dark brown lines).

Note that after further discussion, we decided to annotate the diagram slightly differently. We added "toothbrush with speed control, multiple motors during (and/or after) the black chaotic figure, moving objects chaotically during the colorful chaotic figure" to the long black line and the colorful and black chaotic figures; "frothing wand (bent), then multiple motors" to the thin brown line; "low motor sounds (two motors)" to the thickest brown line; "low motor sounds (one motor)" to the less thick brown line; "rubber band on wooden box" to the light blue line; "rubber band on plastic package" to the dark blue line; and "rubber band on ceramic jar" to the other two blue lines.

161127_3lbclpf7-em-DM

`[duration: 6:04]`

161230_3lbclpf7-em-DM

`[duration: 6:16]`

Clearly, Daniel was not able to imitate the sound of a crowd with various motors, resonators, and rubber bands (which is also why I allowed myself not to transcribe these interpretations). That being said, listening to the recording and trying to imitate it did have an obvious influence on Daniel's playing: it made it frenetic and nervous.

Accordingly, one approach was to imitate the atmosphere of the many people talking at the same time. An alternative approach that I suggested was to try to follow just a single voice and imitate it using only a single motor.

161230_iS4v1-ann-em-DM

```
0:00 loud low motor sounds
1:22 high motor sounds
2:02 soft high motor sounds / soft motor sounds of unclear pitches
2:55 rubber band ("almost a pulse"), crescendo of motors
("expanding")
4:14 only rubber band
4:38 the end
```

A fairly accurate interpretation, with the following exception: it is difficult to differentiate between "soft high motor sounds" and "soft motor sounds of unclear pitches". When the former was interpreted, also other, not necessarily "high" and "soft" motors were on, and when the latter was interpreted, also the "high" and "soft" motor (in this case, the normal GEFU on the large ceramic jar) was on.

161230_iS1iS2v1-em-DM_1

```
0:00 soft rubber band sounds, "once in a while"
0:31 somewhat "agitating"
0:47 somewhat "agitating" again
0:57 slower, somewhat more regular
1:28 faster
1:35 the end
```

161230_iS1iS2v1-em-DM_2

```
0:00 soft rubber band sounds, "once in a while", gradually
"agitating"
1:37 "agitating" softer
1:55 more regular plucks, relatively fast
2:04 slower
2:19 the end
```

In both interpretations, Daniel limited himself to plucking and pulling a rubber band on a plastic package (influenced by the first line "the shortest creak"). The rhythms were influenced by the next lines: "once in a while", then "agitating", "crawling", and at the end "sh", which was the more regular plucks ending both interpretations (in the second interpretation they were faster and played for a longer duration).

Later, to make the last two lines of the text, "creakingly crawling like [small, even tiny] \\sh", more distinguishable, we decided to annotate them differently: "creakingly crawling like [small, even tiny]" was to be interpreted as short interrupted motor sounds, and "sh" as soft static noise-like motor sound.

1.3.2 With Francesca

161123_ diagram9-8-ann-Sc2tl-FN

```
0:00 AM noise, altered by touching circuit board
1:53 soft FM noise
2:45 hard drive chord [occasionally altered by touching circuit
board]
3:31 the end
```

The score *diagram9-8-ann-Sc2tl* consists of three parts, each represented by a different background. Finding the right balance between expressing the differences between these three parts and creating smooth transitions between them, played a central role in Francesca's interpretation of *diagram9-8-ann-Sc2tl*.

For example, to create a smooth transition from "soft FM noise" to "hard drive chord", Francesca lowered the volume towards the end of "soft FM noise" and played "hard drive chord" very softly. The difference between "AM noise, altered by touching circuit board" and "soft FM noise" was not clear enough, however, possibly because we used in this rehearsal Francesca's guitar amp as a loudspeaker, but also because "soft FM noise" was not soft enough.

161221_ diagram9-8-ann-Sc2tl-v1-FN_ 1

```
0:03 AM noise, altered by touching circuit board
1:20 soft FM noise
1:56 [pause]
2:02 between battery and trackpad [occasionally altered by touching
circuit board]
```

```
2:51 the end
```

161221_ diagram9-8-ann-Sc2tl-v1-FN_ 2

```
0:01 AM noise, altered by touching circuit board
1:53 soft FM noise
2:33 [short pause, then] between battery and trackpad [altered by
touching circuit board]
3:21 the end
```

Apart from the fact that the second interpretation was intended to be longer than the first one (it was longer, but only 30 seconds longer), the two interpretations were rather similar.

Compared with *diagram9-8-ann-Sc2tl-FN*, the "different stations" were significantly shorter and sounded more transitory, and "feedback" was notably more present (perhaps too present, considering that in the "soft FM noise" part of the interpretation there was almost constantly feedback, while the curves that represent feedback consist of only a relatively small part of the diagram). Also note that Francesca changed the annotation "hard drive chord" to "between battery and trackpad" because she thought the latter sounded better than the former after "soft FM noise". Therefore, "-v1" ("v" stands for variation) was added to the title of the score.

In addition, the difference between "AM noise, altered by touching circuit board" and "soft FM noise" was considerably clearer. To create a smooth transition between these two parts, Francesca changed from AM to FM while producing feedback. Also, a short pause was added between "soft FM noise" and "between battery and trackpad".

161123_ pen1v1v1v1x1x2pencil1-Sc2tl-FN

```
0:00 FM noise, occasionally moving tuning wheel
0:25 slightly softer
0:34 significantly softer
0:44 louder
0:58 station
1:15 FM noise
1:23 clicks/electric hum
1:42 feedback
1:51 FM noise
2:00 the end
```

Francesca explained her interpretation:

- The white background represented FM noise.
- The long diagonal lines represented moving the tuning wheel.
- The shorter, more chaotic lines represented "disturbing noises".
- The dense group of lines in the right, upper part of the diagram represented "something very intense" (feedback).
- The gray triangle and the colored lines represented a station as well as several "disturbing noises" (like the short, more chaotic black lines).

Francesca felt, however, that she did not have enough control of the instrument in order to realize her interpretation. For example, the changes in volume at the beginning of this interpretation were not intended, but resulted from trying to produce "disturbing noises".

161221_pen1v1v1v1x1x2pencil1-Sc2tl-FN_1

```
0:00 FM noise, clicks/electric hum, occasionally moving tuning wheel
0:51 feedback
1:04 FM noise, clicks/electric hum
1:25 feedback and occasionally electric hum
1:55 AM noise
2:09 feedback (and until 2:12, also a station), fade out
2:31 the end
```

161221_pen1v1v1v1x1x2pencil1-Sc2tl-FN_2

```
0:01 FM noise, occasionally moving tuning wheel, feedback/electric
hum
1:11 AM noise and feedback
1:51 FM noise (more feedback than before)
2:12 high feedback
2:25 FM noise (more feedback than before)
2:43 long and very intense feedback
3:14 FM noise (feedback/electric hum)
3:33 fade out
3:41 the end
```

We were more satisfied with these two interpretations, especially with the second one, in which Francesca was able to differentiate more clearly between short and long (more intense) feedback. Another difference was

that in these two interpretations Francesca interpreted the gray triangle as AM noise instead of as a station.

161221_ iS3x2-ann-Sc2tl-FN

```
0:00 soft radio sound
0:12 noisy rustles
0:19 key T
0:37 noisy rustles
0:49 key 6, altered by touching circuit board
0:53 noisy rustles
1:30 trackpad, soft
1:32 noisy rustles and electric hum
2:11battery, disconnecting power cable
2:15 noisy rustles and electric hum
2:23 between trackpad and hard drive
2:29 noisy rustles
2:38 very short radio sound
2:40 noisy rustles
2:42 opening and closing programs
2:55 noisy rustles and electric hum
3:28 key 3
3:45 high radio feedback
4:00 switching between tabs
4:14 the end
```

With the exception of occasional confusion between noisy rustles and electric hum (as well as the high feedback sound, which started low and somewhat abruptly, and only after a few seconds became high), it was a fairly accurate interpretation.

Before recording it, we discussed the relation between the original text and the annotations added to it. While the relation between the signs "/ ", " \", and " * ", and the sounds of noisy rustles and electric hum might seem rather straightforward, the relation between the other characters (or combination characters) and the sounds described in the annotations probably not. This is because when I annotated *iS3x2*, my main intention was not to find sounds that necessarily correspond to every sign, but to ensure that apart from the noisy rustles and electric hum, each part of *iS3x2* is interpreted as something different. Accordingly, I imagined an interpretation of *iS3x2-ann-Sc2tl* as consisting of varied rhythms of noisy rustles and electric hum sounding on

top of a changing background (interrupted by "soft radio sound", "very short radio sound", and "high radio feedback").

161221_ iS1-Sc2tl-FN

```
0:01 moving telephone pickup coils [occasionally, the hard drive
chord can be heard in the background, most notably from 1:24 to
1:32.]
2:16 hard drive chord
2:33 moving telephone pickup coils
3:02 hard drive chord
3:22 the end
```

Francesca was both inspired and confused by the first part of the text, the oxymoron "muted agitation". She said: "agitation is a very inspiring word, but it is muted...".

Eventually, she decided to interpret "muted agitation" as moving the two telephone pickup coils on the surface of the laptop, and "some light" as the hard drive chord. Most of the time the volume was low (because the "agitation" is "muted"), but occasionally, this was changed by momentarily increasing and decreasing the volume with the pedal, as well as by bringing the telephone pickup coils closer to the laptop and taking them away from it.

Afterwards, we discussed two additional interpretations of *iS1* but did not record them:

- "some light" is to be interpreted as the hard drive chord (as it was in the previous interpretation), but this time the telephone pickup coils are not to be moved (or perhaps, they can be moved only slightly), and "muted agitation" is to be interpreted as "agitatedly" altering the sound by touching the circuit board.
- Putting the laptop to sleep and moving the telephone pickup coils around the left part of the laptop's surface (which produced soft and relatively high "light"-like sounds).

161221_ 1lnnsib-Sc2tl-FN_ 1

```
FM, high feedback [duration:  1:19]
```

161221_ 1lnnsib-Sc2tl-FN_ 2

```
sleep mode, moving telephone pickup coils [duration:  2:26]
```

The first interpretation was a literal imitation of the recording, focusing on the chirping of the crickets and reproducing it by setting the radio to FM and producing high feedback. As Francesca felt that just playing high feedback every time a chirping is heard could become "a bit boring", I suggested trying another approach: imitating the recording more metaphorically by putting the computer to sleep and exploring the possible correspondence between night sounds and the different sounds the computer produces in sleep mode.

In addition, I explained that I found this recording interesting not because of the chirping of the crickets per se, but because of the way in which the low-quality recording altered its sound (as well as the high frequencies in general). Furthermore, listening to the recording more carefully revealed that there were many additional layers to which one could pay attention.

1.3.3 With Oded

161122_ polygon1-ann-psAs-OG_ 1

```
0:00 silence
0:12 combinations of sine waves and noise [1]
0:35 silence
0:42 combinations of sine waves and noise [2]
1:09 silence
1:25 loud noisy rattling, complex beating patterns
3:06 the end
```

Oded stopped after "loud noisy rattling, complex beating patterns" and asked how it is different from the annotation "rattling". Here is the difference summarized in three points:

- The latter should obviously not be as "loud" and "noisy" as the former, and should not consist of "complex beating patterns".
- The latter should be shorter than the former, if one interprets the amount of space a part of the diagram occupies on the page as its duration. ("loud noisy rattling, complex beating patterns" was significantly longer than the two "combinations of sine waves and noise".)
- The "< >" indication suggests that there should be a certain correspondence between the overall shape of a part of the diagram and the

manner in which the volume of its interpretation should change over time. Therefore, "rattling" should have a distinct volume contour, based on the shape of the black figure that represents it.

In addition, the annotation "noise, medium LPF res, low volume" added to the foggy background also required clarification: it implies that the combinations of sine waves and noise should not always be separated with silence, or in other words, that the sound described in the annotation should be heard between combinations represented by the parts of the diagram whose background is not white.

161122_polygon1-ann-psAs-OG_2

```
0:00 silence
0:06 noise, medium LPF res, low volume
0:15 combinations of sine waves and noise [1]
0:40 silence
0:53 combinations of sine waves and noise [2, 3; or more?  separated
with and preceded by "noise, medium LPF res, low volume"]
2:36 silence
2:54 loud noisy rattling, complex beating patterns
5:03 silence
5:09 rattling
5:20 silence
5:36 combinations of sine waves and noise [4, 5, separated with and
preceded by "noise, medium LPF res, low volume"]
6:18 the end
```

The second interpretation was longer, and we observed that the emerging musical structure of an interpretation of *polygon1-ann-psAs* is influenced mostly by when "loud noisy rattling, complex beating patterns" is played. Note that Oded chose to order the events in a rather traditional manner, that is, he read the diagram from left to right (until "rattling" and then backwards), placing "loud noisy rattling, complex beating patterns" towards the end of the interpretation.

We also discussed whether noise with high LPF res should be avoided during "loud noisy rattling, complex beating patterns" and "rattling". A possible justification for answering yes to this question is that avoiding noise in these parts could express more clearly the difference between them and the other parts, which all incorporate noise to a certain extent.

Lastly, I asked Oded to begin "loud noisy rattling, complex beating patterns" with a more gradual fade in and end it with a more gradual fade out (as implied by the "< >" indication).

161122_iS5-ann-psAs-OG

```
0:00 noise, full modulation of LPF cutoff, high to maximum LPF res,
very fast to maximum rLFO rate
0:57 reducing noise mix, modulation of LPF cutoff, and rLFO rate,
but in the end accents (high values of all these parameters)
(although not very often)
2:12 sine waves, full modulation of freq shift, very.  fast to
maximum rLFO rate, low to medium rLFO glide, complex beating
patterns
3:12 loud rattling
3:42 abrupt silence
4:14 rattling aluminum foil, low volume [the volume should have been
lower]
4:44 complex texture of the rattling aluminum foil, occasionally
louder
6:24 the end
```

A fairly accurate interpretation (with the exception of "rattling aluminum foil, low volume"). Also, we both agreed that it would be better to produce the "loud rattling" with other objects than with those with which *polygon1-ann-psAs*'s "loud noisy rattling, complex beating patterns" was produced.

In addition, Oded followed my suggestion of using the envelope to interpret the second part of the second annotation, "but in the end accents (high values of all these parameters) (although not very often)" and used it also to interpret the last annotation, "complex texture of the rattling aluminum foil, occasionally louder". Oded used his voice as the envelope follower's input.

161122_diagram3x1-psAs-OG

```
0:00 noise, low LPF res (sometimes maximum LPF res; varied LPF
cutoff)
2:09 and sine waves
3:36 and rattling coins
4:32 with less and less coins
5:28 the end
```

Oded explained his interpretation:

- The white background represented noise, low LPF res.
- The black lines represented noise, maximum LPF res, low LPF cutoff.
- The purple lines represented noise, maximum LPF res, mid LPF cutoff.
- The red lines represented noise, maximum LPF res, high LPF cutoff.
- The green lines represented sine waves.
- The green lines and the black fill represented rattling coins.

161122_iS1v2iS2-psAs-OG_1

```
[duration: 5:49]
```

At first, Oded struggled with this score. He interpreted the text as a single sound and said "it is about someone sad, he is crawling". His interpretation began with a sound similar to that described at the beginning of *iS5-ann-psAs*, just softer and with medium LPF res. Occasionally, the LPF res was increased and sine waves were added.

Then, I asked him to try to interpret each line differently, and he came up with the following interpretation.

161122_iS1v2iS2-psAs-OG_2

```
0:00 noise, high LPF cutoff, high to maximum LPF res
1:30 noise, downward glissando (by lowering LPF cutoff, high to
maximum LPF res)
2:06 noise, low LPF res, occasionally adding sine waves, several
accents (volume, LPF res)
3:22 low soft sine wave(s)
3:52 the end
```

170219_iS1v2iS2-ann-psAs-OG

```
0:00 low soft sine wave [and upward glissando]
0:54 sine waves, occasionally adding noise, low LPF res (volume, LPF
res)
3:11 noise, upward glissando (by raising LPF cutoff, high to maximum
LPF res)
3:55 noise, high LPF cutoff, high to maximum LPF res
```

```
4:50 noise, medium LPF res, lowering volume
5:48 the end
```

I annotated *iS1v2iS2* by combining Oded's two interpretations of it. To the first two lines ("muted aggregates of, - / {dark", I added the annotation "noise, medium LPF res, low volume, occasionally louder for a short duration", based on the first interpretation. The rest of the lines followed the second interpretation.

Note that in *161122_iS1v2iS2-psAs-OG_2* Oded read the score in reverse order (that is, bottom to top). Because of that, "noise, low LPF res, occasionally adding sine waves" was interpreted as "sine waves, occasionally adding noise, low LPF res" and "downward glissando (by lowering LPF cutoff)" as "upward glissando (by raising LPF cutoff)". Oded also added an upward glissando at the beginning, and at the end, instead of playing "noise, medium LPF res" with "low volume, occasionally louder for a short duration" he just gradually lowered the volume.

170219_zr1tS-psAs-OG

```
rattling plastic box [duration:  4:39]
```

Oded managed to imitate the recording with his playing setup quite accurately. He played a single sine wave and placed a plastic box (the same plastic box that is documented in the recording he was imitating) on the subwoofer's speaker cone while tweaking the "freq shift" and "volume" dials, as well as modulating them with the envelope follower (and experimenting with different settings of it).[23] Additional sounds were produced by hitting and rubbing the subwoofer's wooden enclosure.

[23]Later, we realized that it is more straightforward to imitate the recording without using the envelope follower.

Chapter 2

ccloudlab1x1

After the rehearsal on November 22, 2016, Oded asked me if he could perform *polygon1-ann-psAs* at a concert of the Hochschule für Musik Basel's percussion class on January 18, 2017. I agreed, and as a result, *polygon1-ann-psAs* was the first score of which I created a dynamic and interactive, computer-based version. By dynamic, I mean that the score changes over time, and by interactive, I mean that the way in which the score changes over time can be influenced by the performer.

To create such a version of *polygon1-ann-psAs*, I first numbered the different parts of the diagram and drew lines between adjacent parts, defining how the parts can follow one another (I did so because the order in which the different parts of a diagram were to be read, had to correspond to the order in which they were placed on the page; see section 1.2). Then, based on the aforementioned correlation between the amount of space a part occupies on the page and the duration of its interpretation (see the comments on Oded's first interpretation of *polygon1-ann-psAs*), I traced the shape of each part and measured its area (see figure 2.1).

Table 2.1 shows the areas of *polygon1*'s different parts (in square pixels) and their corresponding durations (in seconds), which I calculated using the following formula:

$$duration = 135 \times \sqrt[3]{\frac{area}{317086}}$$

135 was the duration I set for the largest part (whose area is 317086 px^2), and I extracted the cube root of the resulting ratio in order to lengthen the durations of the events represented by the smaller parts of the diagram (otherwise, the duration of part 1, for example, would have been only 1156 ms). Note that I devised this formula and chose these values to arrive at temporal structures similar to those of Oded's interpretations. (The only

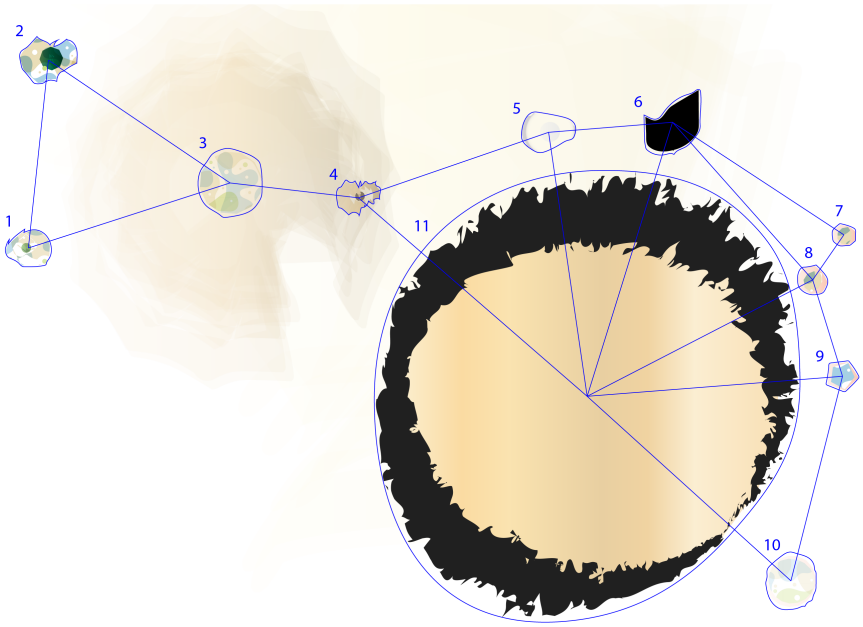


Figure 2.1: Measuring *polygon1*.

Table 2.1: The durations of the score's parts.

	area [px^2]	duration [s]
1	2716	28.064
2	3805	31.366
3	7217	38.744
4	2119	25.856
5	3349	30.072
6	5115	34.583
7	868	19.260
8	1443	22.777
9	1487	23.004
10	4787	33.835
11	317086	135

exception was part 7, which according to the formula was supposed to last for 34.583 seconds, but in Oded's second interpretation lasted for only 11 seconds. Therefore, I added to it also the following annotation: "may be shorter than the indicated duration".)

To determine the durations of the transitions between the parts, I measured the lengths of the lines I drew between them. Table 2.2 shows the length of each line (in pixels) and its corresponding duration (in seconds). I calculated the durations using the same formula given above, but raised the lengths to the power of 1.25 in order to make them more comparable to the areas.[1]

Table 2.2: The durations of the transitions between the score's parts.

	length [px]	duration [s]
$1 \leftrightarrow 2$	271	20.823
$1 \leftrightarrow 3$	304	21.834
$2 \leftrightarrow 3$	315	22.156
$3 \leftrightarrow 4$	186	17.829
$4 \leftrightarrow 5$	289	21.383
$4 \leftrightarrow 11$	435	25.312
$5 \leftrightarrow 6$	179	17.549
$5 \leftrightarrow 11$	383	24.017
$6 \leftrightarrow 7$	294	21.535
$6 \leftrightarrow 8$	303	21.804
$6 \leftrightarrow 11$	412	24.751
$7 \leftrightarrow 8$	79	12.523
$8 \leftrightarrow 9$	145	16.088
$8 \leftrightarrow 11$	365	23.545
$9 \leftrightarrow 10$	303	21.804
$9 \leftrightarrow 11$	368	23.624
$10 \leftrightarrow 11$	395	24.324

Afterwards, I elaborated the annotation "combinations of sine waves and noise", specifying how the different parts of the diagram to which this annotation refers (parts 1–5 and 7–10) are to be interpreted in more detail. To do so, I linked certain graphic characteristics to certain playing instructions, as can be seen in the list below. Table 2.3 shows the new, elaborated annotation of each part.

[1] Note that in *ccloudlab1x1*, the durations of both the parts and the transitions between them were rounded to the nearest second. Later, the unrounded durations were used.

- outline ⇒ noise mix [1]
  Red Orange, 5- or 6-point-thick ⇒ slightly more noise
  Red Orange, 9-point-thick ⇒ more noise
- kernel's size ⇒ noise mix [2]
  small ⇒ slightly more sine waves than noise
  medium ⇒ more sine waves than noise
- shell's fill ⇒ LPF res
  Alyssa fill ⇒ high
  others (Foliage 19 and Blue Vignette) ⇒ low
- opacity ⇒ volume
  more than 50% ⇒ low (soft)
  less than 50% ⇒ very low (very soft)

Table 2.3: The new, elaborated annotations added to the score's parts.

1	soft combination of sine waves and noise (a bit more sine waves than noise, high LPF res)
2	soft combination of sine waves and noise (more sine waves than noise, high LPF res)
3	soft combination of sine waves and noise (high LPF res)
4	soft combination of sine waves and noise (a bit more sine waves than noise, low LPF res)
5	very soft combination of sine waves and noise (more sine waves than noise, low LPF res)
6	rattling (may be shorter than the indicated duration)
7	soft combination of sine waves and noise (a bit more noise than sine waves, high LPF res)
8	soft combination of sine waves and noise (more noise than sine waves, high LPF res)
9	soft combination of sine waves and noise (a bit more noise than sine waves, high LPF res)
10	very soft combination of sine waves and noise (a bit more noise than sine waves, high LPF res)
11	complex beating patterns, loud noisy rattling

In addition, I also differentiated between the foggy background and the light foggy background. The original annotation, "soft noise, medium LPF res", was added to the former, while "very soft noise, low LPF res" was added to the latter.

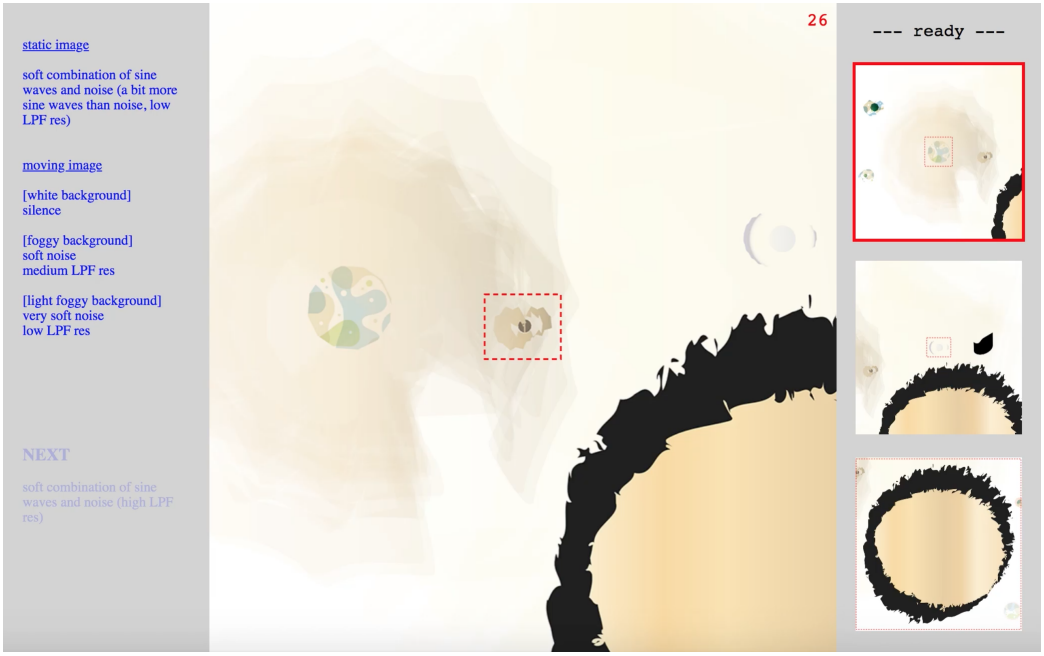


Figure 2.2: A screenshot of *polygon1-ann-psAs-di*.

Figure 2.2 is a screenshot of the new version of the score, titled *polygon1-ann-psAs-di*[2]. In the main, middle part of the screen is the part of the diagram to be interpreted (indicated with a red dashed rectangle) as well as a timer indicating its duration, and in the right part of the screen are the parts of the diagram that can follow the part of the diagram shown in the main, middle part of the screen (the top one is selected by default, however, this can be changed by using a USB triple foot switch or 1, 2, and 3 on the keyboard).[3] In the left part of the screen are the annotations added to the part of the diagram shown in the main part of the screen and to the part of the diagram that is selected to follow it.

polygon1-ann-psAs's dynamic and interactive version, *polygon1-ann-psAs-di*, is available at https://compositioncloud.github.io/polygon1-ann-psAs-di.html (use Google Chrome). After loading the page, you will be asked to choose the part with which you would like to begin (typing "4" and clicking "OK", for example, will bring you to a screen as the one shown in figure 2.2). Press 1, 2, or 3 when you are ready, press Esc when you are done,

[2]Note that "di" stands for dynamic and interactive.

[3]If a part can be followed by more than three parts (for example, part 6 can be followed by parts 5, 7, 8, and 11), the three options that are offered by the computer are the parts that have been interpreted the least number of times since the score was loaded, ordered from the closest to the furthest.

and press Esc once more to save a log file documenting your interaction with the score. Go to https:// compositioncloud.github.io/polygon1-ann-psAs-di-log_reader.html and drag and drop the log file into the browser in order to replay it.

A replay of Oded's interaction with *polygon1-ann-psAs-di* synchronized with an audio recording of his performance can be found on *Composition-Cloud*'s YouTube channel, titled *ccloudlab1x1* (that is, the first extract of *ccloudlab1*; "x" stands for extract).[4]

Note that Oded still chose to order the events in a rather traditional manner (as in his interpretations of *polygon1-ann-psAs*). He began with part 4, moved to part 3, repeated part 4 again, and then continued with parts 5–9 before playing part 11 and ending with parts 8 and 6. He selected four times next parts that were different from the default ones: at 1:45, part 5 instead of part 5 (by default, parts 3 and 4 alternate infinitely); at 4:56, part 9 instead of part 7 (he preferred not to repeat part 7, which was the previous part he had played); at 5:32, part 11 instead of part 8 (part 11 is never the next part by default); and at 9:05, part 6 instead of part 7 (ending with the shorter rattling part).

His interpretation of the new, elaborated annotations could have been more accurate, however. The difference between "soft noise, medium LPF res" and "very soft noise, low LPF res" could have been clearer, and he did not observe the instruction "low LPF res" in the first and fourth parts that he played (parts 4 and 5). Moreover, he still added noise with high LPF res to the long, loud noisy rattling part (see the comments on his second interpretation of *polygon1-ann-psAs* in the previous chapter). After the performance, I asked him if it was a conscious decision, and he said no. Therefore, I decided to change the annotation added to this part to "only sine waves, complex beating patterns, loud noisy rattling".[5]

[4]Note that I had to stretch several parts of the replay video because at the time the score's clock was not precise enough. Luckily, we projected the score during the performance and took a low-quality video recording of it, so I could synchronize the replay with the projected score. This is fixed in the version of *polygon1-ann-psAs-di* currently available online.

[5]Although Oded did avoid noise with high LPF res during the two times he played part 6, for the sake of consistency, I also added the instruction "only sine waves" to this part's annotation.

Chapter 3

ccloudlab1-2

The second stage of the development process spanned from January to April 2017. It began with creating dynamic and interactive, computer-based versions of the other scores,[1] which are described in detail in the first section of this chapter. The second section documents six duo rehearsals during which we explored different combinations of the scores, including (as in section 1.3) transcriptions of the combinations that we recorded as well as comments on them. Lastly, the third section, titled Before *ccloudlab1-3*, documents two tutti rehearsals that preceded the third stage of the development process, ending with several photos taken by visual artist Kostas Tataroglou.[2]

3.1 The computer-based scores

The following is a description of the dynamic and interactive, computer-based versions of the scores interpreted during the first stage of the development process. They are available at https://compositioncloud.github.io/ccloudlab1-2.html (use Google Chrome). After loading the page, you will be asked to choose a performer, a score, and a beginning. To interact with the scores you can either use a USB triple foot switch or 1, 2, and 3 on the keyboard.

[1] I began creating these versions in January 2017 after Oded's performance of *polygon1-ann-psAs-di*. It overlapped with the first stage of the development process (which, as stated earlier, spanned from November 2016 to February 2017) because the last individual rehearsal I held with Oded was on February 19, 2017. The individual rehearsal preceding it was with Daniel on December 30, 2016.

[2] Kostas also created a short teaser for *ccloudlab1* (see *ccloudlab1 (teaser)* on *CompositionCloud*'s YouTube channel) and participated in *ccloudlab1x2v1* (see section 5.2). More photos can be found on *CompositionCloud*'s Facebook page.

3.1.1 *diagram9-8* and *diagram10-2v1*

Both *diagram9-8* and *diagram10-2v1* are databent photos.[3] I used a hex editor to replace certain byte sequences in the original photos by other byte sequences.[4] One of the outcomes of that process was the division of the original photos into several distinct rows: 17 rows in the case of *diagram9-8* and 3 rows in the case of *diagram10-2v1* (see figures 3.1 and 3.2).

The dynamic and interactive, computer-based versions of *diagram9-8* and *diagram10-2v1*[5] are multiple-row, looped horizontal scrolling scores. It is possible to move up and down through the rows while the score is scrolling by pressing the left and right foot switches, as well as change the scrolling direction (left to right or right to left) by pressing the middle foot switch.

The scrolling speed depends on the height of the selected row. Tables 3.1 and 3.2 show the rows' heights (in pixels) and their corresponding speeds (in pixels per second), which I calculated using the following formulas:

$$speed = 70 \times \sqrt{\frac{8}{height}}$$

(*diagram9-8*)

$$speed = 30 \times \frac{595}{height}$$

(*diagram10-2v1*)

8 and 595 are the heights of *diagram9-8*'s and *diagram10-2v1*'s narrowest rows. They are divided by the height of the selected row, so the lower the height, the higher the speed. I extracted the root of *diagram9-8*'s ratios because I felt that the wider rows were too slow. And 70 and 30 determine the general speed of each score.[6]

Figures 3.3 and 3.4 are screenshots of the scores. In the main, middle part of the screen is the selected row centered (the other rows are masked), and an arrow and a dashed vertical line that function as a cursor. In the left part of the screen are the annotations, and the right part of the screen was reserved for showing parts of other scores that could follow (more on that in section 4.1).

---

[3] Wikipedia defines databending as "the process of manipulating a media file of a certain format, using software designed to edit files of another format".

[4] See "diagrams9" and "diagrams10" on *ccloudblog*.

[5] For the sake of brevity, for now on only the titles of the original diagrams/imaginary sounds are used (without the "-ann-[playing setup's abbreviation]" suffix).

[6] It is possible to change the speed by pressing "s", typing the new speed (the default is 1), and clicking "OK".

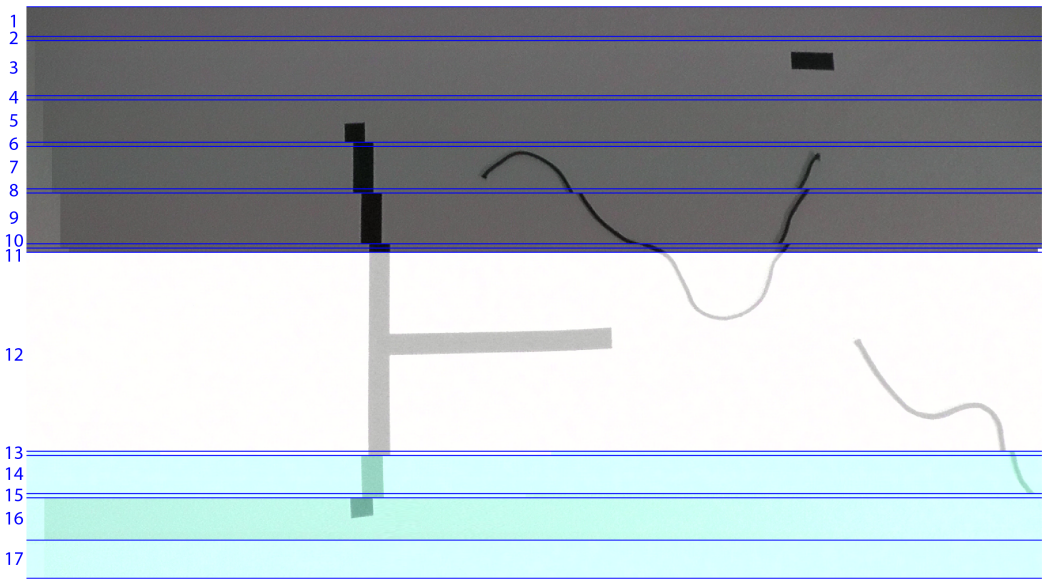


Figure 3.1: *diagram9-8*'s division into rows.

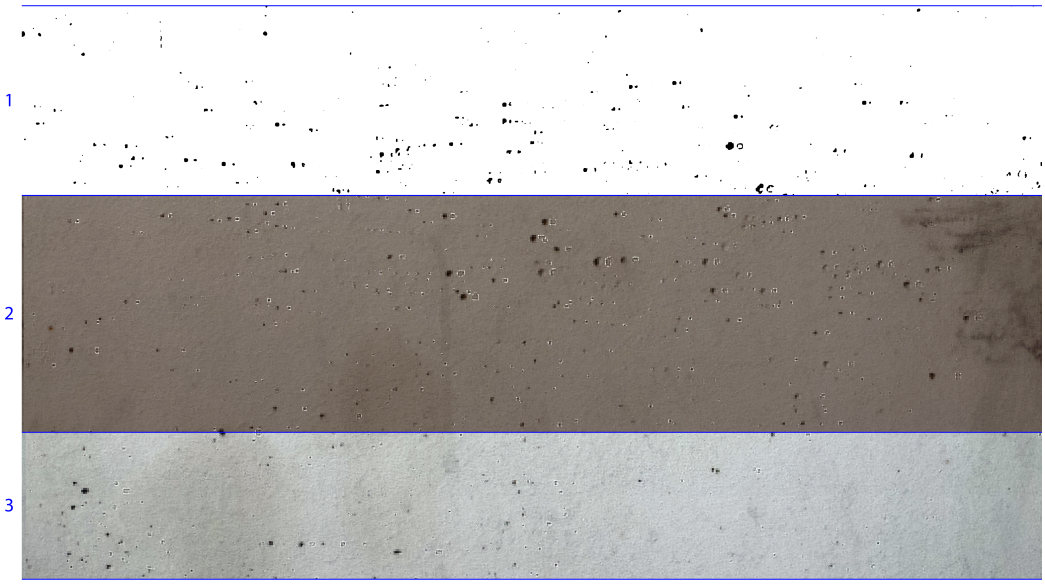


Figure 3.2: *diagram10-2v1*'s division into rows.

Table 3.1: The speeds of the rows (*diagram9-8*).

	height [px]	speed [px/s]
1	56	26.457
2	8	70
3	104	19.414
4	8	70
5	80	22.135
6	8	70
7	80	22.135
8	8	70
9	96	20.207
10	8	70
11	8	70
12	376	10.210
13	8	70
14	72	23.333
15	8	70
16	80	22.135
17	72	23.333

Table 3.2: The speeds of the rows (*diagram10-2v1*).

	height [px]	speed [px/s]
1	768	23.242
2	959	18.6
3	595	30

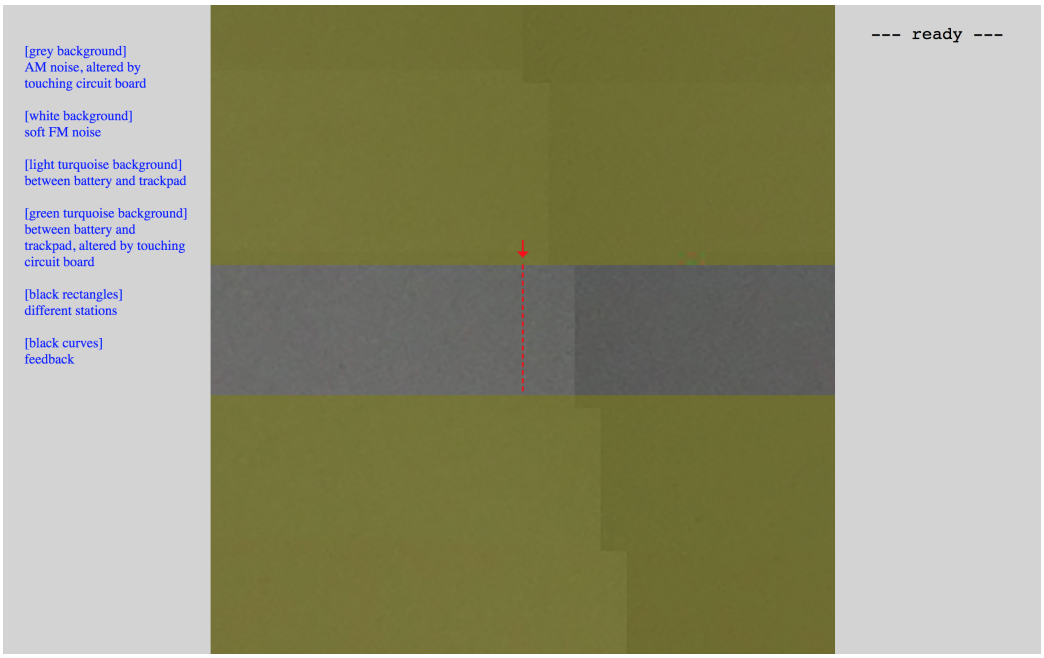


Figure 3.3: A screenshot of *diagram9-8*'s computer-based version.

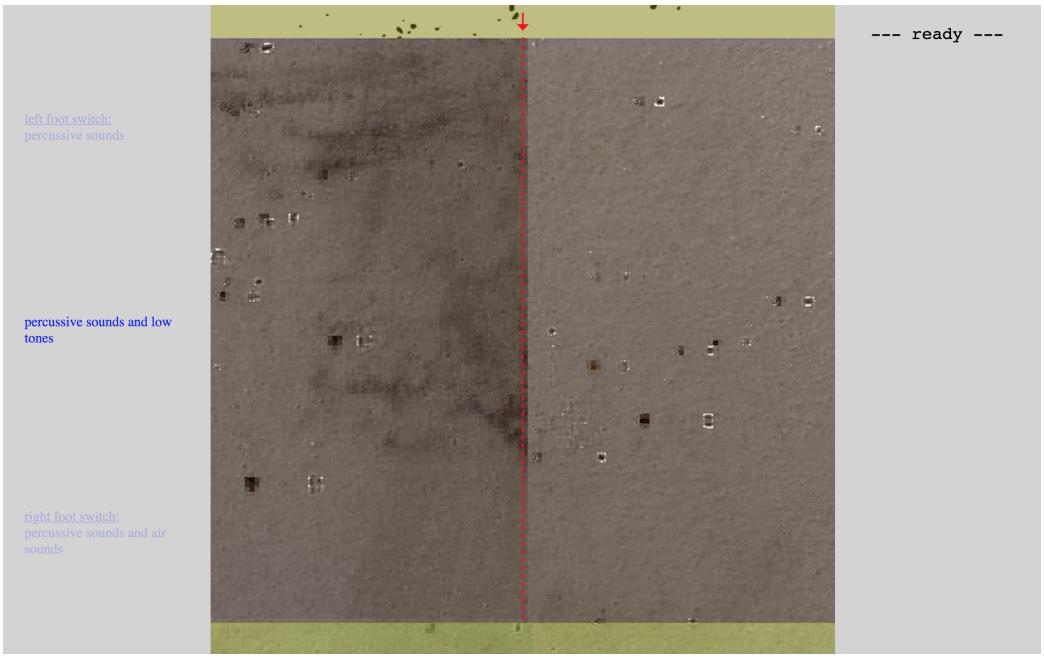


Figure 3.4: A screenshot of *diagram10-2v1*'s computer-based version.

3.1.2 *pen1v1v1v1x1x2pencil1* and *pencil2*

To create the dynamic and interactive, computer-based versions of *pen1v1v1v1 x1x2pencil1* and *pencil2*, I divided both diagrams into individual parts, transforming them into modular scrolling scores in which it is possible order the parts in real-time. In addition, because diagrams in *CompositionCloud* can be read in any direction, each part is also rotated, inverted, and reversed.

The possible orders in which the parts can follow one another were derived from the order in which they were placed on the page. I followed the following steps:

1. I drew lines between the edges of any two parts if the lines did not cross other parts.
2. If two or more lines drawn from the same edge had similar angles (less than five-degree difference), all the lines except the shortest one were deleted.
3. If more than three lines were drawn from the same edge (after deleting those having similar angle), I deleted also all the lines that crossed the parts whose edges they connected. If there were less than three lines, I kept up to three of these lines (the shortest lines were kept).

There were several exceptions, however. In *pen1v1v1v1x1x2pencil1*, I followed these steps strictly only for parts 1–11 (those that Francesca interpreted as "disturbances"). I drew lines only to the left edge of part 12, and these represented only the parts after which part 12 can follow, but not the parts that can follow part 12, which are part 14, part 9 (both edges), part 13, and part 10 (both edges) (part 12 crosses parts 9, 10, and 13, and part 14 is simply close to it). Regarding parts 13 and 14, I did follow the first step, but did not draw the lines from these parts' edges but from their centers, deleted lines that were longer than the longest of the lines drawn between parts 1–11, and if it was possible to draw lines from parts 13 and 14 to both edges of another part, I kept only the shorter line (except for part 10's left edge because otherwise this edge would have been connected only to part 7's left edge). Moreover, when parts 12, 13, or 14 are reached, the scrolling stops, and it is possible to choose freely when to change to the next part. In *pencil2*, the only exceptions concerned part 4, whose reversed versions were identical to its original versions. Therefore, the reversed versions of part 4 could not follow parts 1, 7, and 8 (but these parts could follow part 4). Figures 3.5 and 3.6 show the lines I drew between the different parts of *pen1v1v1v1x1x2pencil1* and *pencil2*.

Since the computer-based versions of *pen1v1v1v1x1x2pencil1* and *pencil2* are scrolling scores, the durations of the parts and the transitions between

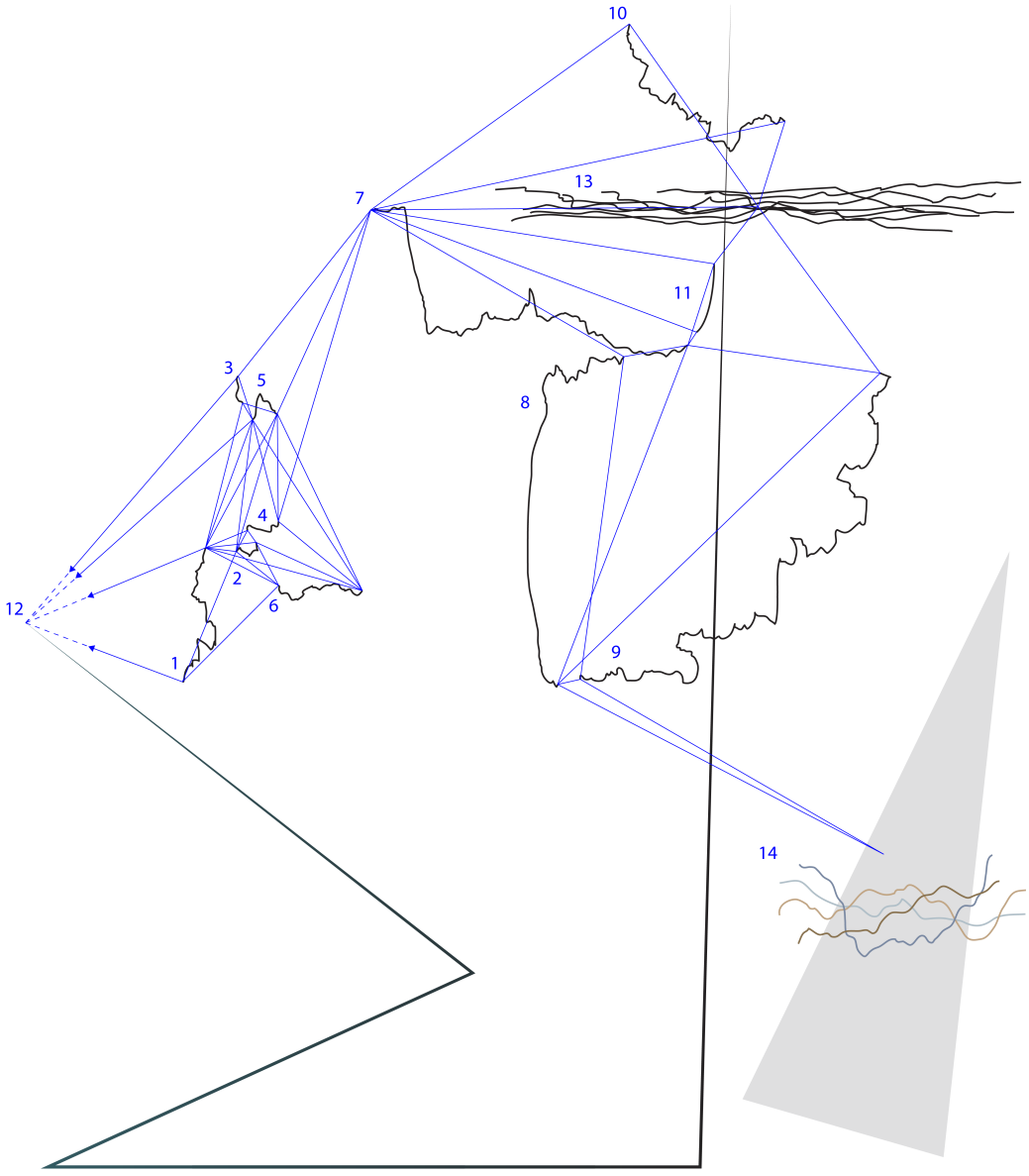


Figure 3.5: The lines I drew between *pen1v1v1v1x1x2pencil1*'s different parts.

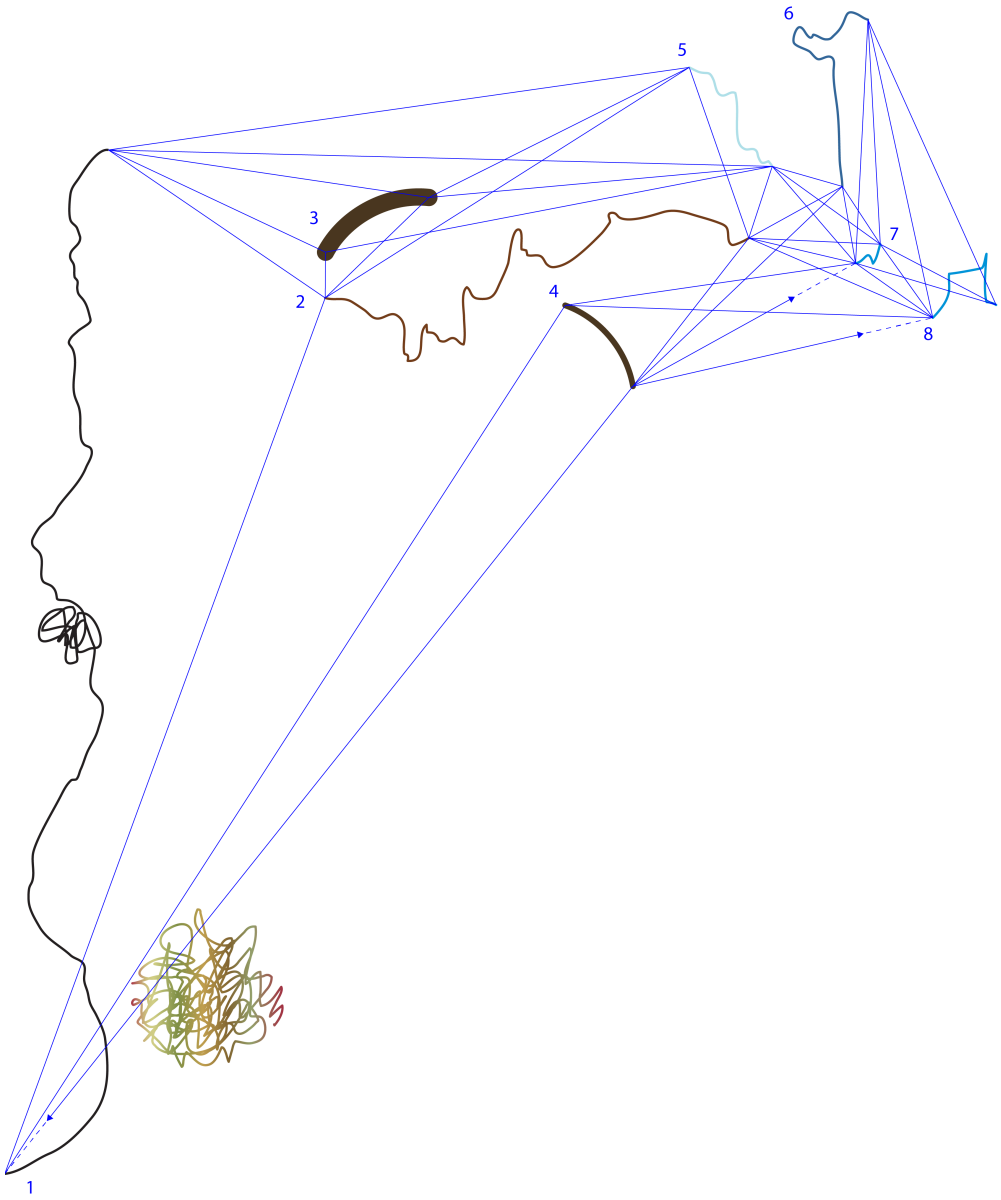


Figure 3.6: The lines I drew between *pencil2*'s different parts.

them depend on their widths and heights (the widths determine the durations of the unrotated versions of the parts; the heights determine the durations of the rotated versions of the parts) and on the lengths of the lines drawn between them, as well as on each score's scrolling speed. The scrolling speed of *pen1v1v1v1x1x2pencil1* is 50 pixels per second, and the scrolling speed of *pencil2* is 7 pixels per second. (These values reflect to a certain extent the temporal structures of Francesca's and Daniel's interpretations of these diagrams.)[7] Tables 3.4 to 3.7 show the widths and heights of the parts and the lengths of the lines drawn between them (in pixels) as well as the corresponding durations (in seconds).[8]

Screenshots of both scores are shown in figures 3.7 and 3.8. In the main, middle part of the screen are the part of the diagram to be interpreted and the part of the diagram selected to follow it (slightly faded) as well as an arrow and a dashed line that function as a cursor (as in the previous scores). In the right part of the screen are the three parts that can follow the part of the diagram to be interpreted,[9] and in the left part of the screen are the annotations added to the part of the diagram to be interpreted and to the part of the diagram that is selected to follow it.

Table 3.3: The durations of the parts (*pen1v1v1v1x1x2pencil1*).

	width/height [px]	duration [s]
1	43/164	0.86/3.28
2	29/20	0.58/0.4
3	11/35	0.22/0.7
4	41/16	0.82/0.32
5	33/35	0.66/0.7
6	104/23	2.08/0.46
7	382/128	7.64/3.64
8	119/400	2.38/8
9	375/375	7.5/7.5
10	156/193	3.12/3.86
11	26/85	0.52/1.7
12–14	-	free

[7] As in the previous scores, changing the scores' speed is possible by pressing "s".

[8] In tables 3.6 and 3.7, "R" stands for the reversed version of a part.

[9] As in *polygon1-ann-psAs-di*, the top part is always selected by default (however, this can be changed by pressing the foot switches), and if a part can be followed by more than three parts, the three options that are offered by the computer are the parts that have been interpreted the least number of times since the score was loaded, ordered from the closest to the furthest.

Table 3.4: The durations of the parts (*pencil2*).

	width/height [px]	duration [s]
1	213/774	30.429/110.571
2	371/135	53/19.286
3	108/66	15.429/9.429
4	65/77	9.286/11
5	76/90	10.857/12.857
6	69/155	9.857/22.143
7	21/25	3/3.571
8	60/60	8.571/8.571

Table 3.5: The durations of the transitions (*pen1v1v1v1x1x2pencil1*).

	length [px]	duration [s]
1 → 2	37	0.74
1 → 2R	61	1.22
1 → 3	179	3.58
1 → 4	54	1.08
1 → 5	163	3.26
1 → 5R	182	3.64
1 → 6	98	1.96
1 → 6R	194	3.88
1 → 12	-	0
1R → 2	169	3.38
1R → 6	163	3.26
1R → 12	-	0
2 → 1R	61	1.22
2 → 4	18	0.36
2 → 6	58	1.16
2 → 6R	140	2.8
2R → 1	169	3.38
2R → 1R	37	0.74
2R → 4	29	0.58
2R → 5	159	3.18
2R → 5R	172	3.44
2R → 6	65	1.3
3 → 5	55	1.1
3 → 7	254	5.08
3 → 12	-	0
3R → 1R	179	3.58

3R → 5	23	0.46
3R → 5R	44	0.88
4 → 5	125	2.5
4 → 5R	129	2.58
4 → 6R	130	2.6
4 → 7	388	7.76
4R → 1R	54	1.08
4R → 2	29	0.58
4R → 2R	18	0.36
5 → 1R	182	3.64
5 → 2	172	3.44
5 → 3	44	0.88
5 → 4R	129	2.58
5 → 6R	235	4.7
5 → 7	268	5.36
5R → 1R	163	3.26
5R → 2	159	3.18
5R → 3	23	0.46
5R → 3R	55	1.1
5R → 4R	125	2.5
5R → 6R	243	4.86
5R → 12	-	0
6 → 1R	194	3.88
6 → 2R	140	2.8
6 → 4R	130	2.6
6 → 5	243	4.86
6 → 5R	235	4.7
6 → 7	455	9.1
6R → 1	163	3.26
6R → 1R	98	1.96
6R → 2	65	1.3
6R → 2R	58	1.16
7 → 8	194	3.88
7 → 8R	40	0.8
7 → 9R	130	2.6
7 → 11	243	4.86
7 → 11R	235	4.7
7 → 13	-	0
7R → 3R	254	5.08
7R → 4R	388	7.76
7R → 5R	268	5.36

7R → 6R	455	9.1
7R → 8R	350	7
7R → 10	381	7.62
7R → 10R	506	10.12
7R → 11	416	8.32
7R → 11R	415	8.3
8 → 7	350	7
8 → 7R	78	1.56
8 → 9	389	7.78
8R → 7R	434	8.68
8R → 9	28	0.56
8R → 9R	536	10.72
8R → 14	-	0
9 → 7R	232	4.64
9 → 8	536	10.72
9 → 13	-	0
9R → 8	28	0.56
9R → 8R	389	7.78
9R → 14	-	0
10 → 7	506	10.12
10 → 13	-	0
10R → 7	381	7.62
10R → 13	-	0
11 → 7	415	8.3
11 → 7R	102	2.04
11 → 13	-	0
11R → 7	416	8.32
11R → 7R	19	0.38
12 → 9	25	0.5
12 → 9R	25	0.5
12 → 10	25	0.5
12 → 10R	25	0.5
13 → 7R	463	9.26
13 → 9R	247	4.94
13 → 10	267	5.34
13 → 10R	107	2.14
13 → 11R	86	1.72
14 → 8	439	8.78
14 → 9	419	8.38
14 → 12	-	0

Table 3.6: The durations of the parts (*pencil2*).

	length [px]	duration [s]
1 → 2	107	15.286
1 → 3	100	14.286
1 → 3R	126	18
1 → 5	196	28
1 → 5R	215	30.714
1R → 2	278	39.714
1R → 4	300	42.857
1R → 4R	294	42
2 → 4R	83	11.857
2 → 5	81	11.571
2 → 5R	42	6
2 → 6	55	7.857
2 → 7	56	8
2 → 7R	64	9.143
2 → 8	88	12.571
2R → 1	278	39.714
2R → 1R	107	15.286
2R → 3	29	4.143
2R → 3R	68	9.714
2R → 5	156	22.286
3 → 1R	126	18
3 → 2	68	9.714
3 → 5	116	16.571
3 → 5R	132	18.857
3R → 1R	100	14.286
3R → 2	29	4.143
3R → 5R	162	23.143
4 → 1	294	42
4 → 2R	83	11.857
4 → 6	115	16.429
4 → 7	105	15
4 → 8	121	17.286
4R → 1	300	42.857
4R → 7	117	16.714
4R → 8	138	19.714
5 → 1R	215	30.714
5 → 2R	42	6
5 → 3	162	23.143

5 → 3R	132	18.857
5 → 6	41	5.857
5 → 7	63	9
5 → 7R	65	9.286
5R → 1R	196	28
5R → 2	156	22.286
5R → 2R	81	11.571
5R → 3R	116	16.571
6 → 7	102	14.571
6 → 7R	96	13.714
6 → 8	120	17.143
6R → 2R	55	7.857
6R → 4R	115	16.429
6R → 5R	41	5.857
6R → 7	43	6.143
6R → 7R	39	5.571
6R → 8R	85	12.143
7 → 2R	64	9.143
7 → 5R	65	9.286
7 → 6	39	5.571
7 → 6R	96	13.714
7 → 8	48	6.857
7 → 8R	63	9
7R → 2R	56	8
7R → 4	117	16.714
7R → 4R	105	15
7R → 5R	63	9
7R → 6	43	6.143
7R → 6R	102	14.571
7R → 8	50	7.143
7R → 8R	69	9.857
8 → 6	85	12.143
8 → 7	69	9.857
8 → 7R	63	9
8R → 2R	88	12.571
8R → 4R	121	17.286
8R → 6R	120	17.143
8R → 7	50	7.143
8R → 7R	48	6.857

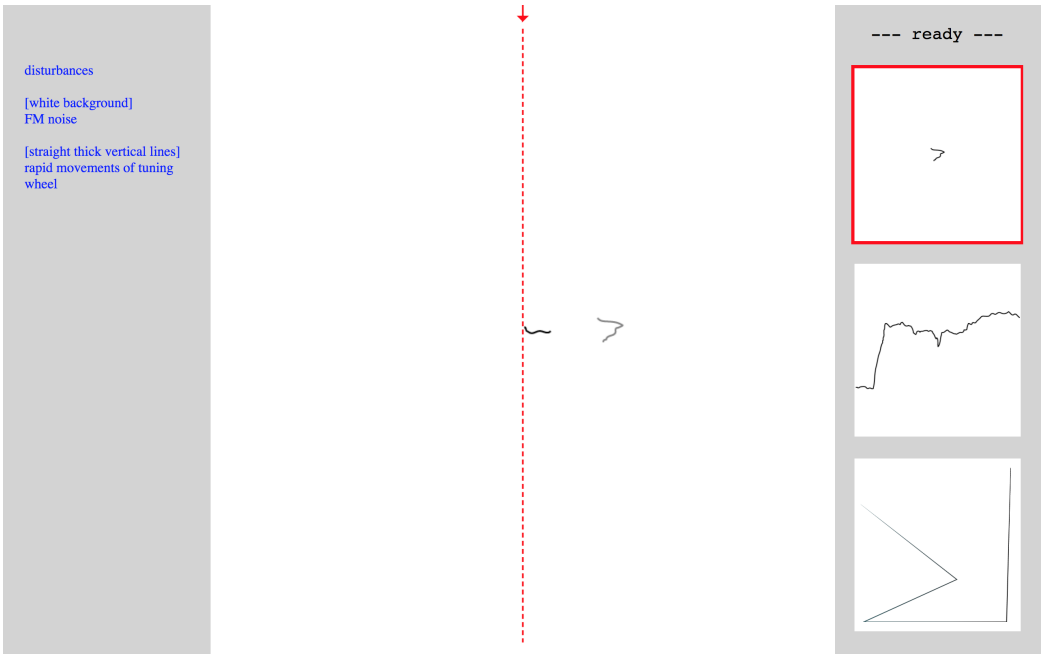


Figure 3.7: A screenshot of *pen1v1v1v1x1x2pencil1*'s computer-based version.

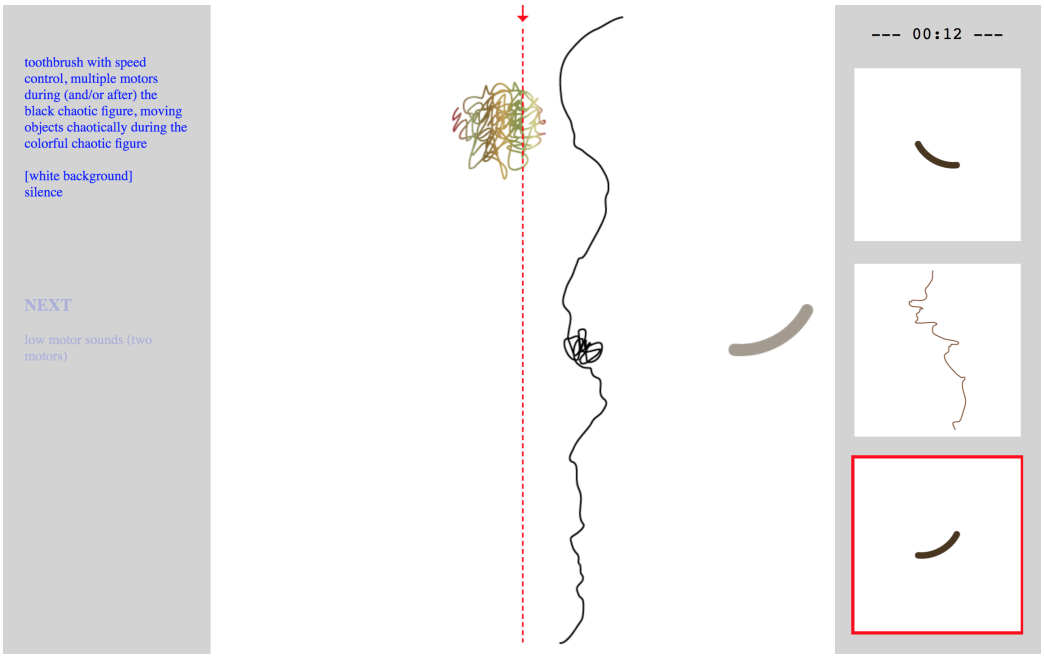


Figure 3.8: A screenshot of *pencil2*'s computer-based version.

3.1.3 *diagram3x1*

The dynamic and interactive, computer-based version of *diagram3x1* is a horizontal/vertical scrolling score in which it is possible to change the scrolling direction by pressing the foot switches (pressing the left foot switch alternates between scrolling left and right, and pressing the right foot switch alternates between scrolling up and down). In addition, whenever one of the score's ends is reached, the scrolling direction is changed automatically. The scrolling speed is 15 pixels per second.[10]

Figure 3.9 is a screenshot of the score. In the middle, main part of the screen is the part of the diagram to be interpreted, indicated with a red dashed square. In the left part of the screen are the annotations, and the right part of the screen (as in the computer-based versions of *diagram9-8* and *diagram10-2v1*) was reserved for showing parts of other scores that could follow.

3.1.4 *type1v1v1*

The computer-based version of *type1v1v1* is not dynamic (in the sense that it does not change over time), but only interactive. The diagram was divided into individual parts, of which different combinations can be created and follow one another.

In Figure 3.10, which is a screenshot of the score, four such combinations are shown: one in the main, middle part of the screen, which is the combination to be interpreted, and three in the right part of the screen, which are the combinations that can follow it. In this example, the combination shown in the main, middle part of the screen, consists of two patterns and the part of the diagram that represents "resonator 1". It can be followed by either the removal of one of the patterns or by the addition of a third pattern.[11] Selecting the next part is possible using the foot switches.

In addition, I slightly changed the annotations. The three patterns no longer represent different motors (as was implied by adding the annotations "motor 1", "motor 2", and "motor 3" to them), but it is the number of patterns that counts: one pattern (no matter which) represents "1-2 motors", two patterns represent "2-4 motors", and three patterns represent "3-6 motors".

[10] As in the previous scores, this can be changed by pressing "s".

[11] Note that it could have also been followed by switching to the second resonator or by adding the second resonator, however, because only three options can be given, these are omitted. As in the case of the computer-based versions of *polygon1*, *pen1v1v1v1x1x2pencil1*, and *pencil2*, if a part can be followed by more than three parts, the three options that are offered by the computer are the parts that have been interpreted the least number of times since the score was loaded.

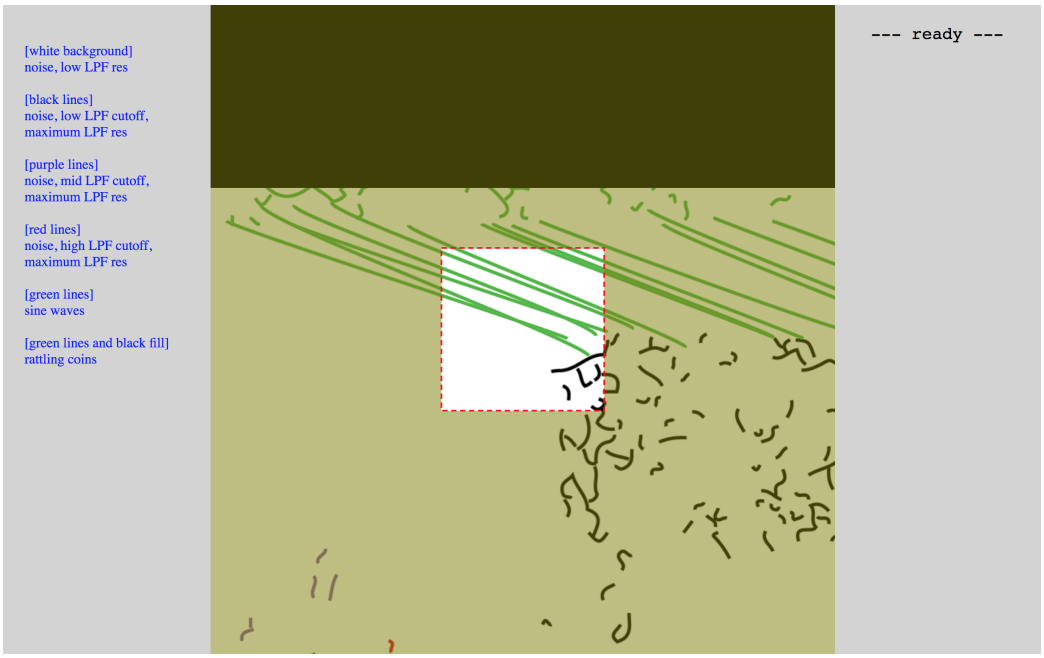


Figure 3.9: A screenshot of *diagram3x1*'s computer-based version.

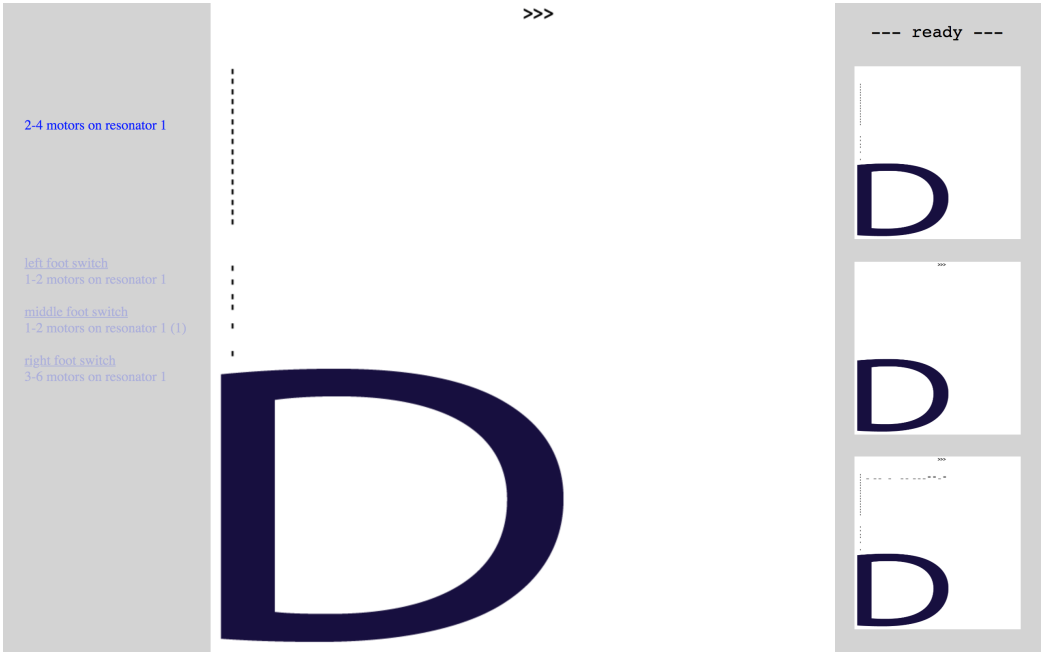


Figure 3.10: A screenshot of *type1v1v1*'s computer-based version.

3.1.5 *polygon1v1*

polygon1v1 is a variation of *polygon1* (recall that "v" stands for variation). Therefore, its dynamic and interactive, computer-based version is very similar to *polygon1*'s dynamic and interactive, computer-based version (which is explained in the previous chapter).[12]

As in *polygon1*, I first numbered the different parts of the diagram and drew lines between adjacent parts, defining how the parts can follow one another, and then traced the shape of each part and measured its area, as can be seen in figure 3.11. Table 3.8 shows the areas of *polygon1v1*'s different parts (in square pixels) and their corresponding durations (in seconds), and table 3.9 shows the lengths of the lines I drew between them (in pixels) and their corresponding durations (in seconds). Figure 3.12 is a screenshot of the score.

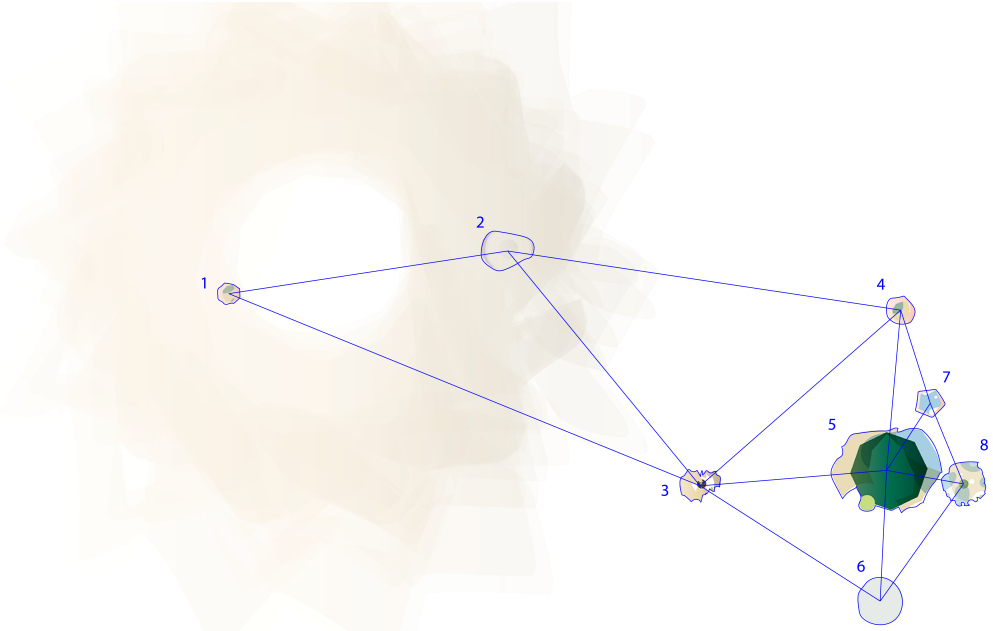


Figure 3.11: Measuring *polygon1v1*.

[12]The only difference is that in *polygon1* I extracted the cube root of the ratio between the area of a part and the area of the largest part, and in *polygon1* I extracted the square root. This is because the difference between *polygon1*'s largest part and its other parts is considerably larger than the difference between *polygon1v1*'s largest part and its other parts.

Table 3.7: The durations of *polygon1v1*'s parts.

	area [px^2]	duration [s]
1	1090	10.404
2	4534	21.218
3	2574	15.987
4	1839	13.513
5	20393	45
6	4928	22.121
7	1715	13.050
8	4213	20.454

Table 3.8: The durations of the transitions between *polygon1v1*'s parts.

	length [px]	duration [s]
$1 \leftrightarrow 2$	484	15.012
$1 \leftrightarrow 3$	873	21.709
$2 \leftrightarrow 3$	520	15.711
$2 \leftrightarrow 4$	682	18.604
$3 \leftrightarrow 4$	457	14.486
$3 \leftrightarrow 5$	321	11.611
$3 \leftrightarrow 6$	366	12.616
$4 \leftrightarrow 5$	275	10.555
$4 \leftrightarrow 7$	167	7.731
$5 \leftrightarrow 6$	224	9.277
$5 \leftrightarrow 7$	137	6.827
$5 \leftrightarrow 8$	134	6.732
$6 \leftrightarrow 8$	246	9.844
$7 \leftrightarrow 8$	149	7.202

3.1.6 The imaginary sounds

The computer-based versions of the imaginary sounds (like that of *type1v1v1*) are interactive but not dynamic. The texts were divided into parts according to the annotations added to them, and moving through the different parts is possible by using the left and right foot switches.

As an example, a screenshot of the computer-based version of *iS5* is shown in figure 3.13. In the main, middle part of the screen is the original imaginary sound (the part of it to be interpreted is written in black; the other parts are written in gray), and in the left part of the screen are the annotation added to the part of the imaginary sound to be interpreted, to the previous part, and to the next part. The right part of the screen (as in the computer-based versions of *diagram9-8*, *diagram10-2v1*, and *diagram3x1*) was reserved for showing parts of other scores that could follow.

3.1.7 The audio recordings

The audio recordings are to a certain extent already dynamic (since audio is a time-based medium), so all that was left was to make them interactive. In the case of *3lbclpf7* and *1lnnsib*, Daniel's and Francesca's interaction with the scores took the form of alternating between two approaches to imitating the recording (see section 1.3). In the case of *tMs3*, the recording was divided into four different sections — "chaotic singing and playing, lots of low tones", "following melody", "very high whistle and air sounds", and "chaotic singing and playing, lots of low tones" (again) — and Amit could change from one section to the one following or preceding it on his own time (the sections were looped). *zr1tS* is the only score that is not interactive, as Oded was only instructed to imitate the recording with a "rattling plastic box".

Note that the computer-based versions of the audio recordings differ from those of the imaginary sounds only in that instead of the imaginary sounds' original texts, in the main, middle part of the screen, "[audio]" is written, and the recordings are played by the laptops on which the scores run and to which pairs of headphones are to be connected. As an example, figure 3.14 shows a screenshot of the computer-based version of *tMs3*.

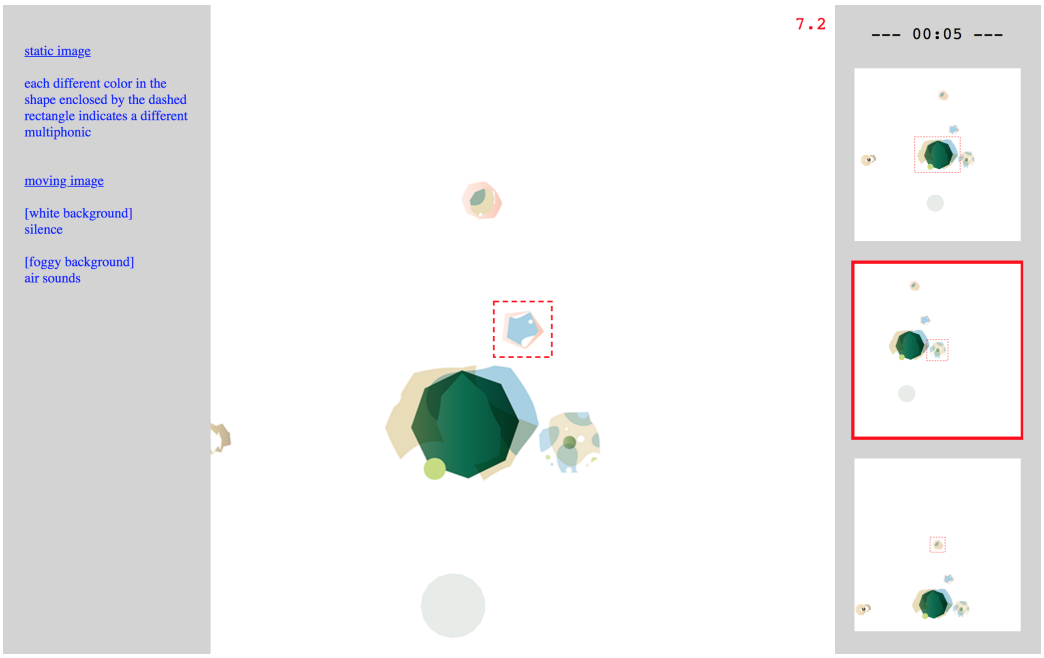


Figure 3.12: A screenshot of *polygon1v1*'s computer-based version.

Figure 3.13: A screenshot of *iS5*'s computer-based version.

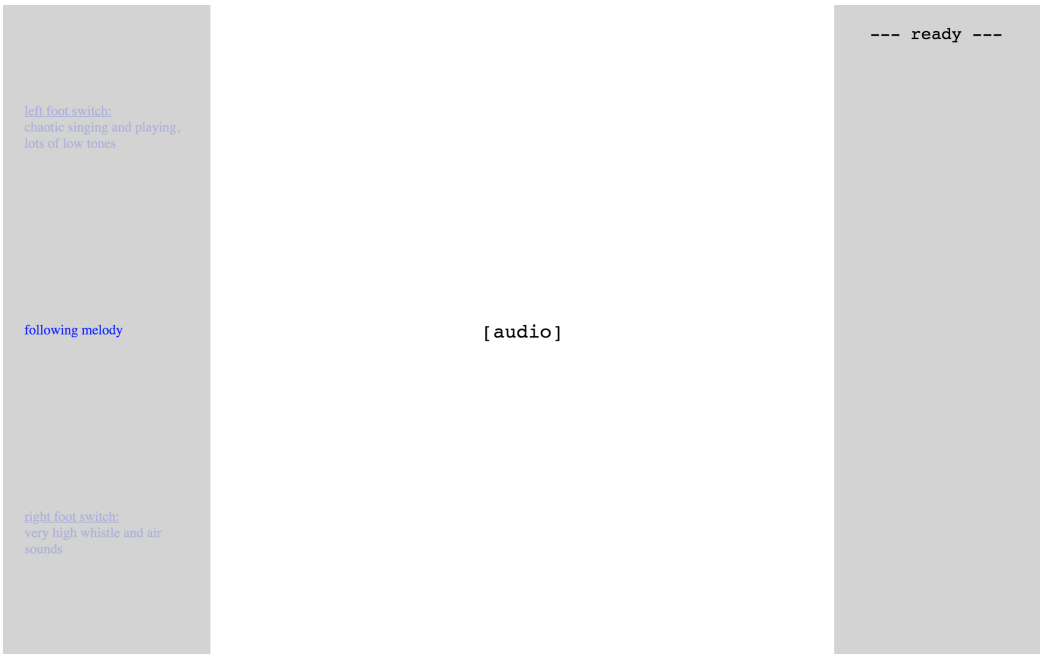


Figure 3.14: A screenshot of *tMs3*'s computer-based version.

3.2 The duo rehearsals

The following section is a documentation of six duo rehearsals we held in March 2017, during which we explored different combinations of the scores described in the previous section.[13] It consists of transcriptions of the combinations that we recorded during these rehearsals, which as the transcriptions presented in section 1.3, specify the order in which the different parts of the scores were interpreted, and are followed by several comments (occasionally, comments were added in square brackets directly to the transcriptions). The title of each combination is a combination of the date of the rehearsal during which it was recorded (in yymmdd format) and the scores' titles (separated with underscores). Recordings of the combinations can be found in the playlist *ccloudlab1-2* on *CompositionCloud*'s YouTube channel.

Note that contrary to *polygon1-ann-psAs-di*, because of time considerations, I did not add to *ccloudlab1-2*'s computer-based scores the possibility to save log files documenting the performers' interaction with them.[14] As a

[13] I chose the combinations of the scores rather intuitively, although I did try to arrange them so that each performer could play each of her/his score at least once during each of the three rehearsals in which she/he participated.

[14] By the time of the first rehearsal I was still working on the computer-based versions of three scores: the computer-based versions of *diagram3x1* and *type1v1v1* were ready

result, I could only infer the part of the score a performer interpreted from what she/he actually played, and therefore the transcriptions are not always very precise. Also for this reason, the recordings of the combinations consist of only audio and the page-based versions of the scores as static images.[15]

In particular, I had difficulties transcribing the interpretations of the computer-based versions of the diagrams, as apart from *diagram10-2v1* and *pencil2*, it was practically impossible to determine the exact part that was played. Accordingly, in the case of *diagram9-8*, I only indicated if what was played was "AM noise, altered by touching circuit board" (rows 1–11), "soft FM noise" (row 12), or "between battery and trackpad" (rows 13–17) (however, I did add a few comments on the occurrences of feedback and stations); in the case of *pen1v1v1v1x1x2pencil1*, I only indicated if it was "FM noise, disturbances" (parts 1–11), "FM, moving tuning wheel" (part 12), "FM, very intense disturbances" (part 13), or "AM noise, disturbances" (part 14); and in the case of *polygon1*, I only indicated if it was "combinations of sine waves and noise", "only sine waves, rattling (may be shorter than the indicated duration)", or "only sine waves, complex beating patterns, loud noisy rattling". In the case of *type1v1v1*, my indications consisted of only the resonators that were used (and if a rubber band was played), and in the case of *diagram3x1*, only a general description of the route taken through the score.

Transcribing the interpretations of the computer-based versions of the imaginary sounds was considerably easier, with the exception of the first two interpretations of *iS3x2*, during which Francesca had a major technical problem related to an important safety issue I overlooked while designing *SRF18-cb_2tpc-lt*: touching the circuit board while it is connected to any device powered by the mains (for example, an amplified loudspeaker) could be dangerous in the case of a ground fault. As I did not want to risk Francesca, I devised a safer version of *SRF18-cb_2tpc-lt*, in which the two telephone pickup coils sniffing the laptop are connected to a battery-powered headphones amplifier, which is connected to the audio input (so the telephone pickup coils match the radio's loudness); the headphones output is connected to the volume pedal, which is connected to two battery-powered loudspeakers; and the electromagnetic waves produced by the two speaker

only before Daniel's and Oded's third duo rehearsals, and the computer-based version of *polygon1v1* was ready only before the last rehearsal. In fact, the possibility to save log files was added only before the performance.

[15] Four exceptions, in which the dynamic and interactive, computer-based versions of the scores are shown, are *170311_iS1iS2v1_tMs3*, *170318__iS1iS2_x1iS6iS5__iS1v2iS2*, *170318_tMs3_iS5*, and *170320_iS1iS2v1_iS1v2iS2*.

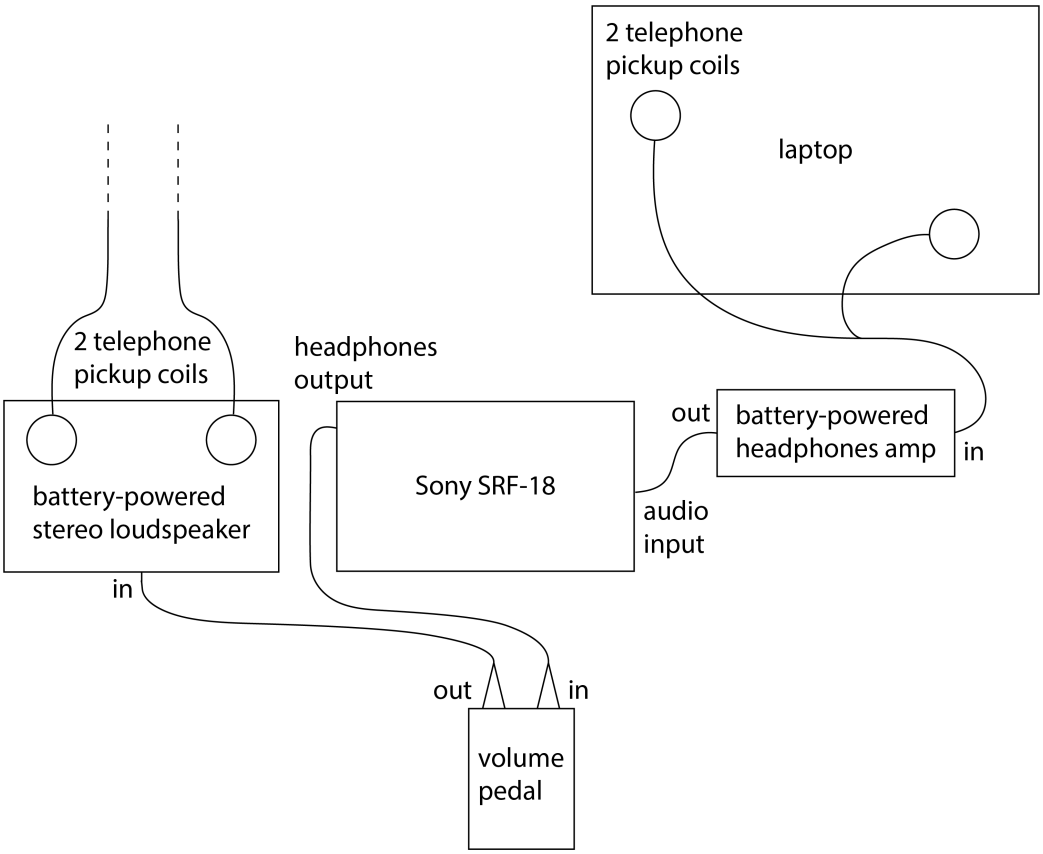


Figure 3.15: A scheme of a safer version of *SRF18-cb_2tpc-lt*.

drivers of the loudspeakers are picked up by two additional telephone pickup coils, which can then be safely connected to any mains-powered device (see figure 3.15).[16]

This solution had one major drawback, however: it significantly softened the electric hum and the noisy rustles. We discovered that during the first interpretation of *iS3x2* (in which both electric hum and noisy rustles played a central role) and found an effective alternative only before the third interpretation of the score. The transcriptions of this score's first two interpretations are therefore only partial.

[16]I also discussed this solution with audio engineer Jan Gubser, who suggested passing the two telephone pickup coils picking up the electromagnetic waves produced by the two battery-powered loudspeakers through two DI boxes. Jan also assisted me with other technical issues during the second and third stages of the development process and recorded the rehearsal on April 4, 2017 (see section 3.3.2) as well as the performance (see section 4.2).

In regard to the audio recordings, while I did not have particular difficulties transcribing their interpretations, for the performers, on the other hand, listening to another performer (and even to themselves) while listening to the recording and trying to imitate it was troublesome. Oded, for example, said that "it's not really a dialogue", "there's little communication", and "it's doing something for oneself".[17] Similarly, Francesca was also ambivalent about these scores and asked if it would be possible to imitate the recording without having to listen to it in real-time. Conversely, Daniel found the experience to be interesting and was keen on exploring further this nonstandard mode of listening and communicating,[18] and Amit even said that "it [the audio recording] is my favorite score" (possibly because Amit's score was the most interactive of the four).

More generally, a recurring theme we discussed during the rehearsals was the apparent conflict between executing the scores accurately and communicating with one another spontaneously. In that regard, my intention was that communication would take place *within* the framework that the scores created. Therefore, I did ask the performers to follow the scores as accurately as they could (and/or were willing to), but simultaneously, I also encouraged them to take advantage of the space the scores left for interpretation as a means for extemporaneous communication (for example, the annotation added to *diagram10-2v1*'s middle row, "percussive sounds and low tones", determined the types of sounds that were to be played but not their loudness, which could be varied spontaneously in accordance with what the other performer was playing).

In addition, in most of the scores the performers also had substantial control over the temporal structure of the resulting music. In other words, they could decide when to change from one part to another part (and often could also choose the part from two or three given options). This, obviously, also served as a means for extemporaneous communication.

3.2.1 With Daniel and Amit

170311_pencil2_iS1iS2iS3

```
0:01 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure
```

[17] Recall that *zr1tS* is the only audio recording whose computer-based version is not interactive. Perhaps, this was another reason for the experience described by Oded.

[18] I collaborated with Daniel also on *ccloudlab1x2*, the second extract of *ccloudlab1*, which focused on the use of audio recordings as real-time musical scores (see chapter 5).

0:09 [A] without mouthpiece, whistle sounds, rubbing tube with plastic card [saxoschlauch220x16]
1:36 [A] without mouthpiece, syllables
1:50 [D] silence
2:03 [D] low motor sounds (two motors)
2:15 [D] silence
2:25 [D] frothing wand (bent), then multiple motors
∼2:50 [A] [pause]
∼3:00 [A] with sax mouthpiece, soft long tones and multiphonics
3:16 [D] silence
3:25 [D] rubber band on plastic package
3:34 [D] silence
3:48 [D] rubber band on ceramic jar
3:52 [D] silence
3:58 [D] rubber band on ceramic jar
4:06 [D] silence
4:16 [D] rubber band on ceramic jar
4:20 [D] silence
4:26 [D] frothing wand (bent), then multiple motors
4:47 [D] silence
4:48 [A] with trumpet mouthpiece, percussive sounds [Amit did not bring a trumpet mouthpiece to the duo rehearsals]
4:55 [D] low motor sounds (two motors)
5:05 [D] silence
5:18 [D] toothbrush with speed control, multiple motors during (and/or after) the black chaotic figure, moving objects chaotically during the colorful chaotic figure
6:23 [A] [pause]
6:37 [A] with sax mouthpiece, very soft high tone, constantly changing intonation, timbre, and dynamics (within very soft)
7:16 [D] silence
7:47 [D] frothing wand (bent), then multiple motors
8:02 [A] with sax mouthpiece, low tone, beating with voice
8:11 [D] silence
8:17 [D] rubber band on ceramic jar
8:20 [D] silence
8:27 [D] rubber band on ceramic jar
8:31 [A] [pause]
8:38 [A] with sax mouthpiece, percussive sounds
8:37 [D] silence
8:54 [D] rubber band on plastic package
9:18 [A] [pause]
9:19 [D] silence

```
∼9:30 [A] without mouthpiece, whistle sounds, plastic card, slowly
fading
9:33 [D] low motor sounds (one motor)
9:42 [D] silence
9:58 [D] rubber band on ceramic jar
10:01 [D] silence
10:07 [D] rubber band on plastic package
10:29 [D] silence
10:43 [D] rubber band on ceramic jar
10:46 [D] silence
11:02 [D] low motor sounds (one motor)
11:15 [D] silence
11:20 the end
```

I found the combination of the toothbrush sounds and the whistle at the beginning particularly interesting (it created a peculiar contrast: low vs high, rough vs delicate).

More generally, the rather linear structure of *iS1iS2iS3* (which was played from the beginning to the end) was repeatedly interrupted by *pencil2*'s intermittent occurrences of motor, "moving objects chaotically", and rubber band sounds. Especially interruptive were motor sounds that followed long silence or long sections of only rubber band.

170311_iS4v1_tMs3

```
0:01 [D] loud low motor sounds [should have been louder]
0:02 [A] chaotic singing and playing, lots of low tones [not enough
low tones] [saxoschlauch220x16]
0:49 [A] [pause]
∼0:50 [D] high motor sounds / soft high motor sounds / soft
motor sounds of unclear pitches [clearer differences between the
different motor sounds (low and high, loud and soft, clearly- and
unclearly-pitched) should have been made]
0:57 [A] following melody
2:12 [D] rubber band ("almost a pulse"), crescendo of motors
("expanding") [no crescendo]
2:40 [D] only rubber band
2:47 [A] chaotic singing and playing, lots of low tones [not enough
low tones]
2:56 [A] following melody [alternating with "very high whistle and
air sounds", intermittent with pauses]
4:35 the end
```

Besides the inaccuracies mentioned in square brackets above, it is also worth noting that *iS4v1*'s "only rubber band" combined well with *tMs3*'s "following melody" and "very high whistle and air sounds".

170311_iS1iS2v1_tMs3

```
0:02 [A] very high whistle and air sounds [saxoschlauch220x16]
0:06 [D] soft rubber band, "once in a while"
0:27 [A] following melody
0:28 [D] soft rubber band, somewhat "agitating"
0:41 [A] very high whistle and air sounds
1:39 [D] short interrupted motor sounds
2:43 [D] soft static noise-like motor sound
2:44 [A] chaotic singing and playing, lots of low tones
3:17 the end
```

In this combination, Daniel and Amit were provided with more specific instructions in regard to how to interact with the scores. I instructed Daniel to play *iS1iS2v1* from the beginning to the end and Amit to begin with "very high whistle and air sounds". Amit was allowed to change to "following melody" but not to "chaotic singing and playing, lots of low tones". In order to play the latter, he had to wait until Daniel reached "soft static noise-like motor sound".

Afterwards, we discussed another possible condition: Daniel can only change from "soft rubber band, somewhat "agitating"" to "short interrupted motor sounds" while Amit is "following melody".[19]

170311_pencil2_diagram10-2v1

```
0:01 [D] low motor sounds (one motor)
0:03 [A] percussive sounds [saxoschlauch220x16]
0:14 [D] silence
0:36 [A] percussive sounds and air sounds [whistles instead of air
sounds; also, "percussive sounds and low tones" was skipped]
0:28 [D] rubber band on ceramic jar
0:31 [D] silence
0:40 [D] rubber band on plastic package
1:00 [D] silence
```

[19]Note that for all the other combinations documented in this section, only the scores were determined in advance. Each performer chose independently the part with which she/he would like to begin and interacted with the score freely. During the two rehearsals documented in the third section of this chapter, we experimented further with similar, more specific instructions.

```
1:14 [D] rubber band on ceramic jar
1:17 [D] silence
1:26 [D] frothing wand (bent), then multiple motors [the normal
frothing wand was played]
1:42 [D] silence
1:59 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure
2:18 [A] percussive sounds and low tones [occasionally also
whistles, for example, at 3:11]
3:22 [A] [louder]
3:43 [A] [softer]
3:50 [D] silence
4:18 the end
```

After playing, Amit asked me if whistles may also be considered air sounds because he thought that actual air sounds would be too quiet. Because of the relative similarity in the sound production technique (just blowing air into the tube produces a whistle), I agreed, but I asked him to look for a way to produce louder air sounds nonetheless. (Later, we found out that loud air sounds can be produced by blowing directly into the microphone.)

On a different note, Amit's response to *pencil2*'s "moving objects chaotically" (he played louder) is an example of the room that the scores left for extemporaneous communication.

170311__3lbclpf7__iS1iS2_x1iS6iS5

```
0:01 [A] percussive sounds [saxoschlauch180x25]
0:02 [D] imitate the atmosphere of the many people talking at the
same time
0:34 [A] very active and complicated passages with many notes
1:25 [A] screeching sounds
1:29 [D] follow just a single voice and imitate it using only a
single motor
2:12 [D] imitate the atmosphere of the many people talking at the
same time
2:31 [A] very active and complicated passages with many notes
2:41 [D] follow just a single voice and imitate it using only a
single motor
2:51 [A] percussive sounds [active passages continue until 2:55]
3:17 [D] imitate the atmosphere of the many people talking at the
same time
```

```
3:48 [D] follow just a single voice and imitate it using only a
single motor
∼3:48 [A] long air sounds, with mouthpiece (into and a bit away from
mouthpiece) and without mouthpiece (a bit away from mouthpiece) (no
whistles), incorporating flutter-tongue and trills, and shaking tube
4:30 [D] imitate the atmosphere of the many people talking at the
same time
4:52 [D] follow just a single voice and imitate it using only a
single motor
5:34 [A] percussive sounds / fade out interrupted by pauses, several
accents in the end [short fade out]
5:40 [D] imitate the atmosphere of the many people talking at the
same time
∼5:43 [A] fast, incomprehensible speaking into mouthpiece/tube
6:32 [D] follow just a single voice and imitate it using only a
single motor
∼6:42 [A] percussive sounds, more and more active
7:26 [A] long high tones, slightly fluctuating in pitch [percussive
sounds continue until 7:31]
7:30 [D] imitate the atmosphere of the many people talking at the
same time
8:34 [A] percussive sounds
∼9:30 [A] [pause]
9:45 [A] long low tones, steady pitch [saxoschlauch220x16]
10:23 the end
```

In this combination, Amit was playing *iS1iS2_x1iS6iS5* from the beginning to the end while Daniel was alternating between *3lbclpf7*'s two approaches to imitating the recording: "imitate the atmosphere of the many people talking at the same time" and "follow just a single voice and imitate it using only a single motor".

Note that Amit's interpretation of "long high tones, slightly fluctuating in pitch" was perhaps too loud, considering that this annotation was added to the expression "is just some light" (it sounded more like "lots of light"). Daniel responded to Amit's loud high tones by changing from "follow just a single voice and imitate it using only a single motor" to "imitate the atmosphere of the many people talking at the same time".

3.2.2 With Francesca and Amit

170312_1lnnsib_diagram10-2v1

```
0:00 [F] [laptop is put to sleep]
```

```
0:07 [A] percussive sounds [saxoschlauch220x16]
0:23 [F] ["laptop's lullaby"]
0:39 [F] sleep mode, moving telephone pickup coil [Francesca used
only one telephone pickup coil and occasionally altered the sound by
touching the circuit board]
0:59 [A] percussive sounds and low tones
1:01 [A] percussive sounds and air sounds
2:03 [A] percussive sounds and low tones
2:39 [A] percussive sounds and air sounds
4:25 [A] [pause]
4:44 [A] percussive sounds and low tones
5:07 [A] percussive sounds and air sounds
8:11 [F] [laptop is woken up accidentally]
8:12 the end
```

1lnnsib and *diagram10-2v1* combined well, creating a soft soundscape, which could have basically continued indefinitely. In fact, it ended only because the laptop woke up when Francesca accidentally pressed one of the keys on the keyboard with the telephone pickup coil.

Amit experimented with many different sounds that could be considered "percussive": he played slap tongues, tapped on the finger holes, rubbed and hit the tube (and the funnel) with different objects (including the microphone), blew air into the microphone, played only the mouthpiece as well as the tube without the mouthpiece, etc.

170312__diagram9-8__iS1iS2_x1iS6iS5

```
0:01 [F] AM noise, altered by touching circuit board
0:01 [A] percussive sounds [from 0:27, percussive sounds among
other sounds:  glissandi, a trill, long tones, multiphonics]
[saxoschlauch220x16]
1:09 [A] very active and complicated passages with many notes
2:27 [A] screeching sounds
∼3:00 [A] very active and complicated passages with many notes
3:47 [A] percussive sounds ["very active passage again" (in fact, a
long tone) continues until 3:58]
4:28 [A] long air sounds, with mouthpiece (into and a bit away from
mouthpiece) and without mouthpiece (a bit away from mouthpiece) (no
whistles), incorporating flutter-tongue and trills, and shaking tube
4:45 [F] [short feedback]
5:14 [A] percussive sounds / fade out interrupted by pauses, several
accents in the end
∼6:20 [A] fast, incomprehensible speaking into mouthpiece/tube
```

```
∼7:14 [A] percussive sounds, more and more active [pitched sounds,
possibly because the microphone did not work]
7:26 [F] [feedback occurs more frequently]
7:30 [A] long high tones, slightly fluctuating in pitch
7:41 [A] percussive sounds [long high tones continue until 8:20]
∼8:55 [A] [pause]
∼9:00 [A] long low tones, steady pitch [very soft]
12:11 the end
```

Francesca played only the gray part of *diagram9-8* because of a misunderstanding about how to interact with the score. Therefore, this combination resulted in Amit playing *iS1iS2_x1iS6iS5* from the beginning to the end while a loud AM noise was almost constantly heard in the background.

170312_pen1v1v1v1x1x2pencil1_iS1iS3iS3

```
0:00 [F] FM, moving tuning wheel
0:06 [A] without mouthpiece, whistle sounds, rubbing tube with
plastic card [saxoschlauch220x16]
0:07 [F] FM noise, disturbances [mostly feedback, also short
movements of tuning wheel at 1:22]
1:55 [F] FM, very intense disturbances [low volume from ∼2:10]
2:31 [F] FM noise, disturbances [or already from 2:15]
2:49 [A] without mouthpiece, syllables
3:32 [F] AM noise, disturbances
∼3:55 [F] [almost muted]
4:17 [F] FM, moving tuning wheel
4:50 [F] FM, very intense disturbances [from ∼5:05 to 5:25, not
noise but a station]
5:20 [A] [pause]
5:53 [A] with sax mouthpiece, soft long tones and multiphonics
[saxoschlauch80x25]
6:15 [F] FM noise, disturbances
6:26 [F] FM, very intense disturbances
7:20 [A] with trumpet mouthpiece, percussive sounds [Amit did not
bring a trumpet mouthpiece to the duo rehearsals]
7:30 [F] FM noise, disturbances
7:50 [A] with sax mouthpiece, very soft high tone, constantly
changing intonation, timbre, and dynamics (within very soft)
∼8:30 [F] [signal gradually becomes almost muted, occasionally short
noise/feedback]
8:39 [A] [pause]
```

```
8:59 [A] with sax mouthpiece, low tone, beating with voice
[saxoschlauch220x16]
9:42 [A] with sax mouthpiece, percussive sounds
∼9:55 [F] FM, very intense disturbances
10:17 [A] [pause]
10:35 [A] without mouthpiece, whistle sounds, plastic card, slowly
fading
10:54 [F] FM noise, disturbances
11:14 [F] FM, very intense disturbances
12:24 the end
```

Francesca asked me what is meant by "disturbances", and I replied that I based this annotation on the expression "disturbing noises", which she used in the individual rehearsals to explain her interpretation of *pen1v1v1v1x1x2pencil1* (see section 1.3.3). Practically speaking, this meant (mostly) feedback, however, I preferred the ambiguity suggested by the word "disturbances" because I could also imagine incorporating other "disturbances" (for example, electric hum, momentarily changing to AM, or even silence).

We also discussed the ending, Francesca was playing "very intense disturbances" while Amit was "slowly fading". It seemed a somewhat contradictory combination (especially as an ending) and was the outcome of superimposing *pen1v1v1v1x1x2pencil1*'s circular structure on *iS1iS2iS3*'s linear structure. Of course, both could have also avoided emphasizing this difference: Francesca could have made choices that were more compatible with *iS1iS2iS3*'s structure and Amit could have interpreted *iS1iS2iS3* less linearly.

170312_iS3x2_tMs3

```
0:00 [F] soft radio sound [afterwards, technical problems]
0:02 [A] chaotic singing and playing, lots of low tones
[saxoschlauch220x16]
0:24 [A] following melody
1:11 [A] chaotic singing and playing, lots of low tones
1:31 [A] following melody
1:47 [A] [pause]
2:02 [A] very high whistle and air sounds [intermittent with pauses]
4:30 [F] very short radio sound
4:32 [F] noisy rustles, electric hum [no electric hum]
5:07 [F] opening and closing programs
5:34 [F] noisy rustles, electric hum [electric hum was reproduced
with the telephone pickup coil]
```

5:44 [F] key 3

5:52 [A] chaotic singing and playing, lots of low tones

6:06 [F] high radio feedback [high only from 6:10]

6:26 [A] [pause]

6:33 [F] switching between tabs

6:34 [A] very high whistle and air sounds

7:32 the end

Francesca looked for alternatives to "noisy rustles" and "electric hum", which were significantly softened in the safer version of *SRF18-cb_2tpc-lt*. The most successful one was quickly bringing the telephone pickup coil closer to the laptop and immediately taking it away, and we decided to compromise the difference between "noisy rustles" and "electric hum" and use it for both of them.

170312_iS1_diagram10-2v1

0:00 [F] moving telephone pickup coil[s] ("muted agitation"), hard drive chord ("some light")

0:07 [A] percussive sounds and low tones/air sounds [both low tones and whistles are audible]

1:22 [A] percussive sounds

∼2:15 [F] touching circuit board ("muted agitation"), moving telephone pickup coil[s] only around hard drive ("some light")

2:55 [A] [pause]

∼3:15 [A] percussive sounds and air sounds

3:38 [F] [laptop is put to sleep]

3:45 [F] ["laptop's lullaby"]

3:59 [F] sleep mode, key A and/or caps lock

∼5:00 [A] [pause]

5:17 [A] percussive sounds and air sounds

6:35 the end

In this combination, Francesca played the three possible interpretations of the expression "muted agitation - some light" that we discussed during the individual rehearsals one after another. This resulted in a three-part structure, whose third part was very similar to the first combination that Francesca and Amit had played.

3.2.3 With Amit and Oded

170318_ diagram10-2v1_ zr1tS

```
∼0:01 [O] rattling plastic box
0:04 [A] percussive sounds [only mouthpiece, then
saxoschlauch220x16]
0:54 [A] [pause]
1:02 [A] percussive sounds
1:16 [A] percussive sounds and low tones
1:49 [A] [pause]
1:57 [A] percussive sounds and low tones
2:34 [A] [pause]
2:42 [A] percussive sounds and air sounds [air sounds from 2:55]
4:05 [A] [pause]
∼4:14 [A] percussive sounds and low tones
5:08 the end
```

zr1tS combined well with *diagram10-2v1*, particularly with "percussive sounds and low tones". Amit played the three rows top to bottom (and then the middle row again) while Oded simply followed the audio recording.

170318_ iS1iS2iS3_ polygon1

```
∼0:05 [O] [7 combinations of sine waves and noise]
0:20 [A] without mouthpiece, whistle sounds, rubbing tube with
plastic card [saxoschlauch220x16]
3:00 [A] without mouthpiece, syllables
5:14 [A] [pause]
5:40 [A] with sax mouthpiece, soft long tones and multiphonics
[saxoschlauch80x25]
∼6:00 [O] only sine waves, complex beating patterns, loud noisy
rattling
7:09 [A] [pause]
∼7:25 [A] with trumpet mouthpiece, percussive sounds [Amit did not
bring a trumpet mouthpiece to the duo rehearsals]
7:57 [A] with sax mouthpiece, very soft high tone, constantly
changing intonation, timbre, and dynamics (within very soft)
∼8:45 [O] [2 combinations of sine waves and noise]
9:01 [A] [pause]
9:20 [A] with sax mouthpiece, low tone, beating with voice
[saxoschlauch220x16]
9:39 [A] [microphone problem]
```

```
9:59 [O] sine waves, rattling (may be shorter than the indicated
duration)
10:06 [A] with sax mouthpiece, low tone, beating with voice
10:48 the end
```

Oded was slightly frustrated because he had to follow the fixed durations of *polygon1* and could not always respond to what Amit was playing. For example, he said that he selected "only sine waves, complex beating patterns, loud noisy rattling" before Amit began playing "soft long tones and multiphonics", but then (after Amit began playing that) wished he was able to play something else or at least pause. In that regard, *polygon1* required Oded to decide in advance what he was going to play, before knowing what the other performer was about to do.

We also discussed pauses more generally, and Amit said he added many pauses not indicated in the scores, usually while he was switching instruments, taking off/reattaching the mouthpiece, and changing the position of the microphone. Note that I did try to indicate most of these pauses in the transcriptions.

170318__iS1iS2_x1iS6iS5__iS1v2iS2

```
0:00 [O] noise, medium LPF res, low volume, occasionally louder for
a short duration
0:05 [A] percussive sounds, more and more active [only mouthpiece,
then saxoschlauch220x16]
0:47 [A] long high tones, slightly fluctuating in pitch
1:33 [O] noise, high LPF cutoff, high to maximum LPF res
1:50 [A] percussive sounds
2:08 [A] [pause]
2:14 [O] noise, downward glissando (by lowering LPF cutoff, high to
maximum LPF res)
2:16 [A] percussive sounds
2:56 [A] [pause]
∼3:10 [A] long low tones, steady pitch
3:15 [O] noise, low LPF res, occasionally adding sine waves, several
accents (volume, LPF res)
4:41 [A] [pause]
4:48 [A] percussive sounds
5:24 [A] [pause]
5:28 [O] low soft sine wave
5:36 [A] long low tones, steady pitch
6:47 the end
```

Amit played only the last four parts of *iS1iS2_x1iS6iS5*, which combined well with *iS1v2iS2*, especially "long high tones, slightly fluctuating in pitch" with "noise, high LPF cutoff, high to maximum LPF res" and "long low tones, steady pitch" with "low soft sine wave".

In addition, Oded used his voice as the envelope follower's input (he used the envelope follower to interpret the first and third parts of *iS1v2iS2*) and produced sounds similar to *iS1iS2_x1iS6iS5*'s "percussive sounds".

170318_tMs3_iS5

```
0:01 [A] chaotic singing and playing, lots of low tones
[saxoschlauch220x16]
∼0:05 [O] noise, full modulation of LPF cutoff, high to maximum LPF
res, very fast to maximum rLFO rate [LPF res is too low]
0:44 [A] following melody
∼0:45 [O] reducing noise mix, modulation of LPF cutoff, and rLFO
rate, but in the end accents (high values of all these parameters)
(although not very often)
1:25 [A] very high whistle and air sounds
2:35 [A] [pause]
2:40 [A] chaotic singing and playing, lots of low tones
∼2:50 [O] sine waves, full modulation of freq shift, very fast
to maximum rLFO rate, low to medium rLFO glide, complex beating
patterns
3:09 [A] following melody
4:05 [A] [pause]
4:18 [O] loud rattling
4:28 [A] following melody [saxoschlauch180x25]
4:52 [O] abrupt silence
5:29 [O] rattling aluminum foil, low volume [a "fresh" aluminum foil
would have produced a brighter sound]
5:33 [A] chaotic singing and playing, lots of low tones
6:10 [A] [pause]
6:12 [O] complex texture of the rattling aluminum foil, occasionally
louder
6:51 [A] following melody
7:25 [A] chaotic singing and playing, lots of low tones
8:03 the end
```

In this combination, Amit and Oded were somewhat out of sync: except for the beginning, Amit was playing *tMs3*'s loud part, "chaotic singing and playing, lots of low tones", while Oded was playing *iS5*'s soft parts, "sine waves, full modulation of freq shift, very fast to maximum rLFO rate, low

to medium rLFO glide, complex beating patterns" and "rattling aluminum foil, low volume", and Oded was playing *iS5*'s loud part, "loud rattling", while Amit was playing *tMs3*'s soft parts, "following melody" and "very high whistle and air sounds".

3.2.4 With Francesca and Oded

170319_iS3x2_polygon1

```
0:03 [F] ∼noisy hum (telephone pickup coil) [and other noises]
0:10 [O] [5 combinations of sine waves and noise]
3:25 [F] short radio sound
4:53 [F] key 6, altered by touching circuit board
∼5:25 [O] sine waves, rattling (may be shorter than the indicated
duration)
5:52 [F] noisy hum (telephone pickup coil)
6:07 [F] key 6, altered by touching circuit board
∼6:15 [O] [combination of sine waves and noise, possibly part 7]
6:31 [F] noisy hum (telephone pickup coil)
7:02 [O] sine waves, rattling (may be shorter than the indicated
duration)
7:15 [F] trackpad, soft / between trackpad and hard drive
∼7:40 [O] [2 combinations of sine waves and noise]
7:43 [F] noisy hum (telephone pickup coil)
8:27 [F] ∼
8:30 [F] noisy hum (telephone pickup coil)
8:49 [F] opening and closing programs
9:29 [F] noisy hum (telephone pickup coil)
∼9:30 [O] only sine waves, complex beating patterns, loud noisy
rattling
10:59 [F] key 3
11:32 [F] high radio feedback
∼12:15 [O] [combination of sine waves and noise]
12:28 the end
```

iS3x2 and *polygon1* combined into a strange soundscape ("like being inside a computer"). While both sounded very exploratory, they did have a climax: *iS3x2*'s "high radio feedback" and *polygon1*'s "only sine waves, complex beating patterns, loud noisy rattling". I particularly liked how the former slightly overlapped the latter and then continued after it.

Technically speaking, however, the alternative that Francesca found to the noisy rustles/electric hum (which from now on is transcribed as "noisy

hum (telephone pickup coil)")[20] could still be improved, as the rhythms were not always articulated enough. Eventually, the solution was to isolate them from the noisy backgrounds (recall that I imagined an interpretation of this score as consisting of varied rhythms of noisy rustles and electric hum *on top* of a changing background), resulting in rhythms of quasi-hum repeatedly *alternated* with different (and relatively) static sounds.

170319_pen1v1v1v1x1x2pencil1_zr1tS

```
0:06 [F] FM noise, disturbances [short movements of tuning wheel at
0:09]
∼0:10 [O] rattling plastic box
0:39 [F] FM, moving tuning wheel
1:10 [F] [muted]
1:25 [F] FM, very intense disturbances [∼low volume]
1:59 [F] FM noise, disturbances [short movements of tuning wheel at
4:19]
4:34 [F] FM, very intense disturbances [low volume from 4:42]
4:54 [F] [muted]
5:01 [F] [almost muted]
5:14 [F] FM noise, disturbances
5:33 [F] FM, very intense disturbances [∼low volume]
∼6:15 [F] FM noise, disturbances
6:35 [F] FM, very intense disturbances
7:12 [F] FM noise, disturbances
8:19 the end
```

Francesca had several times a technical problem because she accidentally touched the locations on the circuit board that mute the signal (she had the similar problem also in the previous interpretation of *pen1v1v1v1x1x2pencil1* and to a certain extent also in *diagram9-8*). To prevent that from happening again, I decided to cover these locations with electrical tape.

With that said, this combination was very effective, creating a rich texture of noise, feedback, low tones, and rattling plastic box sounds.[21]

[20] I did not change the scores though, as I was hoping (and still am) to find an alternative that will allow differentiating between noisy rustles and electric hum.

[21] A relatively high pitched tone, about 1.5 kHz, produced by the air conditioning was also audible.

170319_ 1lnnsib_ iS1v2iS2

```
∼0:00 [O] noise, medium LPF res, low volume, occasionally louder for
a short duration
0:01 [F] [laptop is put to sleep]
0:32 [F] ["laptop's lullaby"]
0:49 [F] [hard drive glissando]
0:50 [F] sleep mode, moving telephone pickup coils
∼1:05 [O] noise, high LPF cutoff, high to maximum LPF res
2:25 [O] noise, downward glissando (by lowering LPF cutoff, high to
maximum LPF res)
3:41 [O] noise, low LPF res, occasionally adding sine waves, several
accents (volume, LPF res)
5:07 [O] low soft sine wave
5:36 the end
```

1lnnsib and *iS1v2iS2* combined well, but I had mixed feelings about the beginning, more specifically, about the "laptop's lullaby" and Oded's reaction to it (I preferred the way he interpreted it when it was combined with Amit's *iS1iS2_ x1iS6iS5*). Also, Francesca was not so happy with the "hard drive glissando".

170319_ diagram9-8_ iS5

```
0:01 [F] AM noise, altered by touching circuit board
0:02 [O] noise, full modulation of LPF cutoff, high to maximum LPF
res, very fast to maximum rLFO rate
∼1:05 [O] reducing noise mix, modulation of LPF cutoff, and rLFO
rate, but in the end accents (high values of all these parameters)
(although not very often)
2:05 [O] sine waves, full modulation of freq shift, very fast
to maximum rLFO rate, low to medium rLFO glide, complex beating
patterns
2:37 [F] [feedback until 2:44; then occasionally short feedback]
3:05 [O] loud rattling
∼3:35 [F] soft FM [different stations]
3:39 [O] abrupt silence
3:41 [F] soft FM noise
3:53 [F] between battery and trackpad [also soft hard drive chord]
4:08 [F] soft FM noise [and different stations]
4:19 [F] between battery and trackpad
4:33 [F] soft FM noise
4:45 [F] between battery and trackpad
∼[O] rattling aluminum foil, low volume
```

```
5:30 [O] complex texture of the rattling aluminum foil, occasionally
louder
8:05 the end
```

Following *iS5*'s "loud rattling" with a station was quite amusing (and perhaps it would have been even more amusing if the station had played music).

On a different note, Francesca asked me how to interpret the black rectangles in the turquoise part of *diagram9-8*, as according to the annotations added to the diagram, the black rectangles represent different stations, while the turquoise background represent the sound "between battery and trackpad" (which requires changing from RADIO to AUDIO IN mode). I replied that this "contradiction" was intentional, and we discussed several solutions: changing momentarily to RADIO mode, changing the location of the telephone pickup coils, and altering the sound more drastically (by touching the circuit board).

170319_iS1_polygon1

```
0:01 [F] moving telephone pickup coils ("muted agitation"), hard
drive chord ("some light")
0:02 [O] [2 combinations of sine waves and noise]
1:11 [O] sine waves, rattling (may be shorter than the indicated
duration)
∼2:00 [O] [7 combinations of sine waves and noise]
2:33 [F] ["laptop's lullaby"]
2:50 [F] sleep mode, key A and/or caps lock
3:17 [F] [laptop is woken up]
3:20 [F] moving telephone pickup coils ("muted agitation"), hard
drive chord ("some light")
∼7:00 [O] sine waves, rattling (may be shorter than the indicated
duration)
7:06 [F] ["laptop's lullaby"]
7:22 [F] sleep mode, key A and/or caps lock
∼7:45 [O] [2 combinations of sine waves and noise]
9:21 the end
```

Oded avoided *polygon1*'s climax, "only sine waves, complex beating patterns, loud noisy rattling", because he thought it would not fit with Francesca's *iS1*. Note that Francesca did use the "laptop's lullaby" again, but this time altered the sound by moving the telephone pickup coils while it was playing (which was better).

3.2.5 With Daniel and Oded

170320_pencil2_diagram3x1

```
~[O] [beginning in the middle of the diagram, then scrolling to the
right]
0:02 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure
0:08 [O] [envelope follower was open and responded to Daniel]
1:52 [D] silence
2:04 [D] low motor sounds (two motors)
2:21 [D] silence
2:25 [O] rattling coins [until 2:56]
2:31 [D] frothing wand (bent), then multiple motors [only bent
frothing wand was played]
3:25 [D] silence
3:34 [D] rubber band on wooden box
3:40 [D] silence
3:57 [D] low motor sounds (two motors)
4:01 [O] rattling coins [until 7:56, but occasionally also noise,
maximum LPF res, low LPF cutoff]
4:13 [D] silence
4:27 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure
4:58 [D] silence
5:36 [D] frothing wand (bent), then multiple motors
5:57 [D] silence
6:03 [D] rubber band on plastic package
6:24 [D] silence
6:39 [D] rubber band on ceramic jar
6:41 [D] silence
6:49 [D] frothing wand (bent), then multiple motors
7:33 [D] silence
7:44 [D] rubber band on wooden box
7:59 [D] silence
8:05 [D] frothing wand (bent), then multiple motors [only bent
frothing wand was played]
8:57 [D] silence
9:06 the end
```

Oded said that the scrolling speed was too slow, and as a result he could only play a small section of the diagram. In this combination, this was the

section consisting of mostly "rattling coins", which combined well with *pencil2*'s motor sounds, particularly with "frothing wand (bent), then multiple motors".

170320_iS4v1_iS5

```
0:00 [D] loud low motor sounds
0:03 [O] noise, full modulation of LPF cutoff, high to maximum LPF
res, very fast to maximum rLFO rate
0:35 [D] high motor sounds
∼0:45 [O] reducing noise mix, modulation of LPF cutoff, and rLFO
rate, but in the end accents (high values of all these parameters)
(although not very often)
∼1:12 [D] soft high motor sounds
1:59 [D] soft motor sounds of unclear pitches
1:59 [O] sine waves, full modulation of freq shift, very fast
to maximum rLFO rate, low to medium rLFO glide, complex beating
patterns
2:40 [D] only rubber band
3:27 [O] loud rattling
3:32 [D] [loud] high motor sound
3:56 [D] loud low motor sounds
4:20 [O] abrupt silence
4:29 [D] soft motor sounds of unclear pitches
4:49 [D] only rubber band
5:08 [O] rattling aluminum foil, low volume
∼6:00 [O] complex texture of the rattling aluminum foil,
occasionally louder
6:33 [D] soft motor sounds of unclear pitches [slight crescendo from
∼8:00]
∼7:10 [O] the end
8:43 [D] only rubber band
9:30 the end
```

Oded played *iS5* from the beginning to the end. Daniel played *iS4v1* also from the beginning, but arrived at the end much earlier, and therefore, "jumped" back to "high motor sounds". This was also a response to Oded, since it made no sense to continue playing the rubber band during *iS5*'s "loud rattling".

Generally speaking, this combination had a rather linear structure, as opposed to the previous one, which was more exploratory.[22]

[22] I used the term *exploratory* also to describe the combination *170319_iS3x2_polygon1*

170320_3lbclpf7_zr1tS

```
0:00 [D] imitate the atmosphere of the many people talking at the
same time
∼0:02 [O] rattling plastic box[23]
2:22 [D] follow just a single voice and imitate it using only a
single motor
7:45 the end
```

In this combination, Daniel focused on *3lbclpf7*'s second approach to imitating the recording: "follow just a single voice and imitate it using only a single motor". Occasionally, but rather infrequently, he turned on the Xavas frothing wand for very short durations, hitting with it one of the glass jars. While he was playing, I thought that he was expressing the difficulty of following a single voice, that is, he repeatedly tried to follow a voice and made a sound, but then failed and stopped. Afterwards, however, he said that he was focusing on the sound of the pub's glasses and turned on the frothing wand only when he noticed it. Oded's interpretation of *zr1tS* complemented for him the sound of the crowd.

170320_iS1iS2v1_iS1v2iS2

```
0:01 [O] noise, medium LPF res, low volume, occasionally louder for
a short duration
0:06 [D] soft rubber band, "once in a while"
0:30 [D] soft rubber band, somewhat "agitating"
1:00 [O] noise, high LPF cutoff, high to maximum LPF res
1:08 [D] short interrupted motor sounds
1:28 [O] noise, downward glissando (by lowering LPF cutoff, high to
maximum LPF res)
∼2:00 [D] soft static noise-like motor sound
2:01 [O] noise, low LPF res, occasionally adding sine waves, several
accents (volume, LPF res)
2:25 [D] short interrupted motor sounds
3:00 [D] soft rubber band, somewhat "agitating"
3:25 [D] soft rubber band, "once in a while"
3:33 [O] low soft sine wave
4:10 the end
```

(see the previous section). To clarify, by exploratory I mean a structure without a strong sense of direction.

[23] The original plastic box was lost. We experimented with alternative boxes but none of them sounded as the original had sounded.

Oded played *iS1v2iS2* from the beginning to the end, and Daniel played *iS1iS2v1* from the beginning to the end and then back to the beginning. The two scores combined well, especially “soft rubber band, "once in a while"” with “noise, medium LPF res, low volume, occasionally louder for a short duration”, and “short interrupted motor sounds” with “noise, low LPF res, occasionally adding sine waves, several accents (volume, LPF res)”.

170320_pencil2_polygon1

```
∼0:00 [O] [7 combinations of sine waves and noise]
0:06 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure [only motors without moving
objects]
0:49 [D] silence
0:57 [D] low motor sounds (two motors)
1:07 [D] silence
1:22 [D] rubber band on wooden box
1:36 [D] silence
1:42 [D] rubber band on plastic package
1:51 [D] silence
2:05 [D] rubber band on ceramic jar
2:08 [D] silence
2:17 [D] frothing wand (bent), then multiple motors
3:09 [D] silence
3:14 [D] low motor sounds (two motors)
3:30 [D] silence
3:38 [D] frothing wand (bent), then multiple motors
3:59 [D] silence
4:04 [D] rubber band on wooden box
4:14 [D] silence
∼4:15 [O] sine waves, rattling (may be shorter than the indicated
duration)
4:26 [D] frothing wand (bent), then multiple motors
5:05 [O] [combination of sine waves and noise]
5:23 [D] silence
5:39 [D] rubber band on wooden box
5:51 [D] silence
6:03 [D] rubber band on ceramic jar
∼6:05 [O] only sine waves, complex beating patterns, loud noisy
rattling
6:05 [D] silence
6:14 [D] rubber band on ceramic jar
```

```
6:21 [D] silence
6:24 the end
```

Shortly after Oded had begun playing "only sine waves, complex beating patterns, loud noisy rattling", Daniel said that all the three parts from which he could choose the next part involved playing the rubber band (which would have been obviously inaudible). To prevent that from happening, Daniel's computer should have taken into consideration what Oded was playing, or at least how loud he was playing, before determining the three possible next parts.[24]

We then stopped and ended the rehearsal, since it was already late and Daniel had to leave.

3.2.6 With Daniel and Francesca

170325_ 3lbclpf7_ diagram9-8

```
∼0:00 [F] AM noise, altered by touching circuit board [occasionally
feedback]
0:09 [D] imitate the atmosphere of the many people talking at the
same time
1:38 [D] follow just a single voice and imitate it using only a
single motor
3:39 [F] between battery and trackpad [probably by mistake]
3:43 [F] soft FM noise
3:46 [D] imitate the atmosphere of the many people talking at the
same time
3:50 [F] [feedback until 4:00]
4:14 [D] follow just a single voice and imitate it using only a
single motor
4:30 [F] [different stations]
4:35 [F] between battery and trackpad
4:52 [F] soft FM noise
4:58 [F] [different stations]
5:03 [F] between battery and trackpad
5:06 [D] imitate the atmosphere of the many people talking at the
same time
5:53 [D] follow just a single voice and imitate it using only a
single motor [or the end]
6:10 the end
```

[24] Note that this was solved during the third stage of the development process (see section 4.1).

Daniel interpreted *3lbclpf*'s second approach to imitating the recording, "follow just a single voice and imitate it using only a single motor", in the same way he had interpreted it in the previous rehearsal, although this time he did not limit himself to only playing the Xavas frothing wand on one of the glass jars.

In addition, Daniel also alternated several times between *3lbclpf*'s two approaches to imitating the recording, which when superimposed on *diagram9-8*'s rather simple three-part structure, created an interesting, complex structure.

170325_pencil2_iS3x2

```
0:00 [F] noisy hum (telephone pickup coil)
0:01 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure [only motors without moving
objects]
∼0:25 [F] between trackpad and hard drive
0:31 [F] noisy hum (telephone pickup coil)
0:37 [F] very short radio sound
0:38 [F] noisy hum (telephone pickup coil)
0:58 [F] opening and closing programs
1:11 [F] noisy hum (telephone pickup coil)
1:27 [F] key 3
∼1:50 [D] silence
2:03 [F] high radio feedback
2:06 [D] frothing wand (bent), then multiple motors
2:33 [F] switching between tabs
2:59 [D] silence
3:09 [D] rubber band on plastic package
3:16 [F] high radio feedback
3:18 [D] silence
3:33 [D] rubber band on ceramic jar [barely audible]
3:35 [D] silence
3:44 [D] frothing wand (bent), then multiple motors
4:02 [D] silence
4:06 [D] low motor sounds (two motors)
4:15 [D] silence
4:30 [F] key 3
4:32 [D] rubber band on wooden box [barely audible]
4:42 [D] silence
5:01 [D] low motor sounds (two motors)
5:09 [D] silence
```

```
5:09 [F] noisy hum (telephone pickup coil)
5:15 [D] frothing wand (bent), then multiple motors
∼5:30 [F] opening and closing programs
∼5:45 [F] noisy hum (telephone pickup coil)
6:03 [F] very short radio sound
6:04 [F] noisy hum (telephone pickup coil)
6:05 [D] silence
6:09 [F] between trackpad and hard drive
6:12 [D] rubber band on wooden box
6:24 [D] silence
6:40 [D] low motor sounds (two motors)
6:51 [D] silence
6:51 [F] noisy hum (telephone pickup coil)
6:55 [D] frothing wand (bent), then multiple motors
6:59 [F] battery, disconnecting power cable
7:10 [F] noisy hum (telephone pickup coil)
7:13 [D] silence
7:22 [D] rubber band on ceramic jar
7:26 [D] silence
7:37 [D] rubber band on plastic package
7:37 [F] trackpad, soft
7:49 [D] silence
8:01 [F] noisy hum (telephone pickup coil)
8:01 [D] rubber band on ceramic jar
8:09 [D] silence
8:29 [D] low motor sounds (one motor)
8:29 [F] battery, disconnecting power cable
8:39 [D] silence
8:43 [F] noisy hum (telephone pickup coil)
8:54 [D] rubber band on ceramic jar
8:55 [F] between trackpad and hard drive
9:03 [D] silence
9:15 [F] noisy hum (telephone pickup coil)
∼9:15 [D] rubber band on plastic package
9:20 [F] very short radio sound
9:21 [F] noisy hum (telephone pickup coil)
9:26 [D] silence
9:29 [F] very short radio sound
9:30 [F] noisy hum (telephone pickup coil)
9:40 [D] rubber band on ceramic jar
9:43 [D] silence
9:45 the end
```

pencil2 and *iS3x2* combined well, although Francesca was slightly too loud and sounded rather harsh. (Afterwards, we discovered that the upper-mid and high frequencies were boosted at the mixer EQ.)

170325_ iS1iS2v1_ 1lnnsib

```
0:00 [F] [laptop is put to sleep]
0:06 [F] ["laptop's lullaby"]
0:06 [D] soft rubber band, "once in a while"
0:20 [F] sleep mode, moving telephone pickup coils
1:20 [D] soft rubber band, somewhat "agitating"
1:53 [D] short interrupted motor sounds
2:28 [D] soft static noise-like motor sound
2:52 [F] FM, high feedback [stations instead of noise until 3:12]
∼3:30 [D] short interrupted motor sounds
4:15 [F] sleep mode, moving telephone pickup coils
4:24 [D] soft rubber band, somewhat "agitating"
4:47 [D] soft rubber band, "once in a while"
6:44 the end
```

Daniel interpreted "soft static noise-like motor sound" with the nose trimmer (he did so also in the previous rehearsal). This sounded more pitched than noise-like, and I suggested using the bent frothing wand on the strawberry tray instead.

That being said, I agreed with Daniel that the nose trimmer combined well with *1lnnsib*'s sleep mode sounds and high feedback (he argued: "it sounded too harmonious, so I kept it").

170325_ type1v1v1_ pen1v1v1v1x1x2pencil1

```
0:01 [D] on resonator 1 [mostly on resonator 1.1, occasionally also
on resonator 1.2]
∼0:05 [F] FM noise, disturbances [low volume until 0:42]
∼2:00 [D] on both resonators
3:18 [D] on resonator 2
4:00 [F] FM, moving tuning wheel
4:28 [F] FM noise, disturbances
4:34 [D] on both resonators
5:08 [D] on resonator 2
5:23 [D] [pause]
5:28 [D] on resonator 1 [crescendo]
5:43 [F] FM, very intense disturbances
6:26 the end
```

Daniel's pause and short crescendo, produced by turning on all the motors, were supposed to be a kind of a "joker card" that I initially wanted to incorporate into *type1v1v1*, but in the end decided not to (mostly because of time considerations).

3.3 Before *ccloudlab1-3*

The following section documents two rehearsals that preceded the third stage of the development process. Although they were tutti rehearsals and accordingly were supposed to be considered part of the third stage of the development process, because we still used the computer-based versions of the scores I created for the second stage (the scores were developed further after these two rehearsals, see below), I decided to include them in this chapter.

During these two rehearsals, we continued to experiment with different combinations of scores, for which, however, I did not only determine the scores to be played but also provided additional instructions. As in the previous section, the documentation of these combinations consists of transcriptions and comments, and recordings of them (also only audio and the scores as static images) end the playlist *ccloudlab1-2* on *CompositionCloud*'s YouTube channel.

In addition, we also experimented with playing the scores without any guidance, that is, the performers were free to choose the score with which they would like to begin (not only the part) and could also change from one score to another. Note, however, that I did set the overall duration in advance, with the aim of gradually simulating a situation similar to that of the performance. Accordingly, the duration of the first free combination, titled *170326_ccloudlab1-2-free*, was set to 30–35 minutes; the duration of the second free combination, titled *170404_ccloudlab1-2-free_1*, was set to 15–20 minutes; and the duration of the third free combination, titled *170404_ccloudlab1-2-free_2*, was set to 45 minutes. Recordings of these free combinations can also be found in the playlist *ccloudlab1-2* on *CompositionCloud*'s YouTube channel, however, for practical reasons, I decided not to transcribe them, but only to add the following comments.

Technically, in order to change from one score to another, it was necessary to refresh the page, choose a performer, a score, and a beginning. This was rather distracting for the performers, who had to choose from dozens of possible parts by reading lists and typing numbers.[25] Furthermore, as already

[25]On the other hand, it also resulted in additional pauses, which was, in fact, a positive outcome. Since the number of performers was doubled, it was obvious to all of us that more pauses would be needed. Therefore, in addition to the pauses that resulted from

playing the scores on the playing setups and making choices in real-time was very demanding, entailing the performers additional responsibilities — either by providing additional (oral) instructions or by allowing more freedom — was found to be generally unsuccessful. These should have been integrated into the computer-based scores, as they eventually were (see section 4.1).

3.3.1 March 26, 2017

(Note that because Amit had to cancel at the last moment, this rehearsal was a trio rehearsal.)

170326_pencil2_polygon1_iS3x2

```
0:01 [D] low motor sounds (one motor)
∼0:05 [O] [combination of sine waves and noise]
0:10 [D] silence
∼0:10 [F] noisy hum (telephone pickup coil)
0:19 [D] frothing wand (bent), then multiple motors [most of the
time only bent frothing wand was played]
0:42 [F] key 6, altered by touching circuit board
0:46 [O] sine waves, rattling (may be shorter than the indicated
duration) [preceded by noise]
1:15 [D] silence
1:15 [O] silence
1:19 [D] low motor sounds (two motors)
1:20 [F] noisy hum (telephone pickup coil)
1:34 [D] silence
∼1:40 [O] [3 combinations of sine waves and noise]
1:51 [D] frothing wand (bent), then multiple motors
∼2:05 [F] trackpad, soft
2:38 [D] silence
2:46 [D] rubber band on plastic package
2:49 [F] noisy hum (telephone pickup coil)
3:07 [D] silence
3:20 [D] rubber band on ceramic jar
3:24 [D] silence
3:34 [D] rubber band on ceramic jar
3:40 [O] sine waves, rattling (may be shorter than the indicated
duration)
3:44 [F] battery, disconnecting power cable
3:47 [D] silence
```

changing scores, I also encouraged the performers to add pauses voluntarily.

```
3:49 [D] rubber band on ceramic jar
3:53 [D] silence
∼4:00 [D] rubber band on wooden box
4:12 [D] silence
4:12 [F] noisy hum (telephone pickup coil)
∼4:15 [O] [3 combinations of sine waves and noise]
4:24 [F] between trackpad and hard drive
4:26 [D] low motor sounds (two motors)
4:40 [D] silence
4:55 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure
5:31 [F] noisy hum (telephone pickup coil)
6:01 [F] very short radio sound
6:02 [F] noisy hum (telephone pickup coil)
6:18 [F] very short radio sound
6:19 [F] noisy hum (telephone pickup coil)
6:38 [F] opening and closing programs
6:44 [D] silence
∼6:50 [O] sine waves, rattling (may be shorter than the indicated
duration)
6:57 [F] noisy hum (telephone pickup coil)
7:12 [F] opening and closing programs
7:23 [D] frothing wand (bent), then multiple motors
∼7:30 [F] noisy hum (telephone pickup coil)
7:42 [F] key 3
7:44 [D] silence
∼7:50 [O] only sine waves, complex beating patterns, loud noisy
rattling
7:54 [D] low motor sounds (one motor)
∼8:05 [D] silence
∼ [D] [not so clear; possibly toothbrush with speed control, multiple
motors, silence, low motor sounds, silence]
10:02 [O] silence
10:07 [D] toothbrush with speed control, multiple motors during
(and/or after) the black chaotic figure, moving objects chaotically
during the colorful chaotic figure
10:16 [F] high radio feedback
∼10:20 [O] [∼2 combinations of sine waves and noise]
11:41 [F] switching between tabs
∼12:00 [D] silence
12:07 the end
```

Oded was instructed to play "only sine waves, complex beating patterns, loud noisy rattling" towards the end. Daniel was instructed to avoid playing the rubber band (and if necessary, to pause) during "only sine waves, complex beating patterns, loud noisy rattling". Francesca was instructed to follow "only sine waves, complex beating patterns, loud noisy rattling" with "high radio feedback", as she did in *170319_iS3x2_polygon1* (see section 3.2.4).

Note that this time the two parts did not overlap. Francesca explained that she "could not hear anything" during Oded's "only sine waves, complex beating patterns, loud noisy rattling".

170326_type1v1v1_zr1tS_pen1v1v1v1x1x2pencil1

```
0:01 [D] on resonator 1 [mostly on resonator 1.1, occasionally also
on resonator 1.2]
0:02 [F] FM noise, disturbances
0:03 [O] rattling plastic box
1:40 [D] on resonator 2
∼1:55 [D] on both resonators
∼2:20 [D] motors on both resonators and rubber band [on resonator 2]
[rubber band until ∼2:30]
2:42 [F] FM, very intense disturbances
2:54 [O] [pause]
3:14 [O] rattling plastic box
∼3:25 [D] on resonator 2
3:31 [F] FM, very intense disturbances
4:03 [O] [pause]
∼4:05 [D] on both resonators
4:05 [F] FM noise, disturbances
4:28 [O] rattling plastic box
5:43 [F] FM, very intense disturbances
∼6:20 [D] [and rubber band]
6:55 [D] [rubber band on resonator 1]
∼7:05 [D] [rubber band on plastic package] [until ∼7:35]
7:26 [F] FM noise, disturbances
7:37 [F] FM, very intense disturbances
8:18 [O] [pause]
9:43 the end
```

In this combination, Daniel was instructed to play at least once only the rubber band (without any motor turned on). Oded and Francesca were instructed to stop playing and pause when they notice that.

They did not manage to do that, however. Although Daniel did try to play several times only the rubber band — at ∼7:05 he even played it on

a plastic package, which was louder than playing it, as the score instructed, on the large ceramic jar (resonator 2) — Oded and Francesca had hard time noticing it.[26]

170326_iS1iS2v1_iS1v2iS2_1lnnsib

```
0:01 [D] soft rubber band, "once in a while"
0:01 [F] sleep mode, moving telephone pickup coils
0:07 [O] noise, medium LPF res, low volume, occasionally louder for
a short duration
1:10 [D] soft rubber band, somewhat "agitating"
∼1:20 [O] noise, high LPF cutoff, high to maximum LPF res
2:05 [O] noise, downward glissando (by lowering LPF cutoff, high to
maximum LPF res)
2:19 [F] FM, high feedback
2:42 [D] short interrupted motor sounds
∼2:45 [O] noise, low LPF res, occasionally adding sine waves,
several accents (volume, LPF res)
4:04 [D] soft static noise-like motor sound
4:13 [F] sleep mode, moving telephone pickup coils
∼5:32 [D] short interrupted motor sounds
6:35 [D] soft rubber band, somewhat "agitating"
∼7:00 [O] low soft sine wave
7:32 [D] soft rubber band, "once in a while"
8:39 the end
```

Contrary to the previous combination, this combination was quite successful. Oded was instructed to play *iS1v2iS2* from the beginning to the end, and Daniel was instructed to play *iS1iS2v1* from the beginning to the end and back to the beginning, as they did in *170320_iS1iS2v1_iS1v2iS2* (see section 3.2.5). Francesca was instructed to begin with "sleep mode, moving telephone pickup coils", change during *iS1v2iS2*'s "downward glissando" to "FM, high feedback", and then (after a while) go back to "sleep mode, moving telephone pickup coils", as she did in *170325_iS1iS2v1_1lnnib* (see section 3.2.6).

[26]Note that Oded did pause twice, from 2:54 to 3:14 and from 4:03 to 4:28, but Daniel could not use these opportunities, since playing the rubber band was not always an option; he was playing other parts of the score and could not "jump" to it (which was also the reason why I instructed Oded and Francesca to pay attention to Daniel and not the other way around).

170326_iS4v1_iS5_iS1

0:01 [F] moving telephone pickup coils ("muted agitation"), hard drive chord ("some light")
∼0:01 [O] noise, full modulation of LPF cutoff, high to maximum LPF res, very fast to maximum rLFO rate
0:05 [D] loud low motor sounds [plays at the beginning high motor sounds accidentally]
1:00 [D] high motor sounds
∼1:05 [O] reducing noise mix, modulation of LPF cutoff, and rLFO rate, but in the end accents (high values of all these parameters) (although not very often)
1:49 [F] touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive ("some light")
1:49 [D] soft high motor sounds
2:44 [D] soft motor sounds of unclear pitches
3:30 [O] sine waves, full modulation of freq shift, very fast to maximum rLFO rate, low to medium rLFO glide, complex beating patterns
3:39 [D] only rubber band [playing "almost a pulse" until 4:27 and from 4:47]
∼4:05 [F] [laptop is put to sleep]
4:24 [F] ["laptop's lullaby"]
4:39 [F] sleep mode, key A and/or caps lock
5:30 [O] loud rattling
5:39 [F] [laptop is woken up] moving telephone pickup coils ("muted agitation"), hard drive chord ("some light")
5:40 [D] [loud] high motor sounds
∼6:05 [D] soft high motor sounds
6:22 [O] abrupt silence
∼6:25 [F] touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive ("some light")
6:25 [D] only rubber band
∼7:30 [O] rattling aluminum foil, low volume
8:23 [D] soft motor sounds of unclear pitches / soft high motor sounds [high until ∼9:50]
8:34 [O] complex texture of the rattling aluminum foil, occasionally louder
∼10:00 [F] "loud light"
∼11:40 [D] the end [then Francesca]
12:20 the end

I wanted to try the combination of *iS4v1* and *iS1* already in Daniel and Francesca's duo rehearsal (which was on the previous day), but we ran out of time. I chose Oded's *iS5* because I was happy with *170320_iS4v1_iS5* (see section 3.2.5).[27]

After they played, I told Francesca that I particularly liked her "loud light" towards the end, but also suggested her to touch more the circuit board when playing "touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive ("some light")".

In addition, Daniel asked me to explain the annotation "rubber band ("almost a pulse"), crescendo of motors ("expanding")", which was added to the following part of *iS4v1*: "almost a pulse, but still irregular, expanding." Daniel ignored it in this combination as well as in the one played with Oded because he did not understand "how these two elements [the rubber band and the motors' crescendo] connect". I proposed two possible interpretations: one was to begin with the motors' crescendo and to end with the rubber bands (as if they were the outcome of the crescendo); the other was to play both of them simultaneously, that is, to play "almost a pulse" with the rubber bands while turning on more and more motors in order to produce a crescendo.[28]

170326_3lbclpf7_diagram3x1_diagram9-8

```
0:00 [D] follow just a single voice and imitate it using only a
single motor
0:01 [F] soft FM noise
0:08 [F] between battery and trackpad
∼0:10 [O] noise, maximum LPF res, high LPF cutoff
0:35 [F] soft FM noise
0:38 [O] rattling coins
1:30 [F] between battery and trackpad [alternating with "soft FM
noise"]
1:42 [D] imitate the atmosphere of the many people talking at the
same time
2:18 [F] soft FM noise [alternating with "between battery and
trackpad"]
∼3:55 [D] follow just a single voice and imitate it using only a
single motor [using a rubber band from 4:15]
4:33 [F] [occasionally feedback until ∼5:40]
∼5:00 [O] mostly noise, low LPF res
```

[27]Note that this was the only combination for which I did not provide additional instructions apart from the scores to be played.

[28]Strangely, during the individual rehearsals Daniel had no problems with this annotation (see *161230_iS4v1-ann-em-DM* in section 1.3.1).

```
5:39 [D] imitate the atmosphere of the many people talking at the
same time
~6:15 [O] noise, maximum LPF res, low LPF cutoff
~6:23 [D] follow just a single voice and imitate it using only a
single motor [using a rubber band from 7:43]
8:56 [F] [feedback until 8:58]
9:21 [F] AM noise, altered by touching circuit board [occasionally
feedback, alternating with "soft FM noise"]
10:02 [F] soft FM noise
10:21 [F] between battery and trackpad [altered by touching circuit
board]
10:49 [F] AM noise, altered by touching circuit board [occasionally
feedback]
10:53 [D] imitate the atmosphere of the many people talking at the
same time
11:23 [O] higher LPF cutoff
11:58 [FM] soft FM noise
12:00 the end
```

Francesca was instructed to begin at the bottom of *diagram9-8* and go upward. Oded was instructed to begin at the top-right of *diagram3x1*, go downward, left, and then upward. Daniel was instructed to alternate between *3lbclpf7*'s two approaches to imitating the recording. My intention was to repeat the complex structure that emerged in *170325_3lbclpf7_diagram9-8* (see section 3.2.6) as well as to try the combination of *diagram3x1*'s "rattling coins" with *diagram9-8*'s "between battery and trackpad". (Regarding the former, an even more complex structure emerged, since Francesca interpreted the instruction to begin at the bottom and go upward only as an indication of a general trajectory and alternated often between adjacent rows.)

Also, I wanted to test again *diagram3x1*'s scrolling speed, which turned out to be indeed too slow, at least compared to the other scores (this was especially noticeable after the first six-seven minutes). Therefore, after this combination, the scrolling speed was changed from 15 pixels per second to 25 pixels per second.

3.3.2 April 4, 2017

(We repeated two of the combinations played in the previous rehearsal, this time joined by Amit.)

170404_-_iS1v2iS2_iS1iS2v1_1lnnsib

```
0:00 [O] noise, medium LPF res, low volume, occasionally louder for
a short duration
0:01 [D] soft rubber band, "once in a while"
0:07 [A] multiphonics (saxoschlauch80x25)
0:28 [F] sleep mode, moving telephone pickup coils
∼1:00 [D] soft rubber band, somewhat "agitating"
1:50 [D] short interrupted motor sounds
∼1:55 [O] noise, high LPF cutoff, high to maximum LPF res
2:32 [A] multiphonics (saxoschlauch180x25)
2:43 [O] noise, downward glissando (by lowering LPF cutoff, high to
maximum LPF res)
∼2:45 [D] soft static noise-like motor sound
3:21 [O] noise, low LPF res, occasionally adding sine waves, several
accents (volume, LPF res)
4:12 [D] short interrupted motor sounds
5:25 [D] soft rubber band, somewhat "agitating"
∼5:50 [O] low soft sine wave
6:08 [D] soft rubber band, "once in a while"
6:45 the end
```

Oded, Daniel, and Francesca were provided with the same instructions as in *170326_iS1iS2v1_iS1v2iS2_1lnnsib* (see the previous section). Amit was instructed to play different multiphonics.

This was a soft combination, and therefore Amit's multiphonics were very dominant (to the extent that Francesca was unable to notice *iS1v2iS2*'s "downward glissando" and played only "sleep mode, moving telephone pickup coils"). Note that at the time, Amit's fifth score (which was supposed to be a diagram) was still missing, although we had already decided that it would focus on multiphonics. Eventually, *polygon1v1* was selected, and its different parts represented different multiphonics separated with silence (or occasionally with air sounds), which was somewhat missing in this combination.

170404_tMs3_zr1tS_type1v1v1_pen1v1v1v1x1x2pencil1

```
0:02 [A] chaotic singing and playing, lots of low tones
∼0:02 [F] FM noise, disturbances
0:07 [O] rattling plastic box
0:34 [A] following melody
1:01 [A] chaotic singing and playing, lots of low tones
∼1:40 [A] following melody
4:48 [F] FM, very intense disturbances
```

```
5:45 [F] FM noise, disturbances
∼6:40 [D] only rubber band
6:40 [O] [pause]
6:42 [O] [pause]
6:45 [A] [pause]
6:52 [A] very high whistle and air sounds
8:39 [D] [pause]
8:50 [A] chaotic singing and playing, lots of low tones
8:58 [D] [motors on resonators]
∼9:00 [F] FM, very intense disturbances
9:07 [O] rattling plastic box
10:36 [F] FM noise, disturbances
10:52 [F] FM, very intense disturbances
11:28 [A] [with trumpet mouthpiece]
11:54 the end
```

I wanted to try agin the combination of *type1v1v1*, *pen1v1v1v1x12pencil1*, and *zr1tS*. The instructions were the same as before: Daniel was supposed to play at least once only the rubber band, and Oded and Francesca were supposed to notice that and pause. Amit was instructed to play at the beginning only *tMs3*'s first two parts, "chaotic singing and playing, lots of low tones" and "following melody", and *tMs3*'s third part, "very high whistle and air sounds", while Daniel was playing only the rubber band. Then, either Daniel or Amit could pause, and the combination was to end with Amit playing *tMs3*'s fourth part (also "chaotic singing and playing, lots of low tones"), joined by Oded, Daniel, and Francesca, playing as they did before the pause.

Again, Oded and Francesca had hard time noticing Daniel's rubber band solo, but this time I intervened and gave them a sign to pause.


KITCHEN
STORAGE


AKAI LPK25
YAMAHA


GENELEC

Chapter 4

ccloudlab1-3

The third stage of the development process spanned from April to May 2017. It was devoted to combining the scores, linking their different parts to one another and creating a network in which choices made by one performer influence the options given to another. This combined version of the scores can be found in *CompositionCloud*'s GitHub Repositories[1] and is described in detail in the first section of this chapter. The second section discusses the performance and consists of a few observations regarding it as well as a brief description of the rehearsal preceding it.

4.1 Combining the scores

The first step was to allow the performers to change scores without having to refresh the page. To do so, I selected at least one part of each score and linked it to a different part of a different score (but of the same performer), making it possible to change from the former to the latter by pressing one of the foot switches. In the combined version of the scores, the linked part appears in the right part of the screen, and its position corresponds to the foot switch that is to be pressed.

[1] To install it, follow the same steps that explain the installation process of *stuckJunk-v1* (see section 5.1.1) Follow also the first three steps that explain how to start a session, and as in *ccloudlab1-2*, a prompt dialog box will appear and you will be asked to choose a performer. Note, however, that contrary to *ccloudlab1-2*, *ccloudlab1-3* cannot be played by less (or more) than four performers, and only after all the four performers are chosen, the score will be initialized. That being said, a partial, single-performer version is available at https://compositioncloud.github.io/ccloudlab1-3-single-performer.html.

In addition, I also selected a specific part of each score after which it is possible to pause. A pause can last for a minimum of 10, 30, or 90 seconds. Every time the computer initializes the scores, it randomly determines the duration of each of the pauses linked to the specific parts I selected, and the durations of the pauses do not change until the scores are initialized again. After the pause, it is possible to choose how to continue from three different, randomly determined parts of three different, randomly determined scores. (Note that there is no obligation to respond immediately).

Tables 4.1 to 4.4 show how the scores are linked to one another as well as after which parts it is possible to pause (in parentheses are the part numbers). As can be seen, there is a considerable number of links between sounds that are relatively similar or that can be smoothly connected, for example, the links from Amit's *iS1iS2iS3* (1) "without mouthpiece, whistle sounds, rubbing tube with plastic card" to *tMs3* (3) "very high whistle and air sounds", from Daniel's *type1v1v1* (28) "rubber band on resonator 2" to *iS1iS2v1* (1) "soft rubber band, "once in a while"", from Francesca's *diagram9-8* (12) "soft FM noise" to *1lnnsib* (2) "FM, high feedback", and from Oded's *diagram3x1* (bottom-left) "noise, low/maximum LPF res, low LPF cutoff" to *iS5* (1) "noise, full modulation of LPF cutoff, high to maximum LPF res, very fast to maximum rLFO rate".[2] Several links are bidirectional (indicated with bidirectional arrows), for example, the links between Daniel's *type1v1v1* (11) "2-4 motors on both resonators" (*type1v1v1* and *iS4v1* (1) "loud low motor sounds" and between Oded's *polygon1* (6) "only sine waves, rattling (may be shorter than the indicated duration)" and *zr1tS*, "rattling plastic box"; and several links form loop-like structures, for example, from Amit's *polygon1v1* (6) "different multiphonics" to *iS1iS2_x1iS6iS5* (4) "very active and complicated passages with many notes" and from *iS1iS2_x1iS6iS5* (1) "percussive sounds" to *polygon1v1* (6) "different multiphonics" as well as from Francesca's *iS3x2* (1) "soft radio sound" to *pen1v1v1v1x1x2pencil1* (12) "FM, moving tuning wheel" and from *pen1v1v1v1x1x2pencil1* (13) "FM, very intense disturbances" to *iS3x2* (1) "soft radio sound". Besides that, I determined the links rather intuitively, although I did make sure that each performer can access all of her/his five scores.

[2]Note that there are a few exceptions in which highly contrasting sounds are linked, for example, from Daniel's *iS1iS2v1* (1) "soft rubber band, "once in a while"" to *pencil2* (1) "toothbrush with speed control, multiple motors during (and/or after) the black chaotic figure, moving objects chaotically during the colorful chaotic figure" and from Francesca's *iS1* (3) "sleep mode, key A and/or caps lock" to *diagram9-8* (16) "between battery and trackpad, altered by touching circuit board".

Table 4.1: The links between Amit's scores.

diagram10-2v1 (1) percussive sounds	→	pause
diagram10-2v1 (3) percussive sounds and air sound	↔	*polygon1v1* (1) different multiphonics
polygon1v1 (4) different multiphonics	→	pause
polygon1v1 (6) different multiphonics	→	*iS1iS2_x1iS6iS5* (4) very active and complicated passages with many notes
iS1iS2_x1iS6iS5 (1) percussive sounds	→	*polygon1v1* (6) different multiphonics
iS1iS2_x1iS6iS5 (3) screeching sounds	→	*iS1iS2iS3* (2) without mouthpiece, syllables
iS1iS2_x1iS6iS5 (7) fade out interrupted by pauses, several accents in the end	→	pause
iS1iS2_x1iS6iS5 (12) long low tones, steady pitch	→	*tMs3* (1) chaotic singing and playing, lots of low tones
iS1iS2iS3 (1) without mouthpiece, whistle sounds, rubbing tube with plastic card	→	*tMs3* (3) very high whistle and air sounds
iS1iS2iS3 (8) without mouthpiece, whistle sounds, plastic card, slowly fading	→	pause
tMs3 (3) very high whistle and air sounds	→	pause
tMs3 (4) chaotic singing and playing, lots of low tones	→	*iS1iS2_x1iS6iS5* (12) long low tones, steady pitch

Table 4.2: The links between Daniel's scores.

pencil2 (2) frothing wand (bent), then multiple motors	→	*3lbclpf7* (1) imitate the atmosphere of the many people talking at the same time
pencil2 (4) low motor sounds (one motor)	→	pause
type1v1v1 (11) 2-4 motors on both resonators	↔	*iS4v1* (1) loud low motor sounds
type1v1v1 (27) 1-2 motors and rubber band on resonator 2	→	pause
type1v1v1 (28) rubber band on resonator 2	→	*iS1iS2v1* (1) soft rubber band, "once in a while"
iS1iS2v1 (1) soft rubber band, "once in a while"	→	*pencil2* (1) toothbrush with speed control, multiple motors during (and/or after) the black chaotic figure, moving objects chaotically during the colorful chaotic figure
iS1iS2v1 (3) short interrupted motor sounds	→	pause
iS1iS2v1 (4) soft static noise-like motor sound	↔	*iS4v1* (4) soft motor sounds of unclear pitches
iS4v1 (6) only rubber band	→	pause
3lbclpf7 (1) imitate the atmosphere of the many people talking at the same time	→	pause
3lbclpf7 (2) follow just a single voice and imitate it using only a single motor	→	*pencil2* (3) low motor sounds (two motors)

Table 4.3: The links between Francesca's scores.

diagram9-8 (1) AM noise, altered by touching circuit board	→	pause
diagram9-8 (12) soft FM noise	↔	*1lnnsib* (2) FM, high feedback
diagram9-8 (17) between battery and trackpad	→	*iS3x2* (14) noisy rustles and short electric hum sounds
pen1v1v1v1x1x2pencil1 (12) FM, moving tuning wheel	→	pause
pen1v1v1v1x1x2pencil1 (13) FM, very intense disturbances	→	*iS3x2* (1) soft radio sound
iS1 (1) moving telephone pickup coils ("muted agitation"), hard drive chord ("some light")	→	*pen1v1v1v1x1x2pencil1* (14) AM noise, disturbances
iS1 (2) touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive ("some light")	→	pause
iS1 (3) sleep mode, key A and/or caps lock	→	*diagram9-8* (16) between battery and trackpad, altered by touching circuit board
iS3x2 (1) soft radio sound	→	*pen1v1v1v1x1x2pencil1* (12) FM, moving tuning wheel
iS3x2 (11) between trackpad and hard drive	→	*iS1* (2) touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive ("some light")
iS3x2 (16) noisy rustles and short electric hum sounds	→	*1lnnsib* (2) FM, high feedback
iS3x2 (19) switching between tabs	→	pause

Table 4.4: The links between Oded's scores.

diagram3x1 (bottom-left) noise, low/maximum LPF res, low LPF cutoff	→	*iS5* (1) noise, full modulation of LPF cutoff, high to maximum LPF res, very fast to maximum rLFO rate
diagram3x1 (bottom-middle) noise, low/maximum LPF res, low LPF cutoff	→	pause
diagram3x1 (top-right) sine waves, rattling coins	↔	*iS1v2iS2* (5) low soft sine wave
polygon1 (1) combination of sine waves and noise (a bit more sine waves than noise, high LPF res)	→	pause
polygon1 (6) only sine waves, rattling (may be shorter than the indicated duration)	↔	*zr1tS*, rattling plastic box
iS1v2iS2 (1) noise, medium LPF res, low volume, occasionally louder for a short duration	→	pause
iS1v2iS2 (5) low soft sine wave	→	*zr1tS*, rattling plastic box
iS5 (3) sine waves, full modulation of freq shift, very fast to maximum rLFO rate, low to medium rLFO glide	→	*polygon1* (4) soft combination of sine waves and noise (a bit more sine waves than noise, low LPF res)
iS5 (5) complex texture of the rattling aluminum foil, occasionally louder	→	pause
zr1tS, rattling plastic box	→	pause

The possibility to pause is also given to performers in the form of a mechanism I call *loudness regulation*. In the combined version of the scores, the computer constantly compares the loudnesses of the parts that are being played as well as the loudnesses of the parts that can follow them, and if it is impossible for a performer to change her/his loudness so it can match the loudness of another performer (that is, the difference between the loudnesses is more than one level), then she/he is given the possibility to pause.[3] To make it possible for the computer to know the loudness of each performer at any given time, I revised the scores and indicated the loudness of each part more explicitly. I used five loudness levels — very soft, soft, Medium, LOUD, and VERY LOUD — and determined for each part the different loudnesses in which it can be played (see tables 4.5 to 4.24). Changing the indicated loudness is possible by pressing and holding the middle foot switch.

Moreover, the combined version of the scores also allows performers to influence one another by linking different parts of different scores (of different performers), so when a certain part is played by one performer, another performer is given the possibility to change to the part to which it is linked (however, only if the other performer is playing a different score and if she/he is not already given the possibility to change to a different part linked to a part played by a different performer). These links are shown in table 4.25, and most of them can be traced back to combinations that we found to be particularly interesting or effective during the rehearsals documented in the previous chapter (see sections 3.2 and 3.3). They include both unidirectional links and bidirectional links (several of the latter are indicated explicitly with bidirectional arrows, while others are more implicitly bidirectional because they depend on the loudness of the parts or connect a range of parts rather than a single part; for example, there are links from any part of Amit's *diagram10-2v1* played softly or very softly to Francesca's *1lnnsib* (1) "sleep mode, moving telephone pickup coils" and from Francesca's *1lnnsib* (1) "sleep mode, moving telephone pickup coils" to Amit's *diagram10-2v1* (3) "percussive sounds and air sounds"). Furthermore, several links can also lead to chain reactions, for example, Daniel's *iS1iS2v1* (1) "soft rubber band, "once in a while"" is linked to Oded's *iS1v2iS2* (1) "noise, medium LPF res, occasionally louder for a short duration", which is linked to Francesca's *1lnnsib* (1) "sleep mode, moving telephone pickup coils", which (as mentioned above) is linked to Amit's *diagram10-2v1* (3) "percussive sounds and air sounds".

[3] To clarify, this is not to suggest that differences in loudness are necessarily negative, but to propose a solution to situations in which the performers felt that what they were instructed to play by the score was senseless, considering what the others were playing (see, for example, the comments on *170320_pencil2_polygon1* in section 3.2.5).

Table 4.5: The possible loudnesses of *diagram10-2v1*'s parts.

	annotation	possible loudnesses
1	percussive sounds	very soft–LOUD
2	percussive sounds and low tones	very soft–LOUD
3	percussive sounds and air sounds	very soft–LOUD

Table 4.6: The possible loudnesses of *polygon1v1*'s parts.

	annotation	possible loudnesses
1		very soft–soft
2		very soft
3		very soft–LOUD
4	different multiphonics	very soft–soft
5		very soft–LOUD
6-7		very soft
8		very soft–soft

Table 4.7: The possible loudnesses of *iS1iS2_x1iS6iS5*'s parts.

	annotation	possible loudnesses
1	percussive sounds	very soft–LOUD
2	very active and complicated passages with many notes	VERY LOUD
3	screeching sounds	soft–VERY LOUD
4	very active and complicated passages with many notes	VERY LOUD
5	percussive sounds	very soft–LOUD
6	long air sounds, with mouthpiece (into and a bit away from mouthpiece) and without mouthpiece (a bit away from mouthpiece) (no whistles), incorporating flutter-tongue and trills, and shaking tube	very soft–LOUD
7	interrupt with pauses, several accents in the end	fade out
8	fast, incomprehensible speaking into mouthpiece/tube	very soft–Medium

9	percussive sounds, more and more active	soft–LOUD
10	long high tones, slightly fluctuating in pitch	very soft–soft
11	percussive sounds	very soft–LOUD
12	long low tones, steady pitch	very soft–Medium

Table 4.8: The possible loudnesses of *iS1iS2iS3*'s parts.

	annotation	possible loudnesses
1	without mouthpiece, whistle sounds, rubbing tube with plastic card	very soft–LOUD
2	without mouthpiece, syllables	very soft–LOUD
3	with sax mouthpiece, soft long tones and multiphonics	soft
4	with trumpet mouthpiece, percussive sounds	very soft–LOUD
5	with sax mouthpiece, high tone, constantly changing intonation, timbre, and dynamics (within very soft)	very soft
6	with sax mouthpiece, low tone, beating with voice	Medium–VERY LOUD
7	with sax mouthpiece, percussive sounds	very soft–LOUD
8	without mouthpiece, whistle sounds, plastic card	fade out

Table 4.9: The possible loudnesses of *tMs3*'s parts.

	annotation	possible loudnesses
1	chaotic singing and playing, lots of low tones	LOUD–VERY LOUD
2	following melody	soft–Medium
3	very high whistle and air sounds	very soft
4	chaotic singing and playing, lots of low tones	LOUD–VERY LOUD

Table 4.10: The possible loudnesses of *pencil2*'s parts.

	annotation	possible loudnesses
1	toothbrush with speed control, multiple motors during (and/or after) the black chaotic figure, moving objects chaotically during the colorful chaotic figure	soft–LOUD
2	frothing wand (bent), then multiple motors	soft–LOUD
3	low motor sounds (two motors)	soft–LOUD
4	low motor sounds (one motor)	soft–LOUD
5	rubber band on wooden box	very soft–soft
6	rubber band on plastic package	very soft–Medium
7–8	rubber band on ceramic jar	very soft–soft

Table 4.11: The possible loudnesses of *type1v1v1*'s parts.

	annotation	possible loudnesses
1–14	1–6 motors on both resonators or only on resonator 1	Medium–VERY LOUD
15–21	1–6 motors on resonator 2	Medium–LOUD
22–27	1–2 motors and rubber band on both resonators or only on resonator 2	soft–Medium
28	rubber band on resonator 2	very soft–soft

Table 4.12: The possible loudnesses of *iS1iS2v1*'s parts.

	annotation	possible loudnesses
1	rubber band, "once in a while"	soft
2	rubber band, somewhat "agitating"	soft
3	short interrupted motor sounds	soft–LOUD
4	static noise-like motor sound	very soft–soft

Table 4.13: The possible loudnesses of *iS4v1*'s parts.

	annotation	possible loudnesses
1	low motor sounds	LOUD
2	high motor sounds	LOUD–VERY LOUD
3	high motor sounds (1)	soft
4	motor sounds of unclear pitches	soft
5	rubber band ("almost a pulse"), crescendo of motors ("expanding")	soft–Medium
6	only rubber bands	very soft–soft

Table 4.14: The possible loudnesses of *3lbclpf7*'s parts.

	annotation	possible loudnesses
1	imitate the atmosphere of the many people talking at the same time	soft–VERY LOUD
2	follow just a single voice and imitate it using only a single motor	very soft–LOUD

Table 4.15: The possible loudnesses of *diagram9-8*'s parts.

	annotation	possible loudnesses
1–11	AM noise, altered by touching circuit board	Medium–VERY LOUD
12	FM noise	soft
13–17	between battery and trackpad	soft–Medium

Table 4.16: The possible loudnesses of *pen1v1v1v1x1x2pencil1*'s parts.

	annotation	possible loudnesses
1–8	FM noise, disturbances	Medium–LOUD
9–10	FM noise, disturbances, rapid movements of tuning wheel	Medium–LOUD
11	FM noise, disturbances	Medium–LOUD
12	FM, moving tuning wheel	soft–Medium
13	FM, very intense disturbances	VERY LOUD
14	AM noise, disturbances	Medium–LOUD

Table 4.17: The possible loudnesses of *iS1*'s parts.

	annotation	possible loudnesses
1	moving telephone pickup coils ("muted agitation"), hard drive chord ("some light")	soft–Medium
2	touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive (“some light”)	soft–Medium
3	sleep mode, key A and/or caps lock	very soft–Medium

Table 4.18: The possible loudnesses of *iS3x2*'s parts.

	annotation	possible loudnesses
1	radio sound	soft
2	noisy rustles	very soft–Medium
3	key T	soft–LOUD
4	noisy rustles	very soft–Medium
5	key 6, altered by touching circuit board	soft–Medium
6	noisy rustles	very soft–Medium
7	trackpad	soft
8	noisy rustles and short electric hum sounds	very soft–Medium
9	battery, disconnecting power cable	soft–Medium
10	noisy rustles and short electric hum sounds	very soft–Medium
11	between trackpad and hard drive	soft–Medium
12	noisy rustles	very soft–Medium
13	very short radio sound	very soft–LOUD
14	noisy rustles and short electric hum sounds	very soft–Medium
15	opening and closing programs	soft–LOUD
16	noisy rustles and short electric hum sounds	very soft–Medium
17	key 3	Medium–VERY LOUD
18	high radio feedback	very soft–LOUD
19	switching between tabs	soft–LOUD

Table 4.19: The possible loudnesses of *1lnnsib*'s parts.

	annotation	possible loudnesses
1	sleep mode, moving telephone pickup coils	very soft–soft
2	FM, high feedback	soft

Table 4.20: The possible loudnesses of *diagram3x1*'s parts.

	annotation	possible loudnesses
∼	noise, low/maximum LPF res, low/mid/high LPF cutoff, sine waves, rattling coins	soft–Medium

Table 4.21: The possible loudnesses of *polygon1*'s parts.

	annotation	possible loudnesses
1	combination of sine waves and noise (a bit more sine waves than noise, high LPF res)	soft
2	combination of sine waves and noise (more sine waves than noise, high LPF res)	soft
3	combination of sine waves and noise (high LPF res)	soft
4	combination of sine waves and noise (a bit more sine waves than noise, low LPF res)	soft
5	combination of sine waves and noise (more sine waves than noise, low LPF res)	very soft
6	only sine waves, rattling (may be shorter than the indicated duration)	Medium–LOUD
7	combination of sine waves and noise (a bit more noise than sine waves, high LPF res)	soft
8	combination of sine waves and noise (more noise than sine waves, high LPF res)	soft
9	combination of sine waves and noise (a bit more noise than sine waves, high LPF res)	soft
10	combination of sine waves and noise (a bit more noise than sine waves, high LPF res)	very soft
11	only sine waves, complex beating patterns, noisy rattling	VERY LOUD

Table 4.22: The possible loudnesses of *iS1v2iS2*'s parts.

	annotation	possible loudnesses
1	noise, medium LPF res, occasionally louder for a short duration	soft
2	noise, high LPF cutoff, high to maximum LPF res	soft–Medium
3	noise, downward glissando (by lowering LPF cutoff, high to maximum LPF res)	soft
4	noise, low LPF res, occasionally adding sine waves, several accents (volume, LPF res)	soft
5	low sine wave	soft

Table 4.23: The possible loudnesses of *iS5*'s parts.

	annotation	possible loudnesses
1	noise, full modulation of LPF cutoff, high to maximum LPF res, very fast to maximum rLFO rate	Medium–LOUD
2	reducing noise mix, modulation of LPF cutoff, and rLFO rate, but in the end accents (high values of all these parameters) (although not very often)	fade out
3	sine waves, full modulation of freq shift, very fast to maximum rLFO rate, low to medium rLFO glide, complex beating patterns	soft–LOUD
4	rattling, abrupt silence	VERY LOUD
5	rattling aluminum foil	very soft–soft
6	complex texture of the rattling aluminum foil, occasionally louder	soft

Table 4.24: The possible loudnesses of *zr1tS*.

	annotation	possible loudnesses
1	rattling plastic box	Medium–LOUD

Table 4.25: The links between the scores of the different performers.

Amit's *diagram10-2v1*, very soft–soft	→	Francesca's *1lnnsib* (1) sleep mode, moving telephone pickup coils, same loudness
Amit's *diagram10-2v1* (2) percussive sounds and low tones, LOUD	↔	Oded's *zr1tS*, rattling plastic box, Medium
Amit's *polygon1v1* (7) different multiphonics	→	Oded's *polygon1* (2) combination of sine waves and noise (more sine waves than noise, high LPF res)
Amit's *iS1iS2_x1iS6iS5* (4) very active and complicated passages with many notes	→	Daniel's *3lbclpf7* (1) imitate the atmosphere of the many people talking at the same time, VERY LOUD
Amit's *iS1iS2_x1iS6iS5* (10) long high tones, slightly fluctuating in pitch, soft	→	Oded's *iS1v2iS2* (2) noise, high LPF cutoff, high to maximum LPF res, soft
Amit's *iS1iS2_x1iS6iS5* (12) long low tones, steady pitch, very soft–soft	→	Oded's *iS1v2iS2* (5) low sine wave
Amit's *iS1iS2iS3* (1) without mouthpiece, whistle sounds, rubbing tube with plastic card	↔	Daniel's *pencil2* (1) toothbrush with speed control, multiple motors during (and/or after) the black chaotic figure, moving objects chaotically during the colorful chaotic figure, same loudness (soft–LOUD)
Amit's *tMs3* (1) chaotic singing and playing, lots of low tones	→	Oded's *iS5* (1) noise, full modulation of LPF cutoff, high to maximum LPF res, very fast to maximum rLFO rate, LOUD
Amit's *tMs3* (3) very high whistle and air sounds	↔	Daniel's *iS4v1* (6) only rubber band

Daniel's *pencil2* (2) frothing wand (bent), then multiple motors, soft–Medium	→	Oded's *diagram3x1* (middle-right) rattling coins, same loudness
Daniel's *pencil2* (2) rubber band on plastic package	↔	Francesca's *iS3x2* (14) noisy rustles and short electric hum sounds, same loudness
Daniel's *iS1iS2v1* (1) rubber band, "once in a while"	→	Oded's *iS1v2iS2* (1) noise, medium LPF res, occasionally louder for a short duration
Daniel's *3lbclpf7* (1) imitate the atmosphere of the many people talking at the same time, VERY LOUD	→	Francesca's *diagram9-8* (7) AM noise, altered by touching circuit board
Francesca's *diagram9-8* (1–5) AM noise, altered by touching circuit board, Medium–LOUD	→	Amit's *iS1iS2_x1iS6iS5* (6) long air sounds, with mouthpiece (into and a bit away from mouthpiece) and without mouthpiece (a bit away from mouthpiece) (no whistles), incorporating flutter-tongue and trills, and shaking tube, same loudness
Francesca's *diagram9-8* (6–11) AM noise, altered by touching circuit board, LOUD–VERY LOUD	→	Daniel's *3lbclpf7* (1) imitate the atmosphere of the many people talking at the same time, same loudness
Francesca's *diagram9-8* (13–17) between battery and trackpad, soft	→	Oded's *iS5* (5) rattling aluminum foil
Francesca's *pen1v1v1v1x1x2pencil1* (1–11) FM noise, disturbances (rapid movements of tuning wheel), LOUD	→	Oded's *zr1tS*, rattling plastic box, LOUD
Francesca's *pen1v1v1v1x1x2pencil1* (12) FM, moving tuning wheel	→	Amit's *iS1iS2_x1iS6iS5* (8) fast, incomprehensible speaking into mouthpiece/tube, one level softer

Francesca's *iS1* (2) touching circuit board ("muted agitation"), moving telephone pickup coils only around hard drive ("some light")	→	Amit's *iS1iS2_ x1iS6iS5* (11) percussive sounds, same loudness
Francesca's *iS3x2* (1) radio sound	→	Oded's *polygon1* (1) combination of sine waves and noise (a bit more sine waves than noise, high LPF res)
Francesca's *1lnnsib* (1) sleep mode, moving telephone pickup coils	→	Amit's *diagram10-2v1*, percussive sounds and air sounds, same loudness
Oded's *diagram3x1* (bottom-right) rattling coins	→	Daniel's *pencil2* (2) frothing wand (bent), then multiple motors, same loudness
Oded's *polygon1* (7) combination of sine waves and noise (a bit more noise than sine waves, high LPF res)	→	Amit's *polygon1v1* (7) different multiphonics
Oded's *polygon1* (11) only sine waves, complex beating patterns, noisy rattling (after 90 seconds)	→	Francesca's *iS3x2* (18) high radio feedback, LOUD
Oded's *iS1v2iS2* (1) noise, medium LPF res, occasionally louder for a short duration	→	Francesca's *1lnnsib* (1) sleep mode, moving telephone pickup coils
Oded's *iS1v2iS2* (3) noise, downward glissando (by lowering LPF cutoff, high to maximum LPF res)	→	Francesca's *1lnnsib* (2) FM, high feedback
Oded's *iS1v2iS2* (5) low sine wave	→	Amit's *iS1iS2_ x1iS6iS5* (12) long low tones, steady pitch, soft
Oded's *zr1tS*, rattling plastic box, LOUD	→	Daniel's *3lbclpf7* (2) follow just a single voice and imitate it using only a single motor, LOUD

Lastly, the beginning is determined by the computer, which randomly selects the score, part, and loudness of each performer. At least one performer (and up to three performers) begins with a pause; none can begin with a part whose loudness is VERY LOUD; if two performers are selected to play from the beginning, their loudnesses can differ only by one level; and if three performers are selected to play from the beginning, the loudness of at least two of them must be the same. Note that the beginning is synchronized (so when one performer starts her/his score, the scores of the other three start as well). Pressing Esc ends the score, and after all four press Esc, a log file is generated.[4] At Happy New Ears, the performers were instructed to press Esc after about 45 minutes.

4.2 The performance

Between the rehearsal on April 4 and the performance, which took place on May 19 at Klaus Linder-Saal, Musik-Akademie Basel, we could schedule only one additional rehearsal: on May 17. This did not really matter, however, as in any case, I was working on the combined version of the scores described in the previous section until the very last moment. Luckily, it was ready before the rehearsal, although without the possibility to save log files (which was added only before the performance).

During the rehearsal, we only had time for a run-through (preceded by a short technical explanation),[5] and as a result, for the performers playing the combined version was somewhat like navigating through a maze. Obviously, they were familiar with the individual scores, but they did not know how they were linked and therefore were not always able to anticipate what could come next and how their choices would influence the others. This, however, had its own advantages, since it created that sense of excitement that comes from exploring the unknown.

The positioning of the performers in the hall was also finalized during the rehearsal. Figure 4.1 is a photo taken by me during the rehearsal and figure 4.2 is a photo taken by Daniel More about an hour before the performance. As can be seen, the audience could choose from a variety of seating positions, either surrounding the performers or sitting between them (or alternatively, standing in the balcony from which the photo was taken).[6]

[4] To replay the interaction with the scores, follow the instructions at the end of section 5.1.1.

[5] An audio recording can be found on *CompositionCloud*'s YouTube channel (titled *170517_ ccloudlab1-3*).

[6] At the time it was not yet possible to monitor the performers' interaction with the

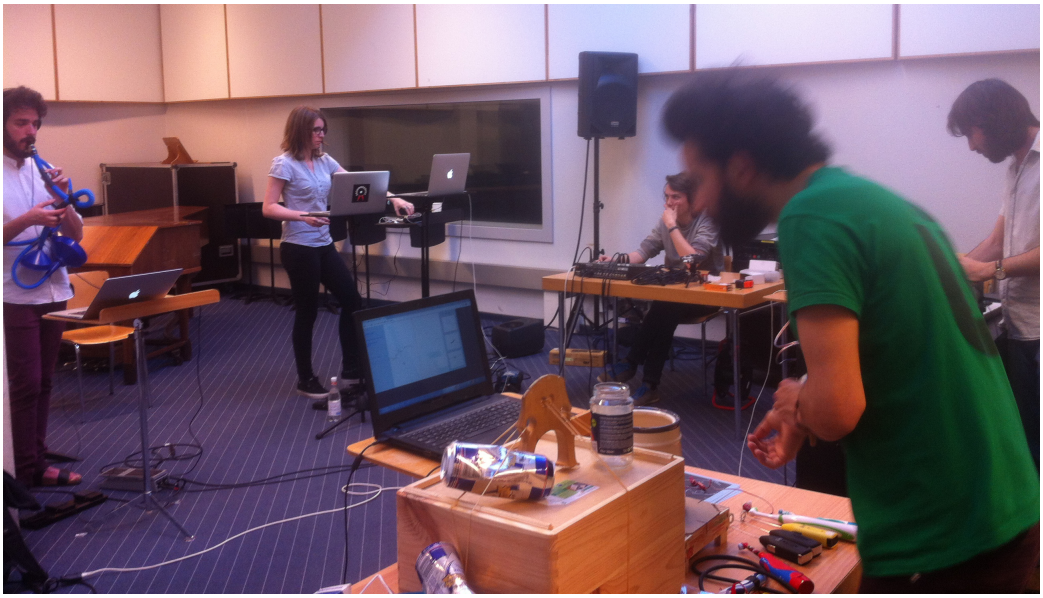


Figure 4.1: The positioning of the performers during the rehearsal.

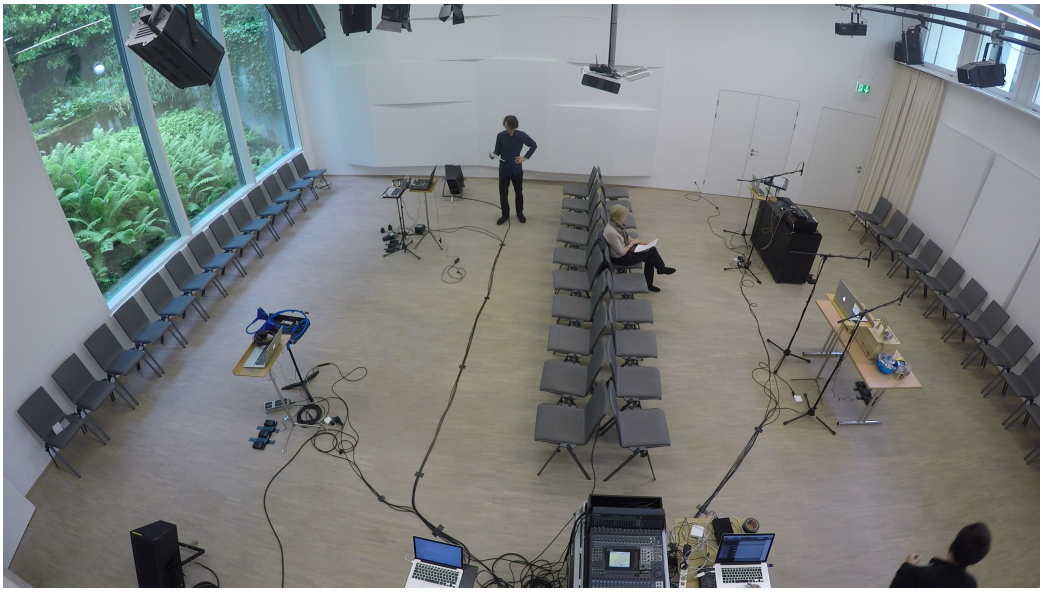


Figure 4.2: The hall an hour before the performance (photo by Daniel More).

Finally, an audio recording of the performance (by Jan Gubser), synchronized with a replay of the performers' interaction with the scores, can be found on *CompositionCloud*'s YouTube channel (titled *170519_ccloudlab1-3*). A screenshot of the replay is on the cover of this book, and the chapter will conclude with a few observations regarding it.

Generally speaking, the performers followed the scores quite accurately, perhaps with the exception of *polygon1v1* and *diagram9-8* as well as several cases in which the loudness of what was played did not match the indicated loudness.[7] In addition, the performers occasionally skipped parts of the scores, especially Amit while playing *iS1iS2_x1iS6iS5*, for example at 3:24, 6:48, 14:52, and 22:09, but also while playing *tMs3* at 26:32 and 39:11.

In that regard, Amit's approach to playing the combined version of the scores was different from the approach of the others: he changed scores 16 times, never playing a score from the beginning to the end (always only a few parts), while Daniel and Oded changed scores 9 times and Francesca only 5 times (excluding pauses and repetitions of scores after pauses).[8] Furthermore, even though Daniel and Oded also skipped parts of the scores — Daniel at 6:14, 16:38, and 30:40, and Oded at 20:12, 23:53, 30:51, and 37:46 — their reason was different. At 16:38, after playing *iS4v1* (1–5) and taking a pause, Daniel skipped *iS1iS2v1* (4) and *iS4v1* (4–5) and played only *iS4v1* (6), continuing in fact from where he stopped. (A similar explanation can also be given to the skipping of *iS4v1* (1) at 30:40.) Oded skipped several parts at 20:12, avoiding a repetition of *zr1tS*, pausing, and then playing *iS1v2iS1* from the beginning to the end. At 23:53 and 30:51, he also changed scores only to pause and play another score, and at 37:46, he skipped from *iS5* (6) to *iS5* (3) in order to change to *polygon1*.[9] Of course, the performers were free to choose when and how often to change scores, however, skipping parts of scores, regardless the reason, should have been avoided.

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scores in real-time from another computer (so it could not be projected onto a screen for the audience to see). In the version of *ccloudlab1-3* currently available for download, it is possible by typing "monitor" instead of choosing a performer.

[7]Note that slow responses to changes were also evident, but this is understandable considering that the performers were instructed to indicate what they were about to play before playing it. Ideally, both would have happened simultaneously, however, as it was practically impossible, indicating before playing was preferable to indicating after playing.

[8]To change scores (and pause), the performers used mostly the links shown in tables 4.1 to 4.4. Pauses that resulted from the loudness regulation mechanism were selected only rarely, as were possibilities given because of the links shown in table 4.25.

[9]At 30:51, Oded skipped part 1 of *polygon1* and paused. The reason was probably his decision to end the performance with *polygon1*, more specifically with "only sine waves, complex beating patterns, noisy rattling". Oded also ended the first and third free combinations mentioned in section 3.3 with this part.

Also, several of the scores were played more than the others. Amit played *diagram10-2v1* once (or twice, if repetitions of scores after pauses are not excluded), *polygon1v1* three times (but skipped the first time), *iS1iS2_x1iS6iS5* six times, *iS1iS2iS3* three times, and *tMs3* four times. Daniel played *type1v1v1* once, *pencil2* twice, *iS4v1* six times (but skipped the first time), and *3lbclpf7* twice. Francesca played *diagram9-8* once, *pen1v1v1v1x1x2pencil1* twice, *iS1* once, and *iS3x2* twice. And Oded played *diagram3x1* once, *polygon1* twice (but skipped the first time), *iS1v2iS2* twice (only separated with a pause and *zr1tS*, which was skipped, however), *iS5* twice, and *zr1tS* three times (but the second and third times were skipped). Note that Daniel did not play *iS1iS2v1* (he did change to it once but then skipped it), and Francesca did not play *1lnnsib*.

Chapter 5

ccloudlab1x2

ccloudlab1x2 was the second extract of *ccloudlab1*. It focused on the use of audio recordings as real-time musical scores, taking the form of a multiplayer music game titled *stuckJunk-v1*. The game is based on the audio recording *stuckJunk*, which documents the process of me trying to fix my junk drawer (in which something was stuck).[1] The intention was to develop a performance for a master's recital of Daniel. This performance, however, was eventually titled *ccloudlab1x2v1* (the first variation of *ccloudlab1x2*) and the title *ccloudlab1x2* was given to an earlier performance, which was part of AKUT, the concert series of the composition students of the Hochschule für Musik Basel.

The following chapter is divided into three sections: the first is a guide to installing, running, and playing *stuckJunk-v1*; the second describes the process of developing the first performance; and the third describes the process of developing the second performance.

5.1 The game (*stuckJunk-v1*)

5.1.1 Installing

To play *stuckJunk-v1*, each player needs a laptop with Google Chrome installed. One of the laptops will also function as the server to which the other laptops connect, and only this laptop requires the game to be installed. The steps below explain the installation process:

1. Download and install node.js[2].

[1] See "stuckJunk" on *ccloudblog*.

[2] See https://nodejs.org/en/download/.

2. Download *stuckJunk-v1*[3] and unzip the downloaded file.
3. Open the command-line (Terminal in Mac or Command Prompt in Windows).
4. Change directory to where you have unzipped the file using the "cd" command.
5. Type "npm install" and press enter.

5.1.2 Running

To start a session:

1. Type "node server" in the command-line and press enter (make sure you are in the directory where you have installed *stuckJunk-v1*).
2. Create a wireless local network and set the network of the other laptops to the network you have just created.
3. Open Chrome and go to the following address: "localhost:3000". Also open Chrome on the other laptops, type in the address bar the IP address of the network + ":3000" (for example, if the IP address is 169.254.43.193, type "169.254.43.193:3000"), and press enter.
4. Choose how many players will play the game, and let each player choose her/his color and where to begin. Note that it is always possible to abort the game by pressing "a" on the keyboard (then you can refresh the page to create a new game).
5. When you are done, close the session by pressing Ctrl+C while in the command-line.

5.1.3 Playing

Figure 5.1 shows a screenshot taken from the very beginning of a three-player game seen from the perspective of the red player. In the main part of the screen there is a board, which consists of 24 rectangles of different sizes, representing different segments of the audio recording *stuckJunk*.[4] After pressing 1, 2, or 3 on the keyboard, the red timer located at the top-right corner of the red-stroked rectangle will start counting down, and the corresponding segment will be played by the laptop, to which a pair of headphones should be connected. Just a single headphone is to be used, as each player should be able to hear both the segment of the recording played by her/his laptop and the sounds she/he and the other players are producing.

[3] See https://github.com/CompositionCloud/stuckJunk-v1. Click on "Clone or download" and then on "Download ZIP".

[4] See appendix A to learn more about how the recording is related to the board.

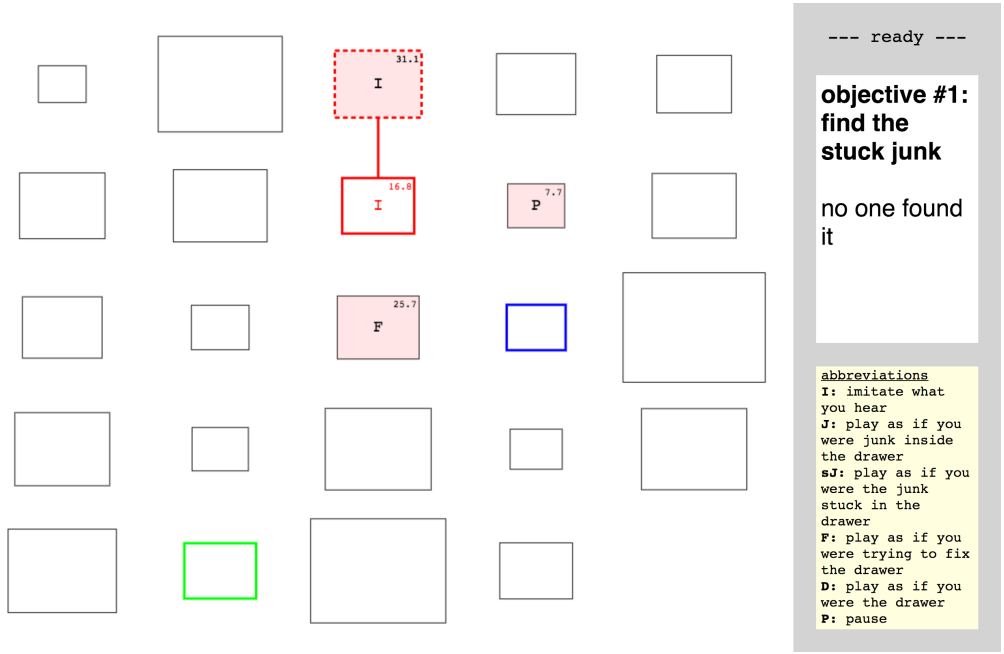

Figure 5.1: A screenshot taken from the very beginning of a three-player game seen from the perspective of the red player.

"I", the letter written at the center of the red-stroked rectangle indicates how the recording is to be interpreted. Its meaning is explained in the abbreviation legend at the right-bottom of the screen. The green and blue rectangles represent where the other two players are located, and as can be seen, the letter of a given rectangle is visible only to the players who are located in that rectangle or in the rectangles adjacent to it. In this respect, it is important to mention that although the rectangles always correspond to the same segments of the recording, the letters are assigned differently each game.

The three rectangles with the light red fill are the rectangles to which the player can move after the red timer reaches zero, and the rectangle outlined with a red dashed line is the selected rectangle. In addition, a red line is drawn between the rectangle in which the player is located and the selected rectangle to which she/he will move. Changing the selected rectangle is possible while the timer is counting down by using a USB triple foot switch or 1, 2, and 3 on the keyboard. The leftmost and topmost rectangle corresponds to the left foot switch; the rightmost and bottommost rectangle corresponds to the right switch; and the rectangle between them corresponds to the middle switch. Note that with the exception of the corners, players can only move to adjacent rectangles in straight lines and always have three choices. Therefore,

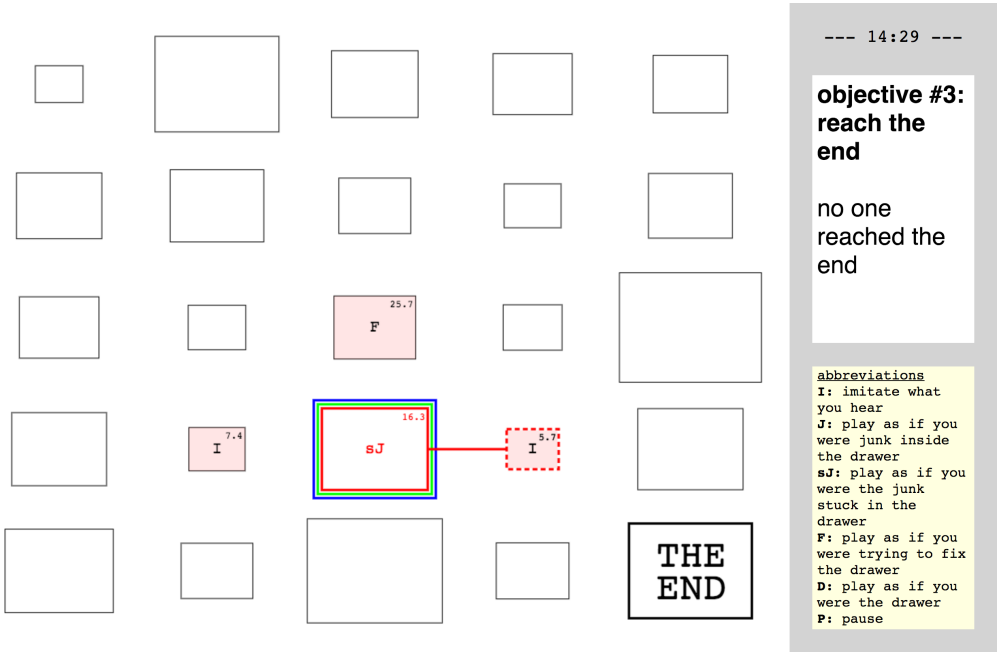

Figure 5.2: A screenshot taken after the second objective was accomplished.

one rectangle is often randomly omitted (in the case of the example above, it is the one to the left of the rectangle in which the red player is located).

To finish the game, the players need to accomplish three objectives: first, all should find the stuck junk, that is, find the rectangle in which the abbreviation "sJ" is written (there is only one such rectangle); second, all should play together as if they were the junk stuck in the drawer, that is, be in the "sJ" rectangle simultaneously; and third, all should reach the end, which is represented by an additional rectangle shown at the bottom-right corner of the board after the second objective is accomplished (see figure 5.2).

After everyone reaches the end, a log file is automatically generated and saved in the "logs" subfolder. Log files can be used to replay games. To do so, go to the following address while *stuckJunk-v1* is running: "localhost:3000/log_reader". Then, drag and drop the log file into the browser, and press 1, 2, or 3 to start replaying the game. By default, you will see an overview of the game, monitoring everyone who is playing. To view the game from the perspective of a specific player, press the first letter of her/his color: "r" for red, "g" for green, "b" for blue, "o" for orange, "c" for cyan, and "m" for magenta. To go back to the overview monitor perspective, press "v".

5.2 The first performance

stuckJunk-v1 was first performed by Arian De Raeymaecker, Cheyenne Häni, and Daniel More.[5] Initially, I held a series of individual meetings with each of them to design the playing setups to be used for producing the sounds (Daniel played the same setup we collaborated on during the first stage of the development process of *ccloudlab1*; see section 1.1.2).

Arian, a guitarist and composer, brought an old rusty guitar to which he added a self-made pickup, and prepared the strings with various metals clips. Plucking the clips produced sounds similar to those of *vibrating_ rulers*[6], so we decided to create a playing setup in which the sound world created by different rulers is extended by the sounds of the amplified prepared guitar. We chose the following rulers: two brass bars, one 15 mm wide and 2 mm thick, another 20 mm wide and 2 mm thick; two PVC bar, one 19.5 mm wide and 2 mm thick, another 29.5 mm wide and 2 mm thick; one cooper rod, 2.9 mm in diameter; one galvanized steel threaded rod, 5 mm in diameter; and several aluminum needles and wooden skewers, 2 to 3 mm in diameter. All the bars and rods were 1 meter long (apart from the first PVC bar, which was 60 cm long), and the needles and skewers were 20 to 30 cm long. We used a wooden table as a surface and taped to it a small piece of aluminum foil. Additional auxiliary objects included a contrabass bow and a hacksaw.

With Cheyenne, a recorder and baroque bassoon player, I developed the altered recorder mouthpiece that was used in *7iS-iSSx1_ arm-GP* (in which the end of the mouthpiece was covered with the closed end of a tubular balloon),[7] exploring different kinds of recorders and tensions of balloons, as well as bassoon mouthpieces connected to straws (and then to recorder mouthpieces). We ended up with the following setup: wooden soprano mouthpiece, tight balloon; wooden soprano mouthpiece, loose balloon; plastic soprano mouthpiece, half-loose balloon; wooden alto mouthpiece, loose balloon; plastic alto mouthpiece, tight balloon; wooden tenor mouthpiece, tight balloon; and several bassoon reeds connected to straws.

Photos of Arian's guitar and Cheyenne's playing setup are shown in figures 5.3 and 5.4, and the whole setup is shown in figure 5.5.[8]

[5] The performance took place on April 7, 2017, as part of AKUT, the concert series of the composition students of the Hochschule für Musik Basel.

[6] A guide to *vibrating_ rulers* can be found on *ccloudblog*.

[7] See "7iS-iSSx1_arm-GP" on *ccloudblog*.

[8] More photos can be found on *CompositionCloud*'s Facebook page.

Figure 5.3: Cheyenne playing on the plastic alto mouthpiece.

Figure 5.4: Arian's guitar.

Figure 5.5: The whole setup.

Simultaneously, I was also developing *stuckJunk-v1* and had the first working version of it when we were almost finished designing the playing setups. We then scheduled two rehearsals to practice playing the game, and these rehearsals can be heard in the playlist *ccloudlab1x2-170401-02* on *CompositionCloud*'s YouTube channel.

The first track (*ccloudlab1x2-1*) is Arian, Cheyenne, and Daniel's first attempt to play *stuckJunk-v1*. After they finished, I asked them to describe how they had felt while playing, and they all said it was a challenging experience, explaining that they had to deal with multiple stimuli and perform multiple tasks simultaneously: following the game, deciding how to move on the board, listening to the recording with one ear and to the sounds they were producing with the other, and making music with instruments that they had just started to explore. Handling all of this improved after they tried playing the game again (*ccloudlab1x2-2*), and it was clear that practice will make it easier to overcome this difficulty. On a more metaphorical level, this quasi-sensory overload experience can also be related to the literal overload of junk that caused the drawer to become stuck.

Another issue we dealt with, was how to balance accomplishing the objectives of the game and making interesting music, a question that remained somewhat open (and perhaps, should remain so). Obviously, the objectives must be followed, otherwise the game will not end. However, it also seemed to me counterproductive to prohibit occasionally ignoring the objectives set by the game, as simply wandering around the board for a while allowed the exploration of its musical potentialities.[9]

Afterwards, we spent some time discussing how the recording was to be interpreted. In *stuckJunk-v1*, this can be one of the following, depending on where one is located on the board: "imitate what you hear" (I), "play as if you were junk inside the drawer" (J), "play as if you were the junk stuck in the drawer" (sJ), "play as if you were trying to fix the drawer" (F), "play as if you were the drawer" (D), or "pause" (P). Note that while the first and last instructions tell the player what to do, the others just tell her/him what to think, and are accordingly very open to interpretation.[10] Therefore, in order to establish better communication between Arian, Cheyenne, and Daniel, I asked each of them to describe in words how she/he interprets

[9]Perhaps, the only reason to focus solely on the game is to avoid a very long performance.

[10]When following the more open instructions, the role of the recording is to give the player an idea of what kind of junk, drawer, etc. is to be imagined. So, for example, when playing "as if you were junk inside the drawer", the player should imagine that she/he is the specific junk that is portrayed in the recording.

each instruction (with the exception of "pause" (P), which is straightforward and did not require any further discussion). Below is a summary of their responses.

Arian:
I* - making noisy sounds with several rulers. sometimes plucking the rulers.
J - this is the least defined, maybe similar to "imitate what you hear" (like Daniel's J). maybe the very distinctive high-pitched plucking sounds.
sJ - this could be anything that is played abruptly, a kind of staccato, like resisting something.
F - mostly low-pitched plucking. just feels this way. the hacksaw was also used for this.
D - something big and slow. examples include slow vibrating rulers, long guitar and feedback sounds, as well as everything that has to do with the movement of the drawer (pulling it back and forth).

Cheyenne:
I* - difficult because of the instrument. maybe following the rhythm of the recording. maybe air sounds and percussive sounds.
J - something "lazy", as if being there by accident.
sJ - loud, high recorder sound ("screaming"), like being stuck without being able to move and wanting to get out.
F - a distinctive gesture, for example, repeating high recorder sounds that go down. also the reeds.
D - long, quiet sounds.

Daniel:
I* - making noises with the plastic packages.
J - focusing only on a single aspect of the sound. a bit similar to "imitate what you hear".
sJ - something "stressed", mostly rubber bands.
F - sounds of motors played with some agitation.
D - hitting the edges of the wooden box with the metal cap of one of the jars.

*"imitate what you hear" (I) does not necessarily mean imitating only the sounds coming from the headphones. imitating the sounds the others are producing is also possible. this was especially helpful for Cheyenne, whose ability to imitate the recording with the altered recorder mouthpieces was quite limited.

As can be seen, these notes are heterogeneous. Most of the notes do refer to specific sounds (Arian's I, J, F, and D; Cheyenne's I, sJ, and F; and Daniel's I, sJ, F, and D), and some of them consist of broader descriptions of sounds (Arian's sJ and D; and Cheyenne's F and D). All the interpretations of the stuck junk use additional (and rather similar) metaphors: "like resisting something" (Arian), "like being stuck without being able to move and wanting to get out" (Cheyenne), and "stressed" (Daniel). Cheyenne also used "something 'lazy', as if being there by accident" for junk inside the drawer (J), and Daniel interpreted J as a mode of listening, "focusing only on a single aspect of the sound". For both Arian and Cheyenne, the drawer was associated with creating large musical spaces (Arian used the adjective "slow" and Cheyenne "long").

In general, however, they all agreed that the way they interpreted the instructions was also very flexible and mostly context-dependent, and this flexibility is also evident in the relative ambiguity with which some of the descriptions above are formulated. See, for example, the use of words such as "sometimes" (Arian's I), "maybe" (Arian's J and Cheyenne's I), "could" (Arian's sJ), "something" (Arian's sJ and D; Cheyenne's J; and Daniel's sJ), "anything" (Arian's sJ), and "everything" (Arian's D). In the second performance, a stricter approach to interpreting the instructions was explored.

The third and the fourth tracks, *ccloudlab1x2-3* and *ccloudlab1x2-4*, are two games that were played before and after this discussion. Although it might be difficult to realize only from listening to these (at the time it was not yet possible to save log files of the games or monitor them from another computer, as I was involved with solving other bugs), at least according to Arian, Cheyenne, and Daniel, having a clearer idea of how the instructions are interpreted by the other performers (as well as making it clearer for oneself) did help. To play better as a group, I also suggested thinking of the different instructions as different perspectives on a shared situation. In other words, playing as if one "were junk inside the drawer", could also mean playing like junk inside the drawer depicted by the player who is playing as if she/he "were the drawer".

A video of the performance can be found on *CompositionCloud*'s YouTube channel (titled *ccloudlab1x2-5*).

5.3 The second performance (*ccloudlab1x2v1*)

In the second performance, which was part of Daniel's master's recital, Arian, Cheyenne, and Daniel were joined by visual artist Kostas Tataroglou. In *ccloudlab1x2v1* (the title given to the second performance), Kostas played

stuckJunk-v1 just like the others, however, rather than interpreting the recording by producing sounds, he was producing visuals, playing several drawer- and junk-related video clips he recorded, and processing them in real-time with the live video mixing software Resolume, which he controlled with a KORG nanoKONTROL 2. In addition, Arian's playing setup was also slightly changed: we removed the guitar and the aluminum foil and added a brass rod 6 mm in diameter in order to focus more on the rulers.

For this performance, we scheduled two rehearsals as well,[11] with the intention of making it easier to follow the game by listening to it. My plan was to devote the first rehearsal to playing all the six possible duos, and to ask the performers to write short descriptions of what they are going to do for each instruction. Contrary to the descriptions they gave when we developed the first performance, this time I wanted something more concrete, even schematic, such as simple descriptions of specific sounds or families of sounds. To do this gradually, for the first duo, the performers were asked to write the descriptions only after they had played; for the second duo, they were asked to write half before and half after;[12] and for the third duo, they were asked to write everything in advance. I also encouraged them to vary their interpretation of the instructions, both for the sake of musical experimentation and to make the game slightly more challenging. To be able to see what they were playing in real time and analyze it afterwards, I developed the possibility to monitor the game from another computer and to save a log file of it, so it could be replayed. Videos replaying these six duos can be found on *CompositionCloud*'s YouTube channel (titled *ccloudlab1x2v1-1*, *ccloudlab1x2v1-2*, *ccloudlab1x2v1-3*, *ccloudlab1x2v1-4*, *ccloudlab1x2v1-5*, and *ccloudlab1x2v1-6*).[13] On the next page are the descriptions the performers wrote (the colors are those chosen by the performers for each game).

Replaying games provides information (that is impossible to obtain only by listening) about the behavior of the players. One can observe in which rectangle each of the players was located, to which other rectangles she/he could move, and to which she/he chose to move. Accordingly, the videos also reveal some inaccuracies in the interpretation of the instructions: short rectangles were occasionally ignored and slow responses to changes were also

[11]The first rehearsal was on June 4, 2017, a little less than two months after the first performance, and the second rehearsal was on June 14, 2017. The performance was on June 22, 2017, at the Hochschule der Künste Bern.

[12]Unfortunately, I did not ask Arian, Cheyenne, Daniel, and Kostas to indicate which descriptions they wrote before they played and which descriptions they wrote after they played.

[13]Because of technical problems, *ccloudlab1x2v1-2* does not include the visuals Kostas produced, and *ccloudlab1x2v1-6* does not include the replayed game.

[1]	Arian (green)	Daniel (blue)
J	pitched sounds by plucking rulers	rubber bands
sJ	bowing two needles	frothing wands
F	rubbing threaded rod with wooden skewer	toothbrushes
D	bowing thick rod	metal cap

[2]	Cheyenne (red)	Kostas (magenta)
J	mixed recorder sounds	-
sJ	"screaming"	-
F	flutter-tongue	-
D	reed sounds	-

[3]	Cheyenne (orange)	Daniel (green)
J	mixed recorder sounds	frothing wands
sJ	"screaming"	rubber bands
F	flutter-tongue	toothbrushes
D	reed sounds	nose trimmer

[4]	Arian (green)	Cheyenne (orange)
J	bowing wooden skewer	mixed recorder sounds
sJ	slapping plastic ruler	balloon noises
F	bowing needle	reed sounds
D	plucking rulers	air sounds

[5]	Arian (cyan)	Kostas (magenta)
J	stroking table with copper ruler	-
sJ	sawing everything	color
F	plucking rulers	-
D	bowing threaded rod	-

[6]	Daniel	Kostas
J	frothing wands	-
sJ	rubber bands	color
F	toothbrushes	-
D	metal cap	-

not very rare. That being said, it is possible to follow the games quite easily, and it is clear that the performers did their best.

Replaying games can also expose when the players tried to accomplish the objectives and when they chose to ignore them. The videos mentioned above show that the performers were all committed to the game, and the only significant exceptions are Arian's and Kostas' delays in finding the stuck junk in *ccloudlab1x2v1-1* and in *ccloudlab1x2v1-5*: in *ccloudlab1x2v1-1*, even though Arian was located next to Daniel when Daniel found the stuck junk, Arian chose to go to the other side of the board and came back to find it only five minutes later; and in *ccloudlab1x2v1-5*, Arian found the stuck junk at the very beginning of the game, but Kostas ignored this and went in another direction.

Kostas' delay in finding the stuck junk, however, was probably not intended, as he was also slightly confused and overwhelmed by the game. Moreover, besides marking the stuck junk by changing the video from black and white to color, it was difficult for him to play the game, produce visuals, and follow a predetermined interpretation of the instructions at the same time. Therefore, Kostas and I decided to meet again without the others for an additional rehearsal, in which we found out that keeping things simple — such as marking the stuck junk by changing from black and white to color — works the best. Kostas wrote similar descriptions also for the other instructions, and we then discussed what it means to "imitate what you hear" with visuals rather than sounds. One thought was to simply use relatively less effects for this instruction, pointing out its literality in comparison to the other, more metaphorical instructions. Another thought was to refer to "imitate what you hear" as the "default" playing mode, and then to modify it when the other instructions are to be followed, according to the simple but specific descriptions Kostas gave to them (for example, changing from black and white to color).

We then played a game together (I played on a wooden skewer and a glass of water, which were recorded with *distortedZoomH5*[14]). A video of this game can be found on *CompositionCloud*'s YouTube channel as well (titled *ccloudlab1x2v1-7*), and below are the descriptions we wrote.

[7]	Goni (red)	Kostas (magenta)
J	high-pitched plucking	speed accents*
sJ	hitting glass of water	color
F	touching microphone	flashlight*
D	low soft plucking	freeze

[14]See "distortedZoomH5" on *ccloudblog*.

*even though Kostas did write these description before playing, he did not manage to realize them. afterwards, they were used also in another game we played but not recorded, as well as in the next rehearsal and in the performance.

The second rehearsal, which was also the last one before the performance, was devoted to practicing playing a four-player game, as we planned for the performance. Videos of the two games played in this rehearsal and the one played in the performance can be found on *CompositionCloud*'s YouTube channel (titled *ccloudlab1x2-8*, *ccloudlab1x2-9*, and *ccloudlab1x2-10*), and the descriptions written by Arian, Cheyenne, Daniel, and Kostas are given below (this time the same interpretation of the instructions was used for all the games).[15] Figures 5.6 to 5.8 are examples of the visuals Kostas produced.

[8] [9] [10]	Arian (red)	Cheyenne (cyan [8], then orange [9] and [10])	Daniel (blue)	Kostas (magenta)
J	dropping rulers	mixed recorder sounds	frothing wands	speed accents
sJ	bowing and sawing rulers	"murmuring" (but also "screaming")	rubber bands	repetitions
F	plucking rulers	reed sounds	toothbrushes	flashlight
D	dragging rulers	plastic alto mouthpiece	nose trimmer	freeze

Four-player games are not very different from two-player games, except that in four-player games there is the possibility that one of the players will find the stuck junk right from the start (as happened to Arian in both *ccloudlab1x2v1-8* and *ccloudlab1x2v1-9*).[16] In addition, accomplishing the second objective, "all players should play at the same time as if they were

[15]Note that because of an unfortunate technical problem, we could not save the visuals Kostas produced during the performance and the log file of the game that was played. Therefore, the video *ccloudlab1x2-10* consists of only a static image and an audio recording taken by Jan Gubser.

[16]This is because "sJ" can be assigned only to 1 of 11 specific rectangles (see appendix A). Therefore, if there are three players or more, it might occur that the instructions assigned to all 11 rectangles are visible to the players (every player sees the instructions assigned to four rectangles: the one in which she/he is located and the three to which she/he can move). At the time, the game did not take into account if these 11 rectangles are actually

the junk stuck in the drawer", tends to be more difficult in four-player games than in two-player games. This should not be too surprising as, naturally, the more players there are, the more difficult it is for them to be in the same rectangle at the same time. For example, in *ccloudlab1x2v1-9*, it took Arian, Cheyenne, Daniel, and Kostas almost five minutes to accomplish this objective, while in *ccloudlab1x2v1-2*, *ccloudlab1x2v1-4*, and *ccloudlab1x2v1-5*, it took them less than 45 seconds to do so.

Of course, there are also other factors involved. In *ccloudlab1x2v1-1* it took Arian and Daniel almost three minutes to accomplish this objective because Arian found the stuck junk only after he moved to the longest rectangle on the board (162 seconds). Whereas in *ccloudlab1x2v1-8*, the stuck junk was located in a medium-long rectangle (40 seconds), and when Cheyenne finally found it all the others were already surrounding it. Therefore, accomplishing this objective in *ccloudlab1x2v1-8* took less than 90 seconds.

The stricter approach to interpreting the instructions meant that accomplishing the second objective also had an explicit impact on the music: the combination of the sounds and visuals intended for playing as if one is "the junk stuck in the drawer", was heard and seen for the first time only when the players accomplished the second objective. Therefore, it is safe to assume that in *ccloudlab1x2v1-10* this objective was accomplished at about 10:15, even though the log file was not saved.

Another influence of the game on the music is that the ending of *stuck Junk-v1* is almost always a solo of the player who is the last to reach the end. This is evident in practically all the games we recorded. Furthermore, Daniel's behavior at the end of *ccloudlab1x2v1-8* is also worth mentioning: at 10:39, four seconds before reaching the end, Daniel changed his mind and moved to another rectangle, exploring the board for another two minutes (possibly because Arian also chose to explore the board for a while before reaching the end). This information is available to us because the log files expose not only how the games were being played, but also some of the dilemmas the players confronted while playing, as well as their final decisions.

To conclude, a few words should also be said about how we approached presenting the two performances to the audience. In both performances, it was important for us to give the audience the feeling that the performers on stage were playing a game together, that they were interacting with one another in a playful manner. That being said, in both performances we also decided not to project the game, so the audience's understanding of what was

visible to the players or not. Accordingly, in *ccloudlab1x2v1-8* and *ccloudlab1x2v1-9* Arian found the stuck junk even though it could have been located in the other rectangles that were not visible to any player (this is fixed in the version of *stuckJunk-v1* currently available for download).

occurring was limited, as they could not know what the performers saw on the screens of their laptops or heard in their headphones. In the first performance, this was also because of a technical consideration (recall that it was impossible to monitor the game back then), and in the second performance, we thought that projecting the visuals Kostas produced would be enough. Obviously, projecting the game could have enriched the audience's experience. Perhaps also incorporating into the performances a short explanation of the game, maybe in the form of a live demonstration or a video tutorial, would have been necessary, if the audience would have been expected to really follow what was projected. Conversely, focusing too much on the game could have also distracted the audience from listening to the musical outcomes of playing it.

Ultimately, it seems to me that what is at stake here is the role of the audience: are they invited to listen to music or to follow a game? Or maybe to both?

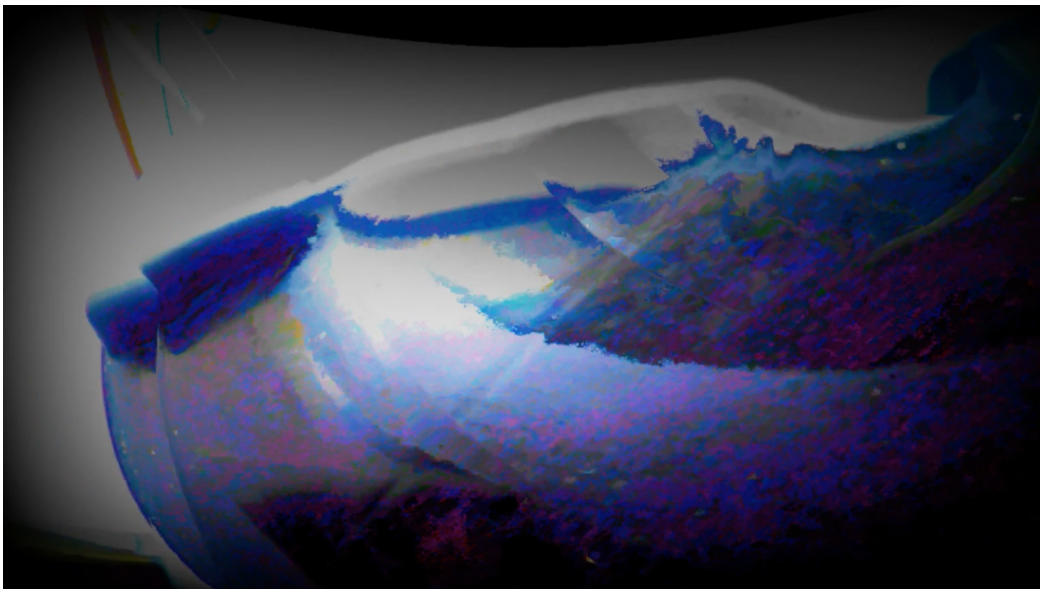

Figure 5.6: An example of the visuals Kostas produced [1].

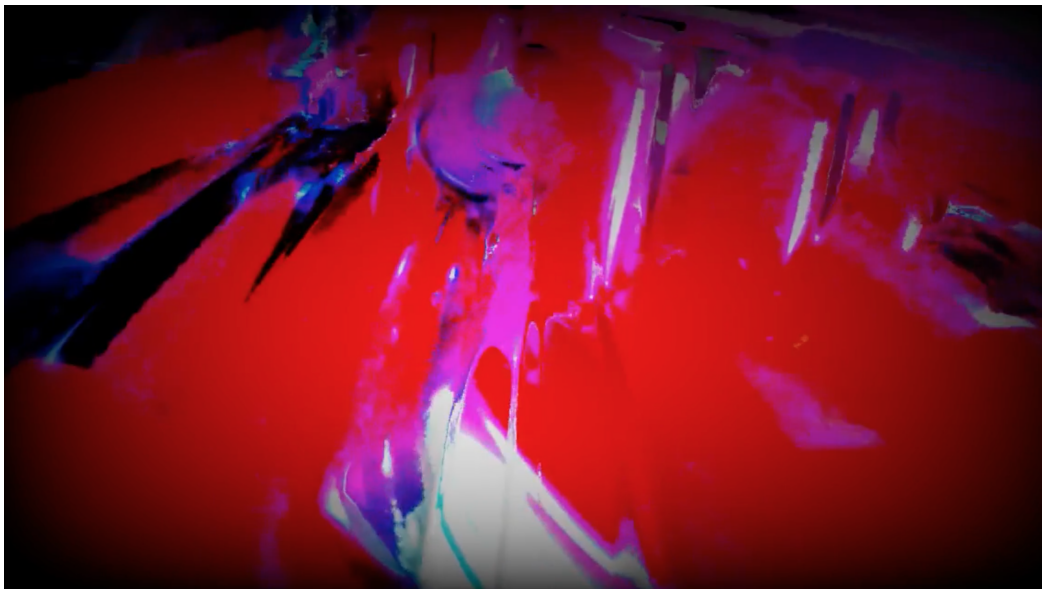

Figure 5.7: An example of the visuals Kostas produced [2].

Figure 5.8: An example of the visuals Kostas produced [3].

Chapter 6

ccloudlab1's future

The future of *ccloudlab1* lies in its potential modularity. Indeed, in the version of *ccloudlab1-3* that is available online, the particular computer-based scores created during the second stage of the development process were linked to one another in the particular way that I determined during the third stage of the development process. However, by changing a few lines of code, the scores could be linked differently. The loudness regulation, for example, could be turned off or modified, and other regulation mechanisms could be developed. Different beginnings could also be specified (as well as different endings), and by providing alternative annotations, the scores could also be adapted to other playing setups (which could also be modular). Moreover, the scores themselves could be changed. There is no reason why, for example, the durations of the different parts of *polygon1* and *polygon1v1* or the orders in which they can follow one another could not be modified, and there is no reason why other, similarly structured diagrams could not be used instead of them (or in addition to them) (possibly edited with a score editor and played and replayed with a score player). Furthermore, other forms of interaction with the scores could also be incorporated (other than using a USB triple foot switch), additional score types (perhaps a generative scrolling score or a modular text) could also be created, and the list continues.

Accordingly, *ccloudlab1* should be considered only a small, preliminary step towards the development of a platform that could resemble, in the long term, a massively multiplayer online game, a virtual world that performers will be able to explore and interpret as a dynamic and interactive, ever-changing ("living") user-specific score. In addition to producing performance scores, parts of it might encourage solitary experience, while others could be more pedagogical in nature, taking the form of tutorial or low difficulty levels. Performances, which could also take place outside the concert hall and the traditional performance venues, could be streamed and archived, and the

data that will be collected could be analyzed in order to study the different types of group behavior in collaborative composition and performance as well as the different tendencies in the interpretation of open scores. Whether it will be realized or not is a different question. In any case, the seeds have already been planted.

Appendix A

stuckJunk (segmented)

After analyzing what might be considered to be the "musical form" of the audio recording *stuckJunk*, I realized that it can be easily divided into 24 sections, referred to in *stuckJunk-v1* as the segments of the recording to which the rectangles forming the game's board correspond. The table on the next page provides the following information about the segments: a description of what is heard in each segment (for example, "moving junk, trying to close the drawer" is the description given to the first segment); the onset and duration of each segment (in milliseconds); and what the possible instructions that could be given to players for interpreting each segment are. This is how the segments are arranged on the board:

00	01	02	03	04
09	08	07	06	05
10	11	12	13	14
19	18	17	16	15
20	21	22	23	THE END

At the beginning of a game, the computer sets up the board by choosing a random instruction from the possible instructions for each segment. Any possible instruction may be chosen by the computer as long as it follows the following three rules: sJ may occur only once, either segment 04 or segment 09 must be J; and J, F, and D must occur at least once and at most three times. Accordingly, I occurs 8 to 16 times; J occurs 1 to 3 times; sJ occurs once; F occurs 1 to 3 times; D occurs 1 to 3 times; and P occurs 4 to 6 times.

	description	onset [ms]	duration [ms]	possible instructions
00	silence	0	4273	P
01	moving junk, trying to close the drawer	4273	102898	I, J, sJ, F, or D
02	moving junk, slow, soft	107171	31133	I, J, sJ, F, or D
03	moving junk	138304	23094	I, J, sJ, F, or D
04	moving junk, rough sound	161398	18957	I or J
05	rough sound, very soft	180355	28050	I or J
06	hit, quasi-silence	208405	7699	D or P
07	broken plastic cup solo, very soft	216104	16790	I or J
08	moving junk, trying to close the drawer, rather slow	232894	40478	I, J, sJ, F, or D
09	broken plastic cup solo	273372	29710	I or J
10	moving junk, trying to close the drawer, rather slow	303082	23507	I, J, sJ, F, or D
11	silence	326589	8011	P
12	taking junk out of the drawer, trying to close the drawer, rather slow	334600	25669	I, J, sJ, F, or D
13	silence	360269	8615	P
14	using a fork to reach the stuck junk, trying to close the drawer	368884	162126	I, sJ, F, or D
15	trying to close the drawer	531010	59690	I, sJ, F, or D
16	moving junk, noisy	590700	5713	I
17	trying to reach the fork, trying to close the drawer	596413	60769	I, sJ, F, or D
18	hitting the microphone	657182	7391	I or F
19	trying to reach the fork, trying to close the drawer	664573	42135	I, sJ, F, or D
20	using a fork to reach the stuck junk, trying to close the drawer	706708	65758	I, sJ, F, or D
21	moving junk, slow, quasi-silence	772466	16610	D or P
22	putting junk back in the drawer	789076	137017	I, J, F, or D
23	silence	926093	17419	P