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It worked yesterday: On (re-)performing electroacoustic music

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It worked yesterday

On (re-)performing electroacoustic music

A thesis submitted to the University of Huddersfield

in partial fulfilment of the requirements for

the degree of Doctor of Philosophy

Sebastian Berweck, August 2012

Abstract

Playing electroacoustic music raises a number of challenges for performers such as dealing with obsolete or malfunctioning technology and incomplete technical documentation. Together with the generally higher workload due to the additional technical requirements the time available for musical work is significantly reduced. Many of the issues have their roots in composers, publishers, performers and promoters considering how their work process could easily be adapted to the additional demands of electroacoustic music. It was also found that the employment of music technologists cannot sufficiently make up for incomplete documentation and inadequate archiving of compositions. Using case studies made up of single compositions and whole concerts, solutions are proposed, which the several parties could effortlessly employ to considerably ease the process of preparing and performing electroacoustic music. Finally hands-on methods on how performers can deal with the situation as it is today are proposed. It is being hoped that by implementing these strategies not only better performances of electroacoustic music will be facilitated but also that electroacoustic works in general will enjoy a longer life-span in the future, thus enabling the sustenance of a vivid electroacoustic repertoire.

'The computer software and hardware extend the sound check into a debugging session. The computer is rebooted again. Will it work this time?'

Miller Puckette and Zack Settel, 1993

'"Just before the concert everything was working perfectly" is a sentence I have often heard, a remark closely related to the "yesterday when I played it, it went so well" that I have heard even more often in the course of my teaching years.'

Catherine Vickers, 2011

Table of Contents

Table of Figures

1 Introduction

1.1 Motivation

The best possible performance of a musical work could arguably be called a faultless performance, where according to Herbert Henck, a fault is defined as 'any moment, where intention and doing fall apart'.[1] In a music performance, this does not only include manifest mistakes like wrong notes, but also ' a slight inhibition and tenseness',[2] since this condition and 'the uncomfortable emotion that goes along with it stands squarely in the way of musical expression'.[3] A good music performance – and this then holds true for a performance of music with electronics, too – is therefore much more than just a technically faultless performance and requires meticulous preparation. However, if the preparation of a performance of an acoustic concert is compared with that of an electroacoustic concert, fundamental differences are revealed – even though the musical ends will be the same.

The pianist who wants to prepare a programme of Beethoven sonatas will be able to buy several editions of the score. Having obtained the music, a trained musician is then able to practise independently for the concert. Arriving at the concert hall, a building likely built for the purpose of playing classical music, a freshly tuned grand piano is waiting. The acoustics of the concert hall and the piano will now be tried out and the pianist will make adaptations to the interpretation, for example by reducing the tempo in very reverberant rooms. For the remainder of the day the pianist will concentrate on the performance and should feel well prepared when the concert begins. This routine caters to the needs of a pianist so that the best possible performance can be produced.

The performer of an electroacoustic concert is likely to have a thoroughly different experience. In searching for information on a certain composition, the instrumentation of the piece is not clear: can the piece for piano and live-electronics be played alone or is it a duo? Has it been written for a specific occasion and thus cannot be played in a regular concert hall? Is the synthesizer a stock synthesizer or a self-programmed computer patch?

Obtaining the score from a composer or a publisher, the performer might find that the electronics are not part of the score and that another institution has a financial interest in it. The piece might also require devices that are not part of the performer's set-up and need to be bought or rented.

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[1] '*alle Momente, in denen Wollen und Tun auseinanderfallen*', Herbert Henck, *Experimentelle Pianistik* (Mainz: Schott, 1994), 105. Here and in every other occurrence foreign-language texts, except where noted, are translated by the author.

[2] '*nur [...] eine leichte Befangenheit und Verspannung*', Ibid.

[3] '*das ungute Gefühl, das ihn begleitet, steht dem musikalischen Ausdruck allemal im Wege*', Ibid.

Furthermore, it is unlikely that the electronics immediately work on the performer's computer because of the frequent changes in operating systems and programs. This requires updating the patches, which can be written in a large number of software languages used in the last three decades. The performer has to be knowledgeable in each of these languages or will again have to ask for help, which will probably bring yet another financial burden. Only then can the performer play the composition for the first time and decide if the piece suits the repertoire.

After the piece has become part of the repertoire the setting up of the concert hall, which is suited for acoustic music, poses more problems. The performer will have to bring all the electronics into the hall or will have to work with the technical team of the venue. Since a classically trained instrumentalist has likely not had any training on digital instruments and does not know how to convey technical information, the proposed set-up and the information might not suffice and the afternoon before the performance is a stressful set-up trying to get everything working for the concert. This setting up might commence right until the performance starts and a stressed performer will come on stage to play with an electronic instrument that has been constructed that very day and has not been tested. The evening performance has little chance to fulfil the above definition of a best possible performance; turning the weeks of preparation into a bitter experience the performer is likely to have no desire repeating.

As a performer of such music, I have encountered a number of solutions and opinions when discussing these experiences, for example in private conversations but also at public events:[4]

- The breakdown of the electronics is comparable to piano strings breaking.

- Electroacoustic compositions are never solo pieces.

- Performers need to learn coding.

- The electronics are just like a musician who can make mistakes.

- Just like a violinist needs a luthier, a performer of electroacoustic music needs a technician.

- Emulation of old computer systems will soon solve any problems stemming from obsolete hard- and software.

From the performer's view, these arguments are not very helpful for they do not relieve the performer of the above-described burdens. They also often do not hold up. If a piano string breaks, the pianist can simply transpose by an octave and finish playing the composition. The breaking of the electronics, however, will likely lead to the performance being aborted. The argument of the

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[4] For instance in the discussion following a lecture at the *Ambiant Creativity – Digital Creativity and Contemporary Music* conference at the ZKM Karlsruhe on March 17, 2011.

electronics making mistakes just as humans do does not hold up either: since mistakes in the electronics most likely result in a complete breakdown of the electronic part, faulty electronics should not be compared to a musician making a mistake but to a musician having to leave the stage during performance.

The immense additional efforts that go into the preparation of an electroacoustic concert – efforts that might not even lead to a successful performance – create confusion for the performer interested in producing such music as to how to approach this music. These experiences are not new and have been strikingly described by personalities as diverse as the programmer of Max and Pure Data Miller Puckette,[5] flutist Elizabeth McNutt,[6] and composer Karlheinz Stockhausen.[7] However, no comprehensive study has been conducted yet.

1.2 Research Questions

The research questions that arise from this situation are therefore:

   a) What are the challenges a performance of music with electronics has to overcome?

   b) Who is responsible for these challenges?

   c) How could these challenges be remedied?

   d) How can a performer deal with the current situation?

Chapter 2 will outline the methodology, which makes ample use of case studies. The case studies themselves can be found in chapter 3 on single pieces and chapter 4 on concert organisation, collectively trying to answer questions a) and b). Chapter 5 gives a summary on the findings in those two chapters and makes solution proposals, thus trying to give some answers to question c). Chapter 6 finally gives practical solutions for performers on how to deal with the situation as it is right now and thus responds to question d).

1.3 Definitions

In order to define the scope of this study some much-discussed terms need to be examined: *electroacoustic music*, *musical work*, *performance* and *interpreter*. It is patently beyond the scope of this study to try defining or even do justice to any one of these concepts. It is hoped, however, that

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[5] Miller Puckette and Zack Settel, "Nonobvious Roles for Electronics in Performance Enhancement," in *Proceedings of the International Computer Music Conference 1993* (presented at the International Computer Music Conference 1993, Tokyo: International Computer Music Association, 1993).

[6] Elizabeth McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," *Organised Sound* 8, no. 3 (2003): 297–304.

[7] Karlheinz Stockhausen and Jerome Kohl, "Electroacoustic Performance Practice," *Perspectives of New Music* 34, no. 1 (1996): 74–105.

with the description of these terms it 'will be possible to approach the subjects using some rough (but not inaccurate) approximations that will at the very least provide a basis'.[8]

1.3.1 Electroacoustic music / live-electronic music / interactive computer music

Electroacoustic music, *live-electronic music*, *performance-oriented computer music* and similar terms defy a clear definition to this day and the usage of the terms is fluid. This has its roots in the relative newness of the tools we use to make music and in the way we use these tools: whereas a home stereo user who uses a record player to play records will see a record player as a tool to play records, a DJ who uses a record player to create new music will see the record player as an instrument. This is different for example from a violin, where most people would readily agree that a violin is an instrument.

In this work, the definition of *electro-acoustic* music by Emmerson and Smalley in *Grove Music* does not apply since it describes electroacoustic music as music 'in which loudspeakers are the prime medium of transmission'[9] whereas many compositions in this study require a balance between the acoustic instrument and the loudspeakers. The definition by Arnold Whittall in the *Oxford Companion to Music* does not pose such restrictions. He defines *electroacoustic* music as

> music that puts electroacoustics, defined in Chambers Dictionary as 'the technology of converting acoustic energy into electrical energy and vice versa', to creative, artistic use. It is now the preferred term for music, which involves the combination of instrumental or vocal sounds with the electronic (often computer-assisted) manipulation of those sounds, or with sounds pre-recorded on tape.[10]

Both these definitions include acousmatic music, which is not the focus of this study, although the borders are certainly ambiguous. However, to put a stronger focus on the performer another definition is taken into consideration:

> Interactive computer music is a sub-genre of what might be called performance-oriented computer music – that is, any computer music that includes a strong performance component. This broader category requires at least one live performer joined with computer-generated or electronically produced or modified music. The genre thus

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[8] Guy E. Garnett, "The Aesthetics of Interactive Computer Music," *Computer Music Journal* 25, no. 1 (2001): 22.

[9] Simon Emmerson and Denis Smalley, "Electro-acoustic Music," *Grove Music Online* (Oxford Music Online, n.d.), accessed 30 April 2012, http://www.oxfordmusiconline.com/subscriber/article/grove/music/08695.

[10] Arnold Whittall, "Electroacoustic Music.," ed. Alison Latham, *Oxford Companion to Music*, n.d., accessed 30 April 2012.

incorporates both the traditional tape-plus-instrument medium [...] and more recent interactive computer music.[11]

The philosophical issues whether or not all music that includes a performer is interactive since skilled performers will necessarily react to their surroundings or whether the act of pressing the play button on a media player constitutes an interpretation (since the preceding choice of loudspeakers could be seen as such) do not play a prominent role in this study. The interested reader is for example referred to the discussions in *Living Electronic Music* by Simon Emmerson.[12]

1.3.2 Musical Work

The definition of a *musical work* at this place does not intend to give a universally applicable definition of a musical work or a composition but merely its usage in this study. Although works that were intended to be played by the composers only are mentioned in the discussion on instrumentation (chapter 5.2.3.1), the broad majority of the works cited follow a definition by David Brooke Wetzel which he calls the 'conservatory model'.[13] This is a model 'in which a musical work is treated as an historical object [to] be preserved, repeated, interpreted, and ultimately owned by the performers, audiences and musicologists who deem it important enough to perform, listen to, and discuss.'[14] It might be noted that this model with its described expropriation of the composer necessarily leads to a differentiation between composer and performer, in which the performer eventually becomes the interpreter of a work. This leads to a performance-centred situation with the 'ability to perform, study and re-interpret the same work over and over again, with different performances proposing different interpretations.'[15] The compositions in this study therefore do not subscribe to the 'change from the traditional structure of music relying on the poles of composer, improviser, performer, instrument, score, audience'[16] as described by Yolande Harris but instead stand in the more traditional composer/performer dichotomy.

1.3.3 Performance / Interpreter

The same 'conservatory model' applies to the performance and the interpreter. The works that are being discussed in this study require trained instrumentalists who possess a high level of skill on their instruments. The compositions also require the prolonged study of the work itself in order to arrive

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[11] Garnett, "The Aesthetics of Interactive Computer Music," 21.

[12] Simon Emmerson, *Living Electronic Music*, New ed. (Aldershot: Ashgate Pub Co, 2007), chap. 1–4.

[13] David Wetzel, "A Model for the Conservation of Interactive Electroacoustic Repertoire: Analysis, Reconstruction, and Performance in the Face of Technological Obsolescence," *Organised Sound* 11, no. 3 (2006): 273.

[14] Ibid.

[15] Nicola Bernardini and Alvise Vidolin, "Sustainable Live Electro-Acoustic Music," in *Proceedings of the Sound and Music Computing Conference '05* (presented at the Sound and Music Computing Conference '05, Salerno: Sound and Music Computing Conference, 2005).

[16] Yolande Harris, "Inside-out Instrument," *Contemporary Music Review* 25, no. 1–2 (2006): 152.

at a performance that fulfils both the technical and intellectual demands of an interpretation. These skills are essentially the same skills required by instrumental interpreters of classical Western music.

The performer of electronics also stands in a by now long-standing tradition and an early example of a player of such music would be the performer of radio and phonograph in John Cage's *Credo in Us*.[17] This tradition is ongoing and the player of many compositions for example by Alvin Lucier from the years 1965-1980 is not an instrumentalist but someone who realizes a score. A modern rendition of such a player could be the player of computer controllers or the laptop itself, although it seems that in the latter case creators and performers are often one and the same.

It is not possible to ascribe certain skills to such a *realizer*, since the requirements for each piece are different. To realize a composition like < by Alexander Grebtschenko,[18] where ten small loudspeakers are slowly roasted by a current greater than they were constructed for, the performer of the piece must know how to solder. In the composition *on_radio* by Scott Hewitt[19] the player must be able to program software. And in Alvin Lucier's *Music for Solo Performer*[20] the player famously has to learn how to produce alpha waves. But whatever the required skills may be, the player does not turn into a professional programmer, artisan, or mentalist but is somebody who produces music by following more or less detailed instructions by a composer.

This attitude toward producing music with electronics is very different from working as an instrumentalist within a team of sound engineers, computer programmers and technicians. These teams naturally demand much greater resources than can be provided by most promoters and none of the concerts in this study was played in the context of a research centre like IRCAM or the Experimentalstudio des Südwestrundfunks.[21]

Most instrumentalists will still perform most often in combination with their instrument[22] and in this study only pieces that include a keyboard instrument are being taken as case studies, due to the writer having been trained as a pianist and having performed only keyboard pieces over the course of this study. However, most problems described are not bound to any specific instrument but are relevant to any scores that make use of electronics.

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[17] John Cage, *Credo in US* (Frankfurt: C.F.Peters, 1962).
[18] Alexander Grebtschenko, < (Manuscript, 2003).
[19] Scott Hewitt, *on_radio* (Huddersfield, 2010).
[20] Alvin Lucier, *Music for Solo Performer* (Köln: MusikTexte, 2005).
[21] Formerly known as Experimentalstudio der Heinrich-Strobel-Stiftung des SWF.
[22] Cp. the performers named in Shai-uen Ding, "Developing a Rhythmic Performance Practice in Music for Piano and Tape," *Organised Sound* 11, no. 3 (2006): 255. See also the interviews with the performers (cp. 2.1.3 and the Appendix).

It must finally be noted that this thesis does not mainly deal with the production of premieres but with the practice of performers to build a repertoire from pieces past and present. The building of an electroacoustic repertoire is being endangered 'where technological obsolescence (or simply the rarity or relative complexity of the required system) becomes a barrier to this process'[23] and the 'diffusion of a musical work among performers (and therefore to audiences) may be hampered without due consideration of its musical merit, since issues of mere feasibility take precedence.'[24] Since the diffusion of musical works is also hampered if technical or organizational issues stand in the way, it is the aim of this thesis to analyse the process of the production of music with electronics from a performer's view.

1.4 Submission

The whole submission consists of

- this text

- a concert given at the University of Huddersfield

- a CD-ROM with interviews

1.5 Endpoints and Further Research

This study, although written from a holistic viewpoint, cannot possibly give an answer to all questions that arise from a topic that extends to the practices of other professions (music publishing, composing, promoting, and music technology) and touches fundamental issues of our culture like the archiving of digital data.

Since most of the issues are still shifting its only goal can be to hint at behaviours that are, from an interpreter's viewpoint, detrimental to the establishment of a repertoire of (live-)electronic works.

This is especially true to the following topics, which will require further research:

- How to organize the music business in a way that suits the re-recreation of electroacoustic music better?

- How to disperse the information from this text and studies that have been published in scientific journals on the topic into the community?

- How to find a common ground in electronic technology?

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[23] Wetzel, "A Model for the Conservation of Interactive Electroacoustic Repertoire: Analysis, Reconstruction, and Performance in the Face of Technological Obsolescence," 273.
[24] Ibid.

It is hoped, however, that this study lays some foundations from which the above topics can be engaged.

2 Methodology

2.1 Interviews

In preparation for this study, over 60 interviews with people involved in the production of music with electronics have been conducted. The interviews took place in Canada, the USA, Great Britain and Germany. They give a broad overview over the use of electronics in contemporary classical music.

Each interview took about one hour and was done in a one-on-one setting because talking about mishaps is inherently a delicate matter. The interviews were conducted in a semi-guided way, which means the interviewees had freedom to elaborate as long as a list of questions was answered. The questions asked are documented in the Appendix. The rough guideline would always be to let the interviewee introduce themselves and explain their work, what their education and training with electronic music was, their strategies to make electronics reliable and their view on what could be or has to be done to make concerts with live-electronics as reliable as concerts without any electronics.

Although most interviewees fulfil several roles, for instance being a composer and a performer or a promoter of a concert series, they are grouped below into one of the five stakeholder groups (cp. chapter 2.2.1) according to the area they were interviewed in.

2.1.1 Composers

The group of composers constitute the largest group of interviewees. It includes the pioneers of live-electronics Alvin Lucier, Richard Teitelbaum and Alcides Lanza as well as the now established middle generation like Ludger Brümmer, Josh Fineberg, Gilles Gobeil, Phil Kline, and Hans Tutschku to younger composers who have already been working for years with electronics like Nicolas Bernier, Johannes Kreidler and Martin Schüttler.

Nicolas Bernier, Montreal	Georg Hajdu, Hamburg
Annesley Black, Frankfurt	Robin Hoffmann, Frankfurt
Ludger Brümmer, Karlsruhe	Phil Kline, New York City
Gene Coleman, Philadelphia	Johannes Kreidler, Berlin
John Croft, London	Alcides Lanza, Toronto
Louis Dufort, Montreal	Chantale Laplante, Montreal
Josh Fineberg, Boston	Cort Lippe, Buffalo
Mike Frengel, Boston	Alvin Lucier, Middletown
Gilles Gobeil, Montreal	Maximilian Marcoll, Berlin

Damian Marhulets, Hannover	Hannes Seidl, Frankfurt
Katarina Miljkovic, Boston	Richard Teitelbaum, Annandale-on-Hudson
Adrian Moore, Sheffield	Hans Tutschku, Cambridge, Mass.
Martin Schüttler, Berlin	

2.1.2 Music Technology

As in all the groups, music technology includes people from different backgrounds: computer programmers, scholars, performers, computer scientists. Since many composers were already interviewed, some people generally known as composers have been interviewed in connection with their knowledge in music technology, too. The group includes trained sound engineers heading technology departments like the former Director of Stage Technology at EMPAC, Robert Bovard, as well as researchers on music technology like Jamie Bullock from Birmingham's Integra project, trained sound engineers like Sebastian Schottke of the ZKM Karlsruhe as well as experienced persons working in the field, although without formal training. It also includes Simon Emmerson as an eminent writer on the topic.

Robert Bovard, Troy	Richard McKenzie, Montreal
Jamie Bullock, Birmingham	Sebastian Schottke, Karlsruhe
Jef Chippewa, Berlin	Pierre Alexandre Tremblay, Huddersfield
Götz Dipper, Karlsruhe	Todd Vos, Troy
Simon Emmerson, Leicester	Ean White, Cambridge
Brad Garton, New York City	Stephan Buchberger, Frankfurt
Jonty Harrison, Birmingham	

2.1.3 Performers

Finding performers that actively engage in the usage of electronics was remarkably more difficult. A reason for this could be the relative absence of formal training classical instrumentalists can receive in performing with electronics[25] and the time and finances needed to specialize in this direction. The performers include seasoned performers of 'classical' music with electronics like violinist Mari Kimura, flutist Margaret Lancaster and pianist Ernst Surberg as well as performers of pop, jazz and experimental music like keyboardist Ruben Scheffler and guitarist Tim Brady.

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[25] The author knows of only two degree programs: the Computer Music Masters Degree in Performance at the Peabody Conservatory of the John Hopkins University, Baltimore and the Music, Technology and Performance program at De Montfort University Leicester.

Tim Brady, Montreal

Margaret Lancaster, New York City

Erik Drescher, Berlin

Xenia Pestova, Bangor

Jacques Drouin, Montreal

Ruben Scheffler, Hamburg

Jennifer Hymer, Hamburg

Ernst Surberg, Berlin

Mari Kimura, New York City

2.1.4 Promoters

The group of promoters include directors of world-renown electronic studios like Johannes Goebel of EMPAC as well as the (artistic) directors of festivals like the Huddersfield Contemporary Music Festival, Graham McKenzie, or Rainer Pöllmann of the Berlin Ultraschall festival. They also include curators like Micah Silver and the artistic manager of the Neue Vokalsolisten Stuttgart, Christine Fischer. Additionally, administrative workers like Martin Böckmann and Dominik Pahnke at ZKM or Mariko Steeb, responsible for project coordination at Ensemble Modern, are included.

Johannes Goebel, Troy (EMPAC)

Joachim Heintz, Hannover (Incontri)

Micah Silver, Troy (EMPAC)

Christine Fischer, Stuttgart (Neue Vokalsolisten)

Mariko Steeb, Frankfurt (Ensemble Modern)

Graham McKenzie, Huddersfield (HCMF)

Rainer Pöllmann, Berlin (Ultraschall/DeutschlandRadio Kultur)

Stefan Fricke, Frankfurt (Hessischer Rundfunk)

Martin Böckmann, Karlsruhe (ZKM)

Dominik Pahnke, Karlsruhe (ZKM)

2.1.5 Publishers

The group of publishers is naturally the smallest group. It includes the head of publishing at Boosey & Hawkes London James Eggleston, Thomas Trapp, responsible for sales and distribution at Breitkopf & Härtel, and the head of promotion at Ricordi München, Michael Zwenzner. It also includes the managing director of a substantially smaller publisher, Matthias Lehmann of Edition Juliane Klein, who nonetheless represents many composers who work with electronics. Finally Jean-François Denis of empreintes DIGITALes illuminates the perspective of a record label specialized in electroacoustic music.

Thomas Trapp, Wiesbaden (Breitkopf & Härtel)

Jean-François Denis, Montreal (empreintes DIGITALes)

James Eggleston, London (Boosey & Hawkes London)

Michael Zwenzner, München (Ricordi)

Rolf W. Stoll, Mainz (Schott Music)

Matthias Lehmann, Berlin (Edition Juliane Klein)

The interviews accumulated a huge amount of data that could easily form the basis for other researches. They were instrumental in defining the scope of the study and in finding suitable methods for research. Quotes from the interviews are being cited where appropriate and the full interviews are provided on an additional CD-ROM. They inform the entire theses and underpin the discussion at each stage. But since this study is the practice-based study of a performer, my own dealings with the subject are at the core of the text.

2.2 Scope of the Study

Since in the production of music with (live-)electronics

a. all involved parties are mostly professionals in their respective fields,

b. mishaps and failures are nonetheless common,

c. and malice, obstruction and sabotage are assumed not to be everyday occurrences,

it can be followed that the problems are of a structural nature in the way we organize these productions.

It must therefore be studied how the people involved in the process of producing music with electronics interact with each other and if the material that is being used is up to the task.

2.2.1 Starting Point, Aim, Material, Stakeholders

In the preparation of this study, it was noticed that the processes of producing and performing a new musical work or works using new technology could be defined as a project. A project, as defined by the Project Management Body of Knowledge (PMBOK),

> is a temporary endeavour undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. [...] Temporary does not generally apply to the product, service, or result created by the project; most projects are undertaken to create a lasting outcome. [...] Although repetitive elements may be present in some project deliverables, this repetition does not change the fundamental uniqueness of the project work.[26]

In order to define a project the starting point and the aim of the project, the material and the stakeholders must be named.

The objective of a performer is the performance of musical works, which necessarily includes a high ability on the instruments used and the practising of the compositions. It is likely that the professional work of a free-lance performer includes additional tasks, like commissioning new pieces, public relations and the acquisition of concerts. However, this work is not part of the core work of an instrumentalist and is often executed by an agency or the artistic administration of an institution. For

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[26] Project Management Institute, *Project Management Body of Knowledge (PMBOK Guide)*, 4th ed. (Newtown Square: Project Management Institute, 2008), 5.

this reason, the starting point can be defined as the time at which the material is being delivered for the performer to start working on with the aim of a performance of the work.

The material with which the performer works consists of the scores, the explanation to the scores, and the software and the hardware, which includes the electronic and analogue instruments.

The stakeholders then 'are persons or organizations (e.g. customers, sponsors, the performing organization, or the public), who are actively involved in the project or whose interests may be positively or negatively affected by the performance or completion of the project.'[27]

The scope of the stakeholders has to be limited though: although the workers in the printing works of a publisher are affected by the success of a performance in that only a successful publishing house will be able to employ them continually it would be unreasonable to include them in the stakeholder's list of the production of a musical piece with electronics. The same goes surprisingly for the audience, which is certainly affected but who are not actively involved in the making of the performance.[28] The scope of the stakeholders in this study is therefore reduced to the people with whom the performer is dealing directly, which in the process of producing music with live-electronics can be defined as:

- Composers

- Performers

- Music technology

- Publishers

- Promoters

Sometimes the work of a special software programmer is involved, which can be a single person or a larger institution like IRCAM or the Experimentalstudio des Südwestfunk. It must also be mentioned that oftentimes one person takes on several tasks, like the composer being composer, publisher and programmer in one.

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[27] Ibid., 27.

[28] This holds true also for concerts with audience participation, since the audience is generally being signalled (verbally and non-verbally) a corridor in which to behave.

2.2.2 Projects

On closer examination, it can be seen that there are actually two projects in which the performer is involved: the realization of the piece itself and the realization of a full concert programme of such music.
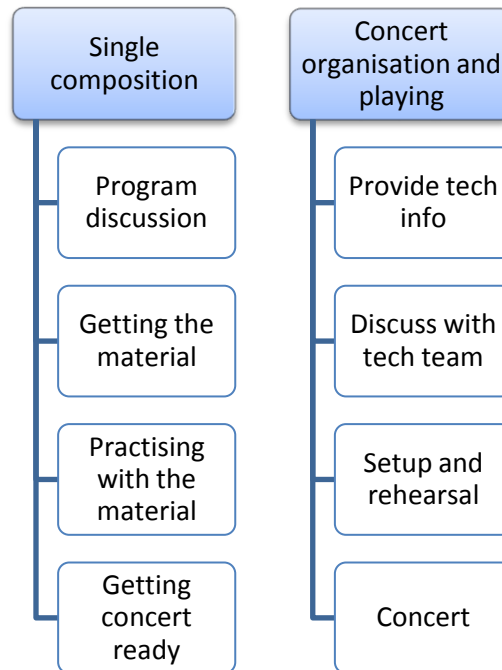
Figure 1: Workflow of an instrumentalist

Commonly the work on a piece will start after the performance of a specific composition was agreed upon with a promoter. Then the material is sent to the performer who then starts working on the piece. Working on the piece involves the actual practising of the score and finding a conclusive interpretation, but also practising the usage of the electronics. A piece ready to be played in a concert is therefore prepared with regards to technical, technological and interpretational issues.

Allotting the stakeholders to this process, we find in the realization of a single composition the performers and the people from whom they get the material to work with, which can include publishers, composers and programmers.

After the pieces that are being played in the concert are all set, the technical requirements are assessed and a tech sheet and other technical information is sent to the tech personnel. The requirements are then discussed and adapted, e.g. when a required technological device is not available at the venue.
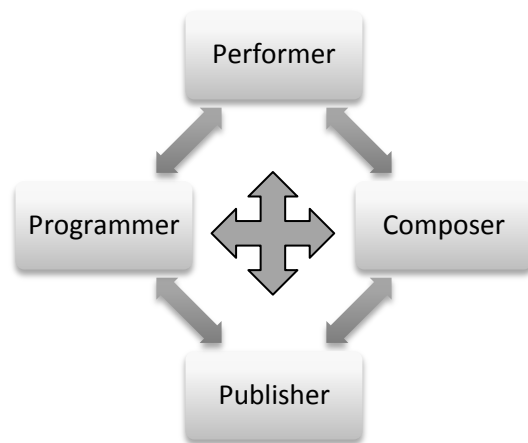
Figure 2: Stakeholders in the realization of a single composition

The second process thus starts from the performer having a concert ready version of the piece until the end of the concert. It could be argued that many more people are involved in the process, e.g. the lighting engineering and the facility management, with whom the performer often deals directly. This holds also true for the piano tuner. Since the problems that are being described in chapter 3 never included either the lighting or the tuner, they can be reduced to again the performer, the promoter, who takes care of the concert hall and its time organization, and the audio engineer(s), who help or are instrumental in the performance.
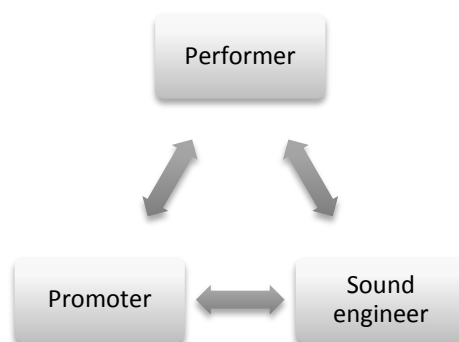
Figure 3: Stakeholders in the realization of a concert/production

The projects called 'Realization of single pieces' and 'Concert Organization' are discussed in chapters 3 and 4 respectively.

2.3 Methods

2.3.1 Method 1: Case studies

The production of music with live-electronics is a deeply collaborative matter. In order to find the structural problems in this collaboration the interaction between the people involved must be studied. A common research method to study the interaction between people is the case study.

The case study is a method that is 'an ideal methodology when a holistic, in-depth investigation is needed'[29] and 'excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research.'[30]

It is a method that emphasizes 'detailed contextual analysis of a limited number of events or conditions and their relationships.'[31]

Finally, case studies have been used by 'researchers [...] for many years across a variety of disciplines.'[32]

2.3.1.1 Typology

The main researchers on case studies are Robert K. Yin and Robert. E. Stakes, who give different typologies of case studies: 'Yin categorizes case studies as explanatory, exploratory, or descriptive. He also differentiates between single, holistic, and multiple-case studies.'[33]

Since the aim of this study is 'to describe an intervention or phenomenon and the real-life context in which it occurred'[34] it is *descriptive* following Yin's categorization.

Since the starting point of the study is that in producing music with electronics errors are general occurrences it would not be enough to study one single case. Therefore, each sub-chapter in chapter 4 and 5 is a case study in itself, which makes the study as a whole a *multiple case study* in Yin's terminology. Multiple case studies enable 'the researcher to explore differences within and between cases.'[35] The goal is then 'to replicate findings across cases.'[36]

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[29] Winston Tellis, "Application of a Case Study Methodology," n.d., accessed 15 March 2012, http://www.nova.edu/ssss/QR/QR3-3/tellis2.html.
[30] Susan K. Soy, "The Case Study as a Research Method," n.d., accessed 13 March 2012, http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm.
[31] Ibid.
[32] Ibid.
[33] Susan Jack and Pamela Baxter, "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers," *The Qualitative Report* 13, no. 4 (December 4, 2008): 547.
[34] Ibid., 548.
[35] Ibid.
[36] Ibid.

In his book *The Art of Case Study Research*[37] Robert E. Stake, on the other hand, uses three terms to describe case studies: intrinsic, instrumental, and collective.

> If you are interested in a unique situation according to Stake, conduct an intrinsic case study. This simply means that you have an intrinsic interest in the subject and you are aware that the results have limited transferability. If the intent were to gain insight and understanding of a particular situation or phenomenon, then Stake would suggest that you use an instrumental case study to gain understanding. This author also uses the term collective case study when more than one case is being examined.[38]

The type of the case study employed in this study is therefore either a *multiple descriptive case study* if we follow Yin or a *collective case study* using the terminology of Stake.

2.3.1.2 Presentation

There is no common approach on how case studies must be presented found in the literature. In fact, the following quotation by Bachor hints at differences in the scientific community on how to conduct and present a case study:

> This can be illustrated by contrasting and comparing some of the different methodological perspectives that can be incorporated into case study writing (e.g., Barrett, 1991; Bassey, 1999; Lincoln & Guba, 1985; Holstein & Gubrium, 1994; Kazdin, 1982; Spradley, 1979; Stake, 1995; Stenhouse, 1988; Strauss & Corbin, 1990; Yin, 1994). The debate in case study design and implementation can, for example, revolve around the degree to which evidence is presented and then interpreted versus deconstructed, integrated with head-notes, and presented.[39]

What seems to be clear though is that

> there is one fundamental requirement placed on a researcher when reporting case studies; that is, the onus on the researcher is to conduct the case study in such a way that the result can be communicated to the reader. There are several implications that follow from this assertion. First, the reader must be able to determine from the evidence presented the nature of the argument, and why and how conclusions were drawn. Second, the reader must be able to determine, without doubt, the evidential nature of the case as published. Stated

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[37] Robert E. Stake, *The Art of Case Study Research* (Thousand Oaks: Sage, 1995).

[38] Jack and Baxter, "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers," 550.

[39] Dan Bachor, "Reformating Reporting Methods for Case Studies" (presented at the Conference of the Australian Association for Research in Education 2000, Sydney: Australian Association for Research in Education, 2000).

differently, the reader should be able to determine, without the benefit of the writers' "head-notes" how the case was developed. Therefore, to reiterate, the evidence must follow convincingly and – when the purpose of the presented case is to move beyond description to explanation – should allow the reader to determine the basis upon which any generalization(s) are being advanced.[40]

In order to arrive at a credible and convincing presentation of the case studies the following order is applied in each case study in chapter 4:

    1) Condition of the material (score and electronics) upon delivery

    2) Genesis of the material / Assessment of the problems

    3) Working with the material

    4) Current state of the material

    5) Summary and Conclusion

Apart from eventual preliminary talks, the work of instrumentalists begins when the score and all relevant material are in their hands. Whether the material is downloaded or sent from a composer or a publishing house is irrelevant. What does matter though is the condition of the material and its usability on arrival.

After the appraisal of the material follows an assessment of problems, combined with an examination of the genesis of the material:

    • Who notated it?

    • Who programmed the electronics and with what hard- and software?

    • When were the electronics programmed and how is it archived?

    • Is an institution involved in the making of the electronics?

Not all of this is obvious at first glance and many of the above topics will only be found in the next step, which is to work with the material. Working with the material starts with setting up the electronics and trying to make them run. Since the focus of this study is not on matters such as how to practise the pieces or different interpretative approaches but technical problems that the performer will encounter playing music with live-electronics, the focus will be on what strategies

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[40] Ibid.

have to be employed to make the material ready for a concert performance. The case studies were each chosen to present different problematic aspects and therefore the solutions that needed to be found in order to bring the compositions into a state where they can be performed differ.

After the material has been worked on until all parties concerned agree that an endpoint has been reached the material is evaluated again. The work that had to go into the material from the point of delivery until its readiness for a concert (if that point was reached) forms then the basis of a summary and eventually a conclusion on the form the material should have taken from the start or where the performer was not up to the task to perform this music.

It must be accepted though that the problems are often part of larger societal topics like the archiving of digital data and the financing of cultural life and that it is not always possible to find simple, ready-made solutions for all the problems. Experience shows though that many small steps can easily be made to reduce the struggles. The summaries at the end of the chapters therefore not only shine a light on how things should be (from the perspective of a performer, that is) but also upon best-practice methods for how to deal with the situation as it is.

2.3.2 Method 2: Why-Because Analysis

Chapter 3 differs from chapter 4 since the work on the single pieces differs dramatically from each other depending on the material and the state of the material. Restoration methods and the learning curve regarding new technologies are different with every composition, and so is the cooperation with the composer. Therefore, learning a new piece also requires the development of a new strategy on how to achieve this goal. The concert organization on the other hand is more or less standardized, which is necessary because of the speed with which things have to be set up on the concert date and which can be seen in the technological questionnaires some venues and organizers send out.

The organizing of a concert can therefore be called a process, since it is 'a sequence of activities that can be repeated'[41] as opposed to a project, which was defined earlier.[42]

From a sociological perspective the cooperation between performers and composers are often on a personal level, since the two parties are dealing only indirectly on a business basis but are trying to realize a piece of art together. The relationship between an organizer and the performer on the other hand, although often being a relationship based on respect and friendship, is at its core a

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[41] Christian Zich, "IT-Kompaktkurs 'Organisation'" (Fachhochschule Deggendorf, 2000).
[42] Cp. chapter 2.2.1.

monetary one, which is shown in their relationship being set out in written contract with legal and financial obligations.[43]

Both factors change the perspective dramatically and a method that can deal with process-oriented operations and which is based on the given facts only must be employed. A method that is capable of doing so, that is easy to learn and where information and advice were readily available to the author[44] is the Why-Because Analysis, which was developed by the Networks and Distributed Systems research group at Bielefeld University.

2.3.2.1   What is it?

The Why-Because Analysis (WBA) is a deductive, top-down method aimed at finding the penultimate factor of why an incident happened. It was developed by Peter Ladkin at the University of Bielefeld and is 'a rigorous technique for causally analysing the behaviour of complex technical and socio-technical systems.'[45] Since 'it doesn't make any presumptions on the nature and structure of the technical or socio-technical background',[46] it can virtually be used in any domain. It is used a posteriori and its aim is maybe best described by citing the title of the first paper on the WBA, published by Peter Ladkin in 1996, 'The X-31 and A320 Warsaw Crashes: Whodunnit?'[47] In the context of this work, it will be used to find out why a concert failed.

2.3.2.2   Why using the WBA?

The strength of the WBA lies in the recognition of all relevant aspects and its connections as well as in finding out the penultimate reason(s) for a failure.[48] The preparation of a concert is a complex task that involves many different parties and their communication amongst each other. Finding out the first reasons why a concert failed is not an easy task since most of the time the involved parties do not discuss the reasons in a structured manner after the incident happened, if at all. The WBA is a rigorous tool that allows to find out the first reasons that led to the concert failing.

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[43] How monetary aspects fundamentally change relations between humans can only be mentioned here on a side note. A popular scientific introduction can be found in Dan Ariely, *Predictably Irrational: The Hidden Forces That Shape Our Decisions*, 1st ed. (HarperCollins, 2008).

[44] The writer is being trained and advised by Dr. Oliver Lemke, Berlin.

[45] Peter B. Ladkin, "AG RVS - The Why-Because Analysis Homepage," February 3, 2012, accessed 25 March 2012, http://www.rvs.uni-bielefeld.de/research/WBA/.

[46] AG Rechnernetze und Verteilte Systeme, "Why-Because Analysis" (Bielefeld University, n.d.), accessed 20 June 2012, http://rvs.uni-bielefeld.de/research/WBA/wba_on_one_page.pdf.

[47] Peter B. Ladkin, *The X-31 and A320 Warsaw Crashes: Whodunnit?* Research Report (Bielefeld: Bielefeld University - Faculty of Technology, 1996).

[48] The penultimate reasons are the reasons behind the incidents. If a concert is stalled because a computer program crashes, the WBA asks *why* the program has crashed. If the wrong type of microphone has been chosen for a concert, the WBA not only states this but also tries to find the reason, why those microphones have been chosen.

The WBA results in a graph depicting the causal reasons between the incident and the primal factors for the incident. This graph is called a Why-Because-Graph (WBG). The advantages of the WBA are:

- the determination and examination of causal interdependencies are supported through the strict logic within the WBA.

- the stringent conclusion of the WBG supports the critical review of the causal factors of the incident.

- the WBG makes it easy to see groups of causal factors and thus makes visible the general problematic area.

- the determined primary causes can lead directly to the identification of deficits in the technical systems, directives or the personnel.[49]

- the WBA is the only accident analysis method with a formal consistency/completeness check.[50]

2.3.2.3 How it works

1. A Why-Because Analysis starts with the gathering of information about an incident. Only accomplished facts, as opposed to hearsay or emotions, are used to construct a list of facts.

2. Then the Why-Because Graph is created by determining the mishap (the 'top node'). The definition of the top node determines scope and content of the WBA. Then the causal factors are determined using the list of facts until a chosen level of detail is reached.

3. To check the completeness and correctness of the WBG two tests, a *counterfactual completeness test*[51] and a *causal sufficiency test* are being conducted.[52] Combined they form the causal completeness test.

4. Eventually a report is written. The Why-Because Analysis consists of both the Why-Because Graph and the report.

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[49] Oliver Lemke, "Die Anwendung der Why-Because-Analyse zur Aufnahme, Untersuchung und Darstellung komplexer Unfallabläufe" (Diplom, Technische Universität Carolo-Wilhelmina zu Braunschweig, 2002), 12.
[50] Ladkin, "AG RVS - The Why-Because Analysis Homepage."
[51] The Counterfactual Completeness Test determines 'rigorously whether event A is a necessary causal factor in the occurrence of event B. [The] counterfactual test was formulated by the eminent logician David Lewis in 1973, formalising a criterion proposed in the 1770s by the great analyst of causality David Hume.' Cp. AG Rechnernetze und Verteilte Systeme, "Why-Because Analysis (WBA)" (Bielefeld University, n.d.), accessed 20 June 2012, http://rvs.uni-bielefeld.de/research/WBA/WBA-shortHistory.pdf.
[52] Thilo Paul-Stüve, "Performing a Why-Because-Analysis" (Bielefeld University, 2005).

A Why-Because Graph consists of knots and the links between them. A knot depicts, in the language of the WBA, a causal factor. It is itself or in connection with other knots the reason why something happened on a higher level: Is the occurrence of incident A the consequence of the occurrence of incident B, then A is the logical consequence of B. Or the reverse: if B hadn't happened, A wouldn't have been possible.

It is wrong to draw the conclusion that if A happened, B must have happened, too. B can indeed happen, without A necessarily happening. This is depicted by arrows showing the logical sequence.

Is the occurrence of incident A
the consequence of the occurrence of incident B,
then A is the logical consequence of B.
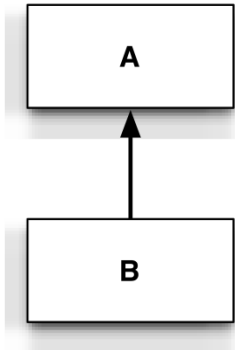
Figure 4: Causal Factors in a Why-Because Analysis

In most cases, no single occurrence will trigger another occurrence. If A is the logical consequence of B1, B2 and B3 then it must follow that A would not have occurred if only one of the factors B1, B2 and B3 had not happened. A is the result of an *AND*-connection between B1, B2 and B3. In relationship to the analysis of accidents; it is then clear that occurrence A is only

A is the result of a AND-composition of the occurrences B1 - B*n*

```
        ┌─────────┐
        │    A    │
        └─────────┘
          ↑   ↑   ↑
       ┌──┘   │   └──┐
┌────────┐ ┌────────┐ ┌────────┐
│   B1   │ │   B2   │ │   Bn   │
└────────┘ └────────┘ └────────┘
```
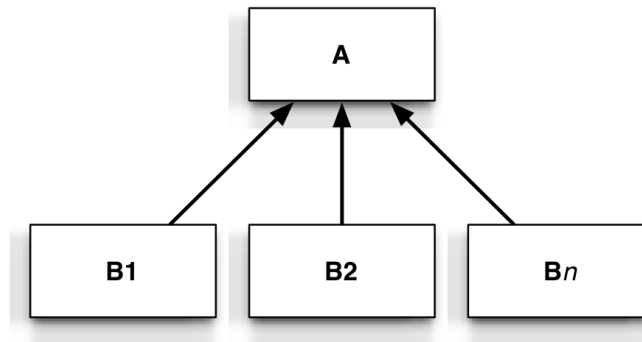
Figure 5: Why-Because Graph: More than one causal factor

completely explained when all factors that led to the occurrence are found.

Two nodes demand special attention: the top node and the primary cause.

TOP NODE

A Why-Because Graph starts with a single event, the top node. This is the mishap and can be described as the event that most directly caused the loss of resources, e.g. the pianist's nerves.

PRIMARY CAUSE

If for a causal factor no other factors can be found (it is thus the end of a WBG) this factor is the root factor and thus a primary cause. Root factors are usually indicated in WBG's, in this work they will be coloured green (if the primary cause is unproblematic) or red (if the primary cause links directly to the mishap).

As mentioned above, the Why-Because Analysis follows strict rules. Since a WBA is subject to human error, the obedience to the rules can be checked:

1. The Necessary Causal Factors are determined. They are then checked by applying the Counterfactual Test.

2. After drawing the Why-Because Graph, the Causal Completeness Test is applied.

It must be mentioned, though, that the WBA does not replace natural language. For this reason, a WBA consists of a graph and a report. In addition, the Why-Because Graph is only an aid in logical reasoning, it does not think by itself. However, it depicts information and its causalities at a glance which otherwise would be subject to possibly faulty interpretation of natural language.

The logic of the Why-Because Analysis and its tests are depicted in Figure 6.

The Why-Because Analysis is mostly used in major transport disasters like train accidents or jumbo jet crashes. Why-Because Graphs of a catastrophe of this scale usually amount to 60-90 nodes.[53] Since the *accidents* in this study are of a much smaller scale the method has been adapted and simplified. In particular, the different types of factors a knot can depict – state, process, event, and non-event – have been ignored in the graphs of this study.

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[53] AG Rechnernetze und Verteilte Systeme, "Why-Because Analysis (WBA)."

Why-Because-Analysis: Tests

Counterfactual Test (CT)

for A to happen

B is necessary

Criterion for determining a *Necessary Causal Factor (NCF)*:
If A had not happened, would B have happened anyway?
If not, then A is a Necessary Causal Factor of B.

Causal Sufficiency Criterion (CSC)

A must happen when all B happen

B1 **B2** **Bn**

A must happen if all of B happen.
If A does not happen, then at least one of B
has not happened either.

To put it the other way round:
A happens only when all B happen.
If one of the factors Bn does not happen,
then A also does not happen.

Causal Completeness Test (CCT)

A

Causal Sufficiency Criterion

B1 is NCF **B2 is NCF** **Bn is NCF**

Technical criterion for determining sufficiency
of causal explanation.
Actually a combination of the above:
a) Each A is a NCF of B and
b) Casual Suffifiency holds between the set
   of A and B.

Figure 6: WBA: The tests

2.4 Personal Involvement and Limits of Methodology

Since the author of the study is also participant in the case studies it is paramount for the credibility of the case studies that all involved parties in each case study read and agreed with the factual points made in the case studies. This does not mean that they necessarily agreed with the findings and I found myself sometimes in the same position Sigmund Freud recalls in *The Psychopathology of Everyday Life*:

> When I recently had the opportunity to carry forward some examples of name forgetting along with their analysis to a philosophically educated colleague, he hastened to say, 'That is very nice, but with me name forgetting works differently.' But this is taking the easy way out, I do not think my colleague had ever before thought of an analysis of forgetting names, and he could not say how it happens with him differently. However, his remark is still a problem that many will be inclined to put in the foreground. Does the here given explanation apply [...] generally?[54]

This issue, which is a fundamental aspect when conducting qualitative research, cannot be discussed away and the readers will have to decide for themselves if the findings in this study do apply to them. Since the ultimate findings are rooted in multiple case studies and many more cited compositions and concerts (cp. page 243), it is believed that the studies and the analyses make a more compelling point than the gut feeling that is commonly used to explain the situation, and it is further believed that the results can be generalized.

My role in the whole process is that of a performer and I am not taking on the role of a project manager to organize concerts. Likewise, I am not an archivist who keeps himself busy with methods of archiving. Here as well I am taking part in the process as somebody who has to deal and work with the material that is given to him, not archiving it. The methodologies described here are all coming from their special fields and are only used as methods to analyse the circumstances in which I, as a performer, am working.

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[54] Sigmund Freud, *Zur Psychopathologie des Alltagslebens Über Vergessen, Versprechen, Vergreifen, Aberglaube und Irrtum*, Kindle ed. (Seattle: Amazon, 2011).

3 Case Studies: Realization of single compositions

This chapter is on the preparation of single pieces for performances. It describes the process from getting the material until the piece is ready to be programmed in a concert. At this stage, there is no obligation to play the piece, as opposed to the chapter on concert organization, where the performer is contractually obliged to 'deliver' the pieces in the concert.

The material with which a performer works consists of the score, one or more patches and instructions, although not always all three are necessary or provided. Oftentimes the performer is required to own the software in order to run the patches. In these cases, the patches are saved configurations for these programs. At other times, the performer gets the software in the form of programs that work on their own. These are then called *stand-alones* or *executables*. Finally, the patches can be saved settings for a hardware instrument that need to be loaded into this instrument with an editor program or as MIDI SysEx.[55]

In conclusion, this means that there are unfortunately multiple meanings for words like *patch* or *interface,* which can mean anything from a computer keyboard to an audio soundcard. Since there are so many possibilities, the context determines what kind of data or device is actually meant.

If a hardware instrument is difficult to obtain the composers are often helpful to lend their own, but this is not possible with software instruments due to licencing issues. Generally speaking, it is the performer who has to organize the required soft- and hardware that is necessary to play the piece and then loads the provided settings into this soft- or hardware. For every task there is a multitude of software that can be used. Common professional sampling programs or programs that can make use of samples are e.g. Apple's Logic Pro,[56] Native Instruments' Kontakt,[57] Propellerhead's Reason,[58] and Avid's Structure.[59] Additionally there are vast amounts of lesser known, though no less professional and mighty programs like the Alchemy synthesizer by Camel Audio,[60] which are more used in the pop music domain. For this reason there is no official set of standard music software and it is naturally difficult for the performer to provide for all of these.

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[55] System exclusive (SysEx) messages consist of data that is not part of the MIDI protocol. This kind of message is convenient when e.g. a flute sound needs to be transferred from one synthesizer to another. Using a SysEx message, this non-MIDI information can conveniently be transferred between two machines of the same build using a MIDI cable.

[56] *Logic Pro* (Apple Inc., 2012).

[57] *Kontakt* (Native Instruments, 2011).

[58] *Reason* (Propellerhead, 2011).

[59] *Structure* (Avid, 2011).

[60] *Alchemy* (Camel Audio, 2011).

An interpreter expects the same completeness of material when playing with electronics as in purely acoustic music, such as a Beethoven piano sonata. It is expected that the material is in a condition where the interpreter – who is assumed a professional musician with some expertise in computers and electronic devices, but is in no way a computer programmer or a full-blown sound engineer – can readily start working.

This kind of expertise could be compared with the knowledge interpreters of classical music bring to the music they play. They know that a trill in a Bach suite needs to be played differently than that in a Beethoven sonata. A pianist knows that the technique for a piece by Liszt differs substantially from that of Scarlatti. They read books or attended master classes on Cage's prepared piano and they know that composers invented about five different ways to notate clusters. All this information is not actually written in the score, it is knowledge learned from teachers in private and at universities. Without going into details of what exactly an interpreter must know, how this information is conveyed and how this knowledge changes over time – discussions that are well beyond the scope of this study – it is understood that the writing of music in a score is never 'complete' and that extra knowledge is needed to be able to interpret it, without turning an instrumentalist into a musicologist.

Likewise is it understood that a certain kind of knowledge must be assumed from the interpreter of music with electronics. Examples for this would be the knowledge of how to load a patch, set up an audio or MIDI interface, and have a general knowledge about how things work, without turning a performer into a computer programmer. Some sort of *intermediate* knowledge has to do.

However, this study is not about the score or if the self-made computer scores by composers today compare favourably to the hand-written ones of Nono or even the set ones by publishers. It is also not a discussion as to where, how and to what extent the electronic part of a piece for instrument and electronics should be notated in the score. No doubt, the author would like to see instantly readable scores and much remains to be desired. However, writing about the visual differences between the computer score typesetting programs, which are often left unrevised by the authors, and *The Practice of the Note Graphic Designer* as described by Herbert Chlapik,[61] would fill several more volumes of this study.

The question rather is if the *additional* material that the interpreter receives attains the same standard as the scores for purely acoustic music. Whether this material is sent with the score, has to be downloaded, or comes on an extra CD-ROM sent by the composer is as irrelevant as is who

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[61] Herbert Chlapik, *Die Praxis des Notengraphikers: Wie entstehen unsere Noten?* (Doblinger, 1987). Chlapik was a teacher of note setting at Austrian publisher Doblinger.

actually provides the material: a publisher, the composer, a programmer, a studio for electronic music. It is purely the material that is looked at and assessed, how well it can be worked with.

However, not only the material is judged but also if performers, who are trained for the concert stage, are actually ready to deal with this material and know the relevant information. The findings can then ascertain whether the education of composers and performers is sufficient with regards to working with electronic music.

What is also investigated are the thresholds and interactions between the work of the composer, the publishers, the programmers and the interpreter, since the division of labour between the parties needs to be redefined with the advent of electronic music. For example, it is a completely different endeavour to write a score for a pianist or to program a new instrument and design its user interface for a performer. It is yet not clear who has to do what in this cooperation or if it actually constitutes a collaboration (cp. page 92 for a definition of the two processes). This becomes dangerous e.g. in cases where the composer and the performer expect each other to do a task and eventually find out that it has not been carried out at all.

Since it is in the nature of a case study that the outcome is not given at the onset of the study, the following cases have been selected from a range of possible other cases that were available. They have been selected for a variety of reasons:

- singularity or reproducibility

- the mode of man/machine interaction (pedals, controllers, monitors)

- the kind of instrument that is used (virtual instrument, hardware synthesizer, piano)

- the foreseeable problematic aspects

- the actual problematic aspects

- the solutions to these problems

It was also decided to choose composers of a wide variety and fame. It would not have been an accurate picture of the work of a common interpreter if only masterworks of accomplished composers with the support of a big studio for electronic music would have been chosen.

The single studies and the reasons why they were chosen as well as a short hint on the outcome are given here in order of the complexity of the electronic part:[62]

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[62] This order differs from the one employed in the upcoming chapters, in which the pieces are grouped thematically.

1. Luigi Nono: *...sofferte onde serene...* (1976) for piano and tape. This is the only composition using a fixed tape in this study. The piece is chosen for its significance and the handling of the material by the publisher.

2. Dodo Schielein: *N381* (2008) uses an extremely amplified piano. The discussion revolves around the threshold between the work of the interpreter and the composer as to how far the electronics must be researched and described.

3. Giacinto Scelsi: *Aitsi* (1974) for distorted piano. The negligent documentation and conflicting statements by the pianists working with the composer make it impossible to know today what the intentions of the composer were.

4. Richard Festinger: *Head over Heels* (1992) for keyboard, Max software and synthesizer. The obsolete hardware synthesizer as well as the programming code written for old operating systems posed rather unexpected difficulties as to the rebuilding of the piece.

5. Enno Poppe: *Arbeit* (2007) for virtual Hammond organ. The study focuses on the difficulties of non-defined responsibilities between programmer, publisher and interpreter as well as the general issues of writing for particular software.

6. Scott McLaughlin: *Dissolution* (2006/2010) and *Bifurcations in a Continuous System* (2011) employ a creative use of the Max/MSP software and revolve around the topic of cooperation and collaboration.

7. Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics is a piece in the tradition of IRCAM. It discusses the exemplary documentation and excellent programming of the piece, but also the disconnectedness between performer and computer in this kind of set-up.

8. Orm Finnendahl: *Wheel of Fortune* (1992-95/2011) for MIDI piano and live-electronics is an example for the complete fusion of the computer with the concert situation. The computer is *played* like an instrument and even prints out the music in real-time for the performer to play. Problematic issues are the cost of recoding old software, the coding on different platforms and the subsequent necessary bug fixing.

It is of importance to realize that the above case studies were chosen only on the grounds of the different electronics they use as well as the discussions that are triggered by using the material. Neither aesthetics nor personal issues are discussed. It is the aim of this chapter to give a broad but detailed overview on the many new discussion points that playing with live-electronics raise. Another important agenda of this research is to raise the awareness that electronics are not mere add-ons to the playing of an acoustic instrument but constitute a completely new field, which demands a reorganization of the workflow between the involved parties as well as a change in the curriculum in the education of musicians.

3.1 Giacinto Scelsi: Aitsi

Aitsi[63] is a composition *pour piano amplifié* by Giacinto Scelsi in 1974. It was transcribed by Riccardo Filippini and published by Salabert one year after his death in 1989. The composition poses extreme problems for a performer to realize a truthful rendition. These problems can only partly be attributed to Scelsi's particular style of composing by handing over recordings that are transcribed by a copyist under the attendance and verbal elucidation by Scelsi[64] because every score that includes a description of the electronics is a mix between a traditional score and a verbal description. The difficulties rather arise in the fact that the hints in the score are scarce and even misleading[65] and we have to fall back on often-conflicting statements by people who try to remember incidents that happened a long time ago.

To fully understand the dilemma we face today we have to discuss the creation of the score, the score itself, look at what the principal sources tell us and eventually see what other interpreters made of it. Finally, the different realizations of the electronics are discussed.

3.1.1 Creation of the score

Giacinto Scelsi's method of composing consisted of him playing on various instruments in his home and recording it on tape machines. In the case of *Aitsi,* his piano and a *Revox G36* transistor reel-to-reel tape recorder were used.[66] Werner Bärtschi, a pianist close to Scelsi, recounts:

> In Scelsi's apartment was an old grand piano whose damper pedal did not function correctly anymore. Especially the deep sounds disappeared only a little while after the release of the keys or the pedal. Thus, all the sounds always smeared into each other, just like the durations of the sounds or the pedal markings in Scelsi's scores for piano demand it. This characteristic of his piano informed the sound of his music.

> Scelsi's recordings, which he himself recorded on a Revox from the 1950s, are brilliantly played but sonically unsatisfying. The technical limits of his reel-to-reel tape recorder later inspired Scelsi to a very special composition. After a long period in which he didn't write anything on the piano he must have had, after he accidentally set the input level of a recording too high, the idea to use the thereby emerging sound distortions. Thus originated

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[63] Giacinto Scelsi, *Aitsi* (Paris: Editions Salabert, 1989).
[64] For a discussion of this division of labour cp. Friedrich Jaecker, "Der Dilettant und die Profis," *MusikTexte* 104 (February 2005): 27–40. For a summary of the ensuing discussion on authorship cp. Eric Drott, "Class, Ideology, and Il Caso Scelsi," *The Musical Quarterly* 89, no. 1 (2006): 80–120.
[65] As is the case in Luigi Nono's *...sofferte onde serene...*, cp. 3.2.
[66] Cp. Jaecker, "Der Dilettant und die Profis," 32.

'Aitsi' for distorted piano, where the piano is recorded with a too high input level and played with an amplification system.[67]

However, the tape that led to the notation of *Aitsi* and the *5th String Quartet* is not just a recording of an improvisation: The tape is *produced* and there are audible cuts on it.[68] This is in line with Riccardo Filippini's description of Scelsi's general method of working:

> Of course Giacinto knew how to use the Revox to produce overdubs, effects, echoes, delays and more. He literally created a recording for Ondiola[69] and Revox. [...] Giacinto gave me the tapes, we listened to them together and he explained to me in detail how he wanted them to be realized (he was extremely pedantic [...]), and little by little, as the transcription progressed, I showed him the score and we checked it.[70,71]

Sharon Kanach, who helped Scelsi in his later years to prepare the transcribed scores for publication, confirmed this scrupulousness: 'Scelsi, I can affirm you, knew his scores (written, transcribed) very well.'[72] That the score of *Aitsi* was also subject of this conscientious method is proven by the existence of at least two preliminary scores: one of them can be found in the Mikhashoff archives at the University of Buffalo and the other is in the possession of Werner Bärtschi.

All this stands squarely to the commonly heard notion that Scelsi simply recorded his improvisations,[73] as his long time scribe Vieri Tosatti wrote in his now infamous article *Giacinto Scelsi c'est moi* in Il Giornale della Musica and later reiterated in a letter to the same journal: 'Scelsi didn't

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[67] '*In Scelsis Wohnung stand ein alter Flügel, dessen Dämpfung nicht mehr richtig funktionierte. Vor allem die tiefen Töne verschwanden erst einige Zeit nach dem Aufheben der Taste oder des Pedals. So schmierte ständig alles ineinander, genau so, wie es die Tonlängen- und Pedalvorschriften in Scelsis Klavierwerken verlangen. Die Eigenart seines Flügels hatte den Klang seiner Musik geprägt.*
Scelsis Aufnahmen, die er selbst zuhause auf einem Revox aus den Fünfzigerjahren aufgenommen hat, sind hervorragend gespielt, aber klanglich unbefriedigend. Die technischen Grenzen seines Bandgeräts haben Scelsi später zu einem ganz besonderen Stück inspiriert. Nachdem er lange nichts mehr für Klavier geschrieben hatte, muss ihm, als er versehentlich eine Aufnahme zu hoch aussteuerte, die Idee gekommen sein, die dabei entstehenden Klangverzerrungen zu benützen. So entstand «Aitsi» für verzerrtes Klavier, wobei der Klavierklang mit zu hohem Pegel aufgenommen und verstärkt wiedergegeben wird.' Bärtschi in an e-mail correspondence with Jaecker in 2003, forwarded by Bärtschi to the author in December 2011.

[68] Jaecker in an e-mail correspondence with the author, December 2011.

[69] An Ondiola is a monophonic electronic music instrument capable of producing microtonal deviations. Scelsi used it often to produce his recordings.

[70] '*Natürlich verstand es Giacinto die Revox zu benutzen, um Überspielungen, Effekte, Echos, Verzögerungen und anderes zu erzeugen. Er schuf also ein Stück für Ondiola und Revox. [...] Giacinto gab mir die Bänder, wir hörten sie zusammen an, er erklärte mir genau, wie er sie realisiert haben wollte (er war extrem pedantisch [...]) und nach und nach, wie die Transkription voranging, legte ich ihm die Partitur vor und wir prüften zusammen das Ganze.*' Jaecker, "Der Dilettant und die Profis," 32.

[71] Here and in other Italian quotes by Jaecker: Original source in Italian and translated into German by Jaecker.

[72] Friedrich Jaecker, "Explodierende Asteroiden," *MusikTexte* 100 (2004): 65.

[73] Cp. e.g. 1) Riccardo Filippini, "Scelsis Stück mit den Gläsern," trans. Friedrich Jaecker, *MusikTexte* 105 (2005): 19–20. 2) Kerry Yong, "Performance Practices in Music for Piano with Electroacoustics" (PhD, Royal College of Music, 2007), 187–203., 3) Keumok Heo, "Quattro pezzi per orchestra (1959) von Giacinto Scelsi" (Diplom, Robert Schumann Hochschule Düsseldorf, n.d.).

know anything about music; and about his abilities to convey detailed information and instructions on the sound – I would have to write a big humorous article about it [...]'.[74]

As a conclusion, we can say that Scelsi's scores are not just transcriptions of his tapes but that Scelsi meticulously – as far as his abilities went – oversaw and corrected the creation of the scores. It is thus the score that is the final product and handed over to interpreters.[75] At the same time though the tape is still important since it must be decided on a case-by-case basis if the transcription of the tape served just as a copy of the tape or was the basis for further compositional elaboration – or anything in between the two.

3.1.2   The Score 1: Performance Notes

The edition of *Aitsi* consists of eight pages with one page being performance notes. It was published in either the year or the year after Scelsi's death[76] by Editions Salabert.

The performance notes are in French and English as opposed to Italian in the score. The score itself is notated in seconds and consists of 43 numbered events consisting of single notes to clusters. Unfortunately, the five sentences of the performance notes create immediate confusion on the reader's behalf. The performance notes are divided in two parts, which are given here:

Performance notes

- The pianist controls the duration of the resonance with the right pedal (vertical line)

 - Someone else controls the duration of the distortion by amplification

Alternative possibility

- The pianist does everything himself, controlling the distortion with a mechanism attached to the left foot.

- Use the half-pedal to obtain the effect of a disappearing note.

- For numbers two, three and four there are a few seconds of natural resonance; i.e. without pedal.

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[74] '*Scelsi verstand von Musik nicht einen Deut; und was seine Fähigkeiten zu genaueren Angaben und klangliche Vorschriften betrifft – ich müßte einen großen humoristischen Aufsatz darüber verfassen [...].'* Jaecker, "Der Dilettant und die Profis," 37.

[75] This would even go so far that Scelsi would refuse to attend rehearsals in 1986 and 1987 as recalled by Jürg Wyttenbach and Hans Zender, (Ibid.) but this could have also been a result of Scelsi already being in his early 80s. Franco Sciannameo, violinist of the *Quartetto di Nuova Musica* which premiered several string quartets by Scelsi, recalls very intense rehearsals in the 1960s (Franco Sciannameo, "The Birth of a Masterpiece," *Creare* no. 5 (2011).). Another proof for this view, albeit more anecdotally, is the change of his own description of the *Fifth String Quartet* from 'a place in space where you can hear asteroid explosions [*einen Ort im Weltraum, an dem Asteroiden-Explosionen gehört werden können]*' to 'a few sausage slices *[ein paar Scheiben Wurst]*' in 1985 (Jaecker, "Explodierende Asteroiden," 70.)

[76] Most sources on the web give 1989 as the year of publication but the edition itself has a copyright of 1988.

What are immediately confusing are the details for the alternative possibility: only the first sentence is referring to the technical part whereas the other information is again general information. The most likely solution to this is to assume that the page layout is wrong and the performance notes actually consist of four details, which read like this:

Performance notes

- The pianist controls the duration of the resonance with the right pedal (vertical line)

- Someone else controls the duration of the distortion by amplification *(Alternative possibility:* The pianist does everything himself, controlling the distortion with a mechanism attached to the left foot.)

- Use the half-pedal to obtain the effect of a disappearing note.

- For numbers two, three and four there are a few seconds of natural resonance; i.e. without pedal.

This makes much more sense and we can extract the following information as safe: the distortion (by amplification) must be controlled by either the pianist or a helping hand and the half-pedal is used for the 'effect' of notes 'disappearing'.

3.1.3 The Score 2: Risonanza / Riverbo / Distorsione

What remains unclear are the notes on the *resonance*, a term that is also mentioned in the score – albeit here in Italian and with the word *Riverbo* accompanying it.

3.1.3.1 Reading A

Under the time line (cp. Figure 7), we can see a small legend: a solid horizontal line with the denotation *Risonanza (Riverbo)*[77] and a dotted horizontal line marking the *Distorsione*. Since it says in the performance notes that 'The pianist controls the duration of the resonance with the right pedal' it looks like the solid horizontal line refers to the right pedal. Not only has the author played the piece like this for three years now but so also have Yong ('implies that the damper pedal is to be used for durations marked by a solid squared bracket in the score, signified by "risonanza (reverbero)"'),[78] Jaecker ('Above the system is a squared bracket with the denotation "risonanza (reverbo)", meaning resonance (reverberation), that, according to the performance notes is to be controlled with the

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[77] Kilian Schwoon, head of the electronic studio at the University of the Arts in Bremen, who worked for several years at the Centro Tempo Reale in Florence confirms that only *riverbo* is used to denote the right pedal of a piano and that *risonanza* and *riverbo* are not synonymous.

[78] Kerry Yong, "Electroacoustic Adaptation as a Mode of Survival: Arranging Giacinto Scelsi's Aitsi Pour Piano Amplifée," *Organised Sound* 11 (2006): 251.

right pedal')[79] and Vidolin ('According to Scelsi's introductory comments the resonance should be controlled by the pianist with the right pedal [...]').[80]

AITSI

pour piano amplifié

Giacinto SCELSI

Figure 7: Excerpt from *Aitsi* by Giacinto Scelsi[81]

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[79] '*Über dem Notensystem befindet sich eine eckige Klammer mit der Angabe "risonanza (riverbo)", also Resonanz (Nachhall), die den Spielanweisungen zufolge durch das rechte Klavierpedal zu regeln ist.*' Jaecker, "Explodierende Asteroiden," 66.

[80] '*Scelsis einführenden Bemerkungen zufolge soll der Nachklang vom Pianisten mit dem rechten Klavierpedal kontrolliert werden*' Alvise Vidolin, "Synthetische Resonanzen," trans. Harald Muenz, *MusikTexte* no. 81/82 (1999): 100.

But this reading is not consistent with the last performance note which reads that 'numbers two, three and four' are different from other events in that they are to be played partly 'without pedal'. Already event five would be a mistake then and in over a dozen other events, the line denoting *risonanza* is shorter than the duration of the event.

3.1.3.2   Reading B

It is remarkable that all four writers, who have worked on the piece extensively by interpreting and writing articles about it have been confused by the word *risonanza* in both the performance notes and the score and thus ignore what is expressly stated in brackets in the performance notes: that the length of the resonance is noted by a 'vertical line'. In a bold move, one could turn everything on its head and take another position: the French translation[82] reads, *Le trait droit*. This could mean a final line, a straight line or even a line on the right side. Together with the English translation, vertical line, it can be assumed that what is actually meant is indeed the vertical line at the end of the system. This line was mistakenly interpreted as a line denoting the end of an event, but since it is missing in number 15 in the printed edition by Salabert it is likely that the vertical line is indeed a sign for the damper pedal and that it is supposed to be changed before a new event with the exception of the beginning of number 16. This would also be consistent with the noted exceptions of events two to four, which show indeed yet another characteristic in that the resonance is depicted with several bows instead of only one large bow as in the other events. This then could be interpreted as delicate usage of the damper pedal to the degree that even 'a few seconds of natural resonance' can happen[83] and this notation can only be found in these three events.

If we accept this reading of the score we have on the one hand solved the inconsistencies in the reading of performance notes one and four, but we must wonder why the words 'natural resonance' are written expressly in the performance notes instead of moving the vertical line to an earlier point in the musical score. However, overall this new reading of

1. controlling the resonance with the right pedal

2. which is denoted by the vertical line at the end of a line

3. with the added information that the effect of a disappearing note is to be obtained by using the half-pedal

4. and three special instances where there is no pedal to be used

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[82] We do not know who translated the text or if it is the original text by Scelsi, who was fluent in French.
[83] It must be remembered that the events can also be sustained using the fingers only.

seems to be more consistent than reading A.

We must then accept that there is another instance of live-electronic treatment which is not mentioned in the performance notes and which is denoted by the solid horizontal line. This other *Risonanza* is then further elucidated by the word *Riverbo*.

3.1.3.3 Conclusion

Unfortunately, there are two striking arguments against this reading:

a) there is no mentioning of another electronic treatment other than 'distortion by amplification' in the performance notes.

b) a manuscript,[84] which obviously forms the basis of the Salabert edition, does not omit the vertical line at the end of number 15.[85]

Ultimately we have to come to the conclusion that neither of the two ways to read the score are satisfactorily consistent[86] and that, unless further sources can clear up the picture, we ultimately don't know whether the vertical lines mark the usage of the right pedal of the piano or hint at more live-electronic treatment.

This leads to a critical assessment of the score and it must be said that the edition of Scelsi's *Aitsi* can only be called careless. The work is listed as merely 'pour piano' on the French website of Salabert,[87] just as if it was a composition by Claude Debussy. On the German and English sites, even this misleading designation is missing and information about the piece literally consists of the name of the author and the name of composition. Inquiries to Salabert received no response, as repeated attempts by the author via the website of Durand Salabert Eschig show. Considering that Edition Salabert calls itself (and certainly is) 'one of the greatest cultural treasures of the French patrimony'[88] and is owned by 'the global leader in music publishing'[89] the amount of neglect is disquieting.

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[84] This manuscript was used by Bärtschi and was sent to me by Jaecker. This manuscript has no performance notes whatsoever.

[85] Curiously this manuscript is written on paper by *Casa musical G. Ricordi*. A note on top of the staves states that the duration of the piece is exactly 365(!) seconds.

[86] Using a reverbation unit and the pedal at the same time does not solve the problem.

[87] "Catalogue Ventes - Aitsi," n.d., accessed 27 September 2011, http://www.durand-salabert-eschig.com/fiche_vente.php?id=13410⟨=fr.

[88] "Salabert History," n.d., accessed 27 September 2011, http://www.durand-salabert-eschig.com/english/historique2.php.

[89] "Universal Music Publishing Classical," 2009, accessed 27 September 2011, http://umpgclassical.com/en/.

3.1.4 The main sources: Mikhashoff, Bärtschi, the original recordings

There are three renditions of *Aitsi* with the composer present: The first one is of course the tape as produced by Scelsi himself and the other two are by Werner Bärtschi and Yvar Mikhashoff – as far as is known the only pianists who played it for Scelsi.

Jaecker states convincingly that *Aitsi* was premiered in Copenhagen by Mikhashoff on Scelsi's 75th birthday on January 8, 1980 as the second piece of a composition called *Two pieces for Piano* (1979).[90] Under the name *Aitsi,* it was premiered on February 21, 1995 by Werner Bärtschi in Rome. Fondazione Isabelle Scelsi lists the *prima esecuzione* as 'Roma, 1980, pianoforte Yvar Mikhashoff'[91] and Sharon Kanach gives as 'Création' either '1980(?) [...] Yvar Mikhashoff ou [...] Rome, 1982 [...] Werner Bärstschi (?)[sic].'[92]

In an article published on the occasion of Scelsi's death in 1988 Mikhashoff wrote that he worked very closely with Scelsi for the premiere of *Aitsi.*[93] According to Jaecker, who found the Copenhagen recording in the archives of *Danmarks Radio*, the distortion in that recording is rather subtle. This corresponds to a recording at the Yvar Mikhashoff Archive at the University of Buffalo, to which I was able to listen for the first two and a half minutes.[94,95]

The recording by Werner Bärtschi,[96] on the other hand, features extreme distortion. Bärtschi came to this consequence by analyzing the process by which the piece came into being: As a result of an accidentally distorted recording of Scelsi's piano (see above). This means that the piano sound on the recording is actually masked by the distortion, something that cannot be achieved when a live piano is distorted because the undistorted piano sound will always be present (along with the distorted sound coming from the loudspeakers). This led Bärtschi to the conclusion that the piece can only be played with the amplification set very high in order to mask the undistorted piano sound as good as possible. Although Bärtschi played the piece in a concert with Scelsi present, he did not work on his interpretation of *Aitsi* with Scelsi directly. However, he must have talked with Scelsi about the piece

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[90] Jaecker, "Explodierende Asteroiden," 67.

[91] Fondazione Isabella Scelsi, "- Fondazione Isabella Scelsi - Le Opere," n.d., accessed 27 September 2011, http://www.scelsi.it/leopere/le_opere_copia(5).htm.

[92] Sharon Kanach, *Les anges sont ailleurs...* (Arles cedex: Actes Sud, 2006), 297.

[93] Mikhashoff himself died in 1993.

[94] "Yvar Mikhashoff Sound Recording Collection - Music Library - University at Buffalo Libraries," *University at Buffalo - Music Library*, n.d., accessed 14 February 2012, http://library.buffalo.edu/music/spcoll/ymaudio.html.

[95] Only the link to the webpage can be given here. The recording is on a tape reel and finding a reel machine, finding the means for the digitalization, digitising it as well as discussing the legal issues for allocating the recording to the author was not an easy task for the library and was only made possible through the constant efforts by librarian John Bewley over the course of nine months. This stands pars pro toto for many problems discussed in this study.

[96] Werner Bärtschi, *KlangKlavier* LP (RecRec Music, 1984).

since his score does not include any technical directions, which therefore must have come from Scelsi himself. Bärtschi maintains that, after having worked with Scelsi for so many years, he knows what Scelsi wanted[97] and the reasoning for his way to interpret the piece is sound.[98] Rumour has it though that Scelsi did not like this interpretation,[99] but this statement cannot be proven nor do we know if it refers to the concert in Rome (where Bärtschi has been playing this very loud interpretation) or to the recording. The recording is hailed by Yong as well as by user *truth and soul* in Google group rec.music.classical as 'most striking and convincing'[100] and 'brilliant',[101] albeit without giving specific reasons.

The original tapes, although digitized and catalogued[102] at the *Fondazione Isabella Scelsi* in Rome, are still not available for the general public.[103] Although they can only be seen as 'drafts'[104] and are omitted by musicologists,[105,106] they are indispensable for the interpreter to get an idea of what Scelsi wanted since the score obviously leaves many things unanswered. Friedrich Jaecker, who has heard the original recording at the Fondazione, recalls:

> The duration of the distortion on the tape with Scelsi's original improvisation is not easy to determine. A certain distortion can be heard; however, it hardly conforms to the notated durations. They seem to correspond rather on the beatings, which result from the inharmoniousness of the semitones.[107] – The decay of the cords, meaning the filtering of the remaining sounds on the other hand can clearly be tracked.[108]

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[97] W. Bärtschi, personal communication via telephone, November 29, 2011.

[98] In the same conversation Bärtschi favoured a much more intuitive approach to the piece and spoke out against counting the seconds, something Scelsi vigorously demanded.

[99] Jaecker citing an unknown source in a personal communication via e-mail, December 28, 2011.

[100] Yong, "Electroacoustic Adaptation as a Mode of Survival: Arranging Giacinto Scelsi's Aitsi Pour Piano Amplifée," 250.

[101] "Improv/noise/etc.cd Sale Updt A.14 - Rec.music.classical | Google Groups," 1994, accessed 14 February 2012,
http://groups.google.com/group/rec.music.classical/browse_thread/thread/d53e0b053afe8ff7/980d55c7c45d0a1a%3Fq%3D%2522G%25C3%25BCnter%2BSommer%2522%23980d55c7c45d0a1a&ei=iGwTS6eaOpW8Qpmqic0O&sa=t&ct=res&cd=15&source=groups&usg=AFQjCNFTGVH2BvJKbzBCDC67f4hWh.

[102] Volker Helbing, "Zyklizität und Drama(turgie) in Scelsis viertem Streichquartett," *Zeitschrift der Gesellschaft für Musiktheorie* 7, no. 3 (2010), accessed 23 December 2011,
http://www.gmth.de/zeitschrift/artikel/575.aspx.

[103] Yong, "Performance Practices in Music for Piano with Electroacoustics," 188.

[104] Helbing, "Zyklizität und Drama(turgie) in Scelsis viertem Streichquartett."

[105] Ibid.

[106] Johannes Menke, *PAX. Anaylse bei Giacinto Scelsi: Tre canti sacri und Konx-Om-Pax* (Hofheim: Wolke, 2004), 22.

[107] The beatings could also be a result of the bad shape the piano was in (cp. the description by Bärtschi above).

[108] '*Die Länge der Verzerrung ist auf dem Tonband mit Scelsis Originalimprovisation nicht so leicht zu bestimmen, jedenfalls hört sie nicht abrupt auf. Es ist eine gewisse Verzerrung zu hören, die allerdings kaum den notierten Dauern entspricht. Diese scheinen sich eher auf die Schwebungen zu beziehen, die durch die Reibungen der Halbtöne entstehen. - Das Verklingen der Akkorde, d. h. das Herausfiltern von „Restklängen" ist auf dem Tonband dagegen gut zu verfolgen.*' Jaecker, personal communication via e-mail, December 20, 2011.

In conclusion we must say that the versions by the pianists who have worked with Scelsi on *Aitsi* are wildly different: Bärtschi creating a very loud heavily distorted rendition and Mikhashoff employing the distortion in a rather subtle way. Mikhashoff's interpretation seems to be closer to the original tape by Scelsi but at the end of the day, we just do not know.

3.1.5   Other Interpretations

There are remarkably many recordings of *Aitsi*, some of which are discussed in Yong:[109],[110] Werner Bärtschi, Jacqueline Méfano,[111] Leon Michener,[112] but also Aki Takahashi,[113] who lists Michael Hynes and Steve Puntolillo as responsible for the electronics,[114] as well as Jean-Luc Fafchamps,[115] who lists André Stordeur for the 'additional distortion'.[116]

All these recordings read the rectangular appearance of the brackets in the score not as signs to turn the distortion on and off abruptly but employ the distortion as a declining effect. But to read the brackets as signs for an abrupt treatment is nonetheless common: Jaecker asks this question in his communication with Bärtschi (cp. footnote 67) and Yong discusses it in a paper on *Aitsi* and finds that this usage achieves 'questionable results'.[117] I myself, after discussing it at length with Kilian Schwoon at the electronic studio of the University of the Arts in Bremen, found this solution rather pleasing, as the abrupt changes would contrast nicely with the decaying sound of the piano and therefore played this version not only in Bremen, but also in other concerts in Hamburg, Hannover, Karlsruhe and Huddersfield.

3.1.6   Realizations of the electronics

As for the realization of the distortion, we have the details of four different versions we can compare: Bärtschi, Yong, an interpretation made by Alvise Vidolin for the Ex Novo Ensemble in Venice and that of myself.

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[109] Yong, "Electroacoustic Adaptation as a Mode of Survival: Arranging Giacinto Scelsi's Aitsi Pour Piano Amplifée."
[110] Yong, "Performance Practices in Music for Piano with Electroacoustics."
[111] ensemble 2e2m, *Chamber Music for Winds* CD (ADDA 581189, 1988).
[112] Leon Michener, *Imaginary Landscape* CD (future music recordings, 2003).
[113] Aki Takahashi, *Scelsi: The Piano Works 3* CD (Mode, 2006).
[114] "http://www.discogs.com/Giacinto-Scelsi-Aki-Takahashi-The-Piano-Works-3/release/968552," n.d., accessed 15 December 2011, http://www.discogs.com/Giacinto-Scelsi-Aki-Takahashi-The-Piano-Works-3/release/968552.
[115] Jean-Luc Fafchamps, *Tre Canti Popolari* CD (Sub Rosa, 1992).
[116] "http://www.discogs.com/Giacinto-Scelsi-Tre-Canti-Popolari/release/1862112," n.d., accessed 15 December 2011, view-source:http://www.discogs.com/Giacinto-Scelsi-Tre-Canti-Popolari/release/1862112.
[117] Yong, "Performance Practices in Music for Piano with Electroacoustics," 250.

3.1.6.1 Bärtschi / Berweck

Werner Bärtschi's approach is straightforward in using a contact microphone and a Mackie mixing console, where he then uses the filters and the distortion effect.[118]

My own interpretation made use of either a Max/MSP patch by Martin Schüttler for his composition *schöner leben 2 (Monument für T.H.)* or alternatively a patch I made using a Clavia Nord G2 synthesizer as effects unit, with which I had a wider array of possible distortion modules to adapt the distortion to the acoustics of the hall:
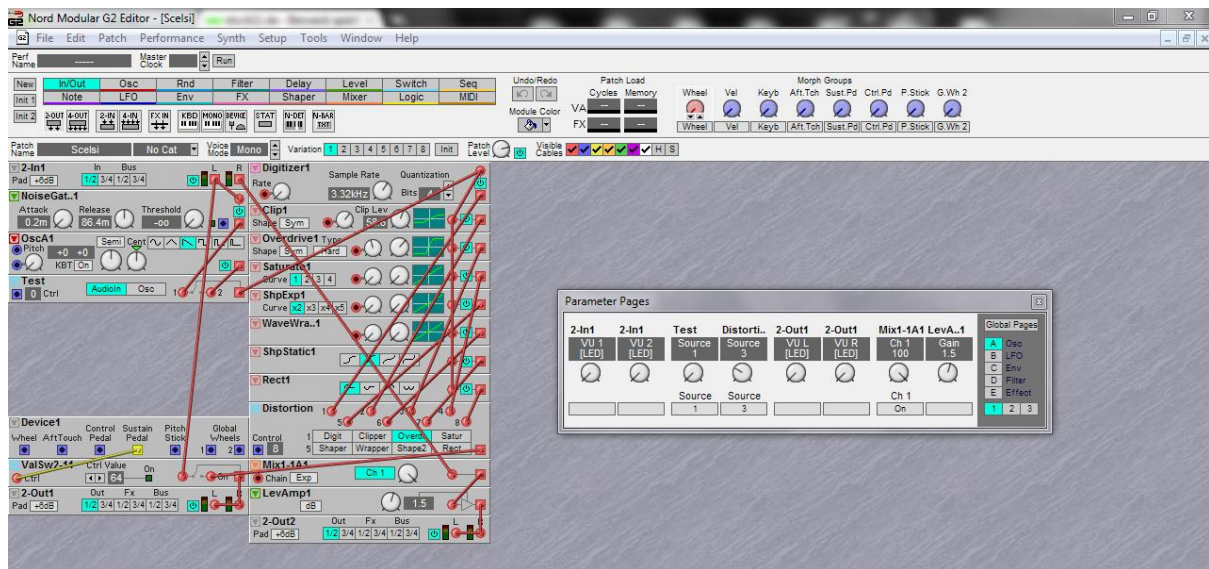
Figure 8: Patch for *Aitsi* for a Clavia Nord G2 synthesizer

The versions of the electronic part by Werner Bärtschi and me employ no treatment other than distortion.

3.1.6.2 Yong / Vidolin

Kerry Yong and Alvise Vidolin on the other hand see much more freedom in the realization of the score, albeit for different reasons: Kerry Yong sees *Aitsi* as only 'one rendition of a particular work'[119] and takes the *Fifth String Quartet*, which is based on the same tape as *Aitsi*, as guide to other ways

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[118] The settings by Bärtschi were sent by to the author in a private e-mail on December 27, 2011.
[119] Yong, "Performance Practices in Music for Piano with Electroacoustics," 199.

the piano sound can be altered. The automated version of the Max/MSP patch[120] he uses therefore employs a flanging effect to mimic the vibrato of the strings.

Alvise Vidolin, who also wrote the technical notes for *...sofferte onde serene...* (cp. chapter 3.2), came to yet another conclusion 'because the first aim of an interpreter must be to adhere to the musical intention of the work. This can also be achieved when, after giving deep thought, the technical instructions are transgressed, and by doing so an original artistic contribution is achieved.'[121] He therefore employs technical means which were not feasible at the time of the creation of the piece but of which he 'nonetheless believes, that they are in line with Scelsi's thinking and the spirit of the work.'[122] Vidolin takes the *riverbo* in the musical score literally and not only uses an additional reverb but also adds sine oscillators to enhance the 'natural, only subliminally recognizable colours'[123] of the decaying piano sound. The 32 additional sine tones are produced with the help of two Yamaha TX81Z synthesizers, which are controlled by a computer program. The first rendition of this set-up was played on December 15, 1988, four months after Scelsi's death, at the Diabolus in musica II festival in Venice with Aldo Orvieto on the piano.

3.1.6.3   Conclusion

It is out of the range of this study to evaluate if enhancements like these are indeed 'in line with Scelsi's thinking' and whether technical advancement and how much of it should be employed in the recreation of a musical composition.[124] These are indeed questions of interpretation but it is clear that the minimal instructions in the score of *Aitsi*, which only consist of the information to control 'the duration of the distortion by amplification' and possibly to do so with the means of 'a mechanism attached to the left foot'[125] leaves ample room for interpretations that are possibly not on par with the intentions of the work.

3.1.7   Summary

What we find in the case of Giacinto Scelsi's *Aitsi* is a composer who knew exactly what he wanted and who employed scribes to notate his ideas. Scelsi was meticulous in the realization of his ideas, which is proven by the various citations by his collaborators Tosatti, Vieri, Filippini and Kanach as well as musicians like Franco Sciannameo (cp. footnote 75). On the other hand, we have a misleading

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[120] Michael Oliva is given as the computer programmer.

[121] '*Denn erstes Ziel des Interpreten muß es sein, am musikalischen Gehalt des Werks festzuhalten. Das kann man auch erreichen, wenn man nach gründlicher Überlegung zwar die technischen Vorschriften des Autors verletzt, gleichzeitig aber einen ganz eigenständigen künstlerischen Beitrag leistet.*' Vidolin, "Synthetische Resonanzen," 100.

[122] '*trotzdem glaube, daß sie sich auf einer Linie mit Scelsis Denken und dem Geist der Werks befinden.*' Ibid.

[123] '*natürlichen, nur unterschwellig wahrnehmbaren Klangspiele*' Ibid., 101.

[124] Basically the same questions can be asked when trumpets with valves are being used when a modern day symphony orchestra plays works by Gustav Mahler.

[125] Scelsi, *Aitsi*.

score and the general notion that Scelsi merely recorded improvisations on the piano, which were then transcribed by copyists. This leads to interpretations that seem to stray far from the original intentions from the composer, like a quasi improvisational approach by Bärtschi[126] or taking extreme liberties in the realization of the electronic part like Yong and Vidolin do. The problem lies primarily in that we cannot know what Scelsi wanted having a score that is as incomplete as the one that we have. Scelsi's view of his role as composer ('*le compositeur n'existe que comme absent de son oeuvre*')[127] does not work when the work is not penned down as precisely as possible. In fact, it opens the door to speculation like that of Yong: 'It is not easy to ascertain whether his limited specifications are an oversight or deliberately vague and intended to encourage a certain degree of licence on the part of the performer(s)',[128] which is, as we now know, the opposite of what Scelsi intended. The recordings that we have by the two interpreters very close to Scelsi are as different as they can get and thus refute the sometimes heard argument that a recording can serve as a substitute for a clear and unambiguous description of the intentions of the piece.[129]

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[126] It is questionable if a listener would realize that *Aitsi* is exactly 365 seconds long if it was played exactly in time. It is nonetheless something that can hardly be ignored, as it is unlikely that the length of 365 seconds is just a coincidence.

[127] Kanach, *Les anges sont ailleurs...*, 12.

[128] Yong, "Performance Practices in Music for Piano with Electroacoustics," 189.

[129] Cp. Ludger Brümmer, "Interview with Ludger Brümmer" interview by Sebastian Berweck, Digital Recording, September 2, 2009., Martin Schüttler, "Interview with Martin Schüttler" interview by Sebastian Berweck, Digital Recording, December 3, 2010.; and chapter 5.2.1

3.2 Luigi Nono: ...sofferte onde serene...

...sofferte onde serene... (1976) for piano and tape by Luigi Nono[130],[131] famously came into being as a collaboration between the pianist Maurizio Pollini and the composer. It is the result of tape recordings of Pollini improvising on the piano under some guidance from the composer and the subsequent subtle electroacoustic treatment of the tape by the composer with the studio technician Marino Zuccheri. Starting with this material, Nono, in a nonlinear mode of operation would alternate between writing the score and working on the tape until the last corrections were made on the galley proof in early 1977.

3.2.1 Condition of the material upon delivery

The piece was published for the first time in 1977 with some technical annotations and a drawing of the set-up by Luigi Nono. A second edition was released in 1992,[132] this time with 'Technical Notes for the Sound Engineer' by Alvise Vidolin. This 1992 edition as well as a second circulation in 1997 includes a CD with the tape part, which previously was provided as a reel tape and could only be hired from the Casa Ricordi in Milan.[133] This is the material sent out as of today[134] by the publisher.

3.2.2 Assessment of the problems

A performer starting to learn the piece will certainly listen to the recording by Mauricio Pollini on Deutsche Grammophon[135] since this recording is of course the ultimate reference for any interpretation. What will appear odd then are the differences in the tape as provided by Ricordi and as can be heard in the recording:

1. the tape on the recording sounds much brighter

2. the timings differ from those in the score

3. the tape on the recording is clearly in stereo, as opposed to the mono tape on the CD that comes with the score

Moreover, a comparison between the two editions shows differences in the set-up. These four points are discussed below.

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[130] Luigi Nono, *...sofferte onde serene...*, 1st ed. (Milan: Edizione Ricordi, 1977).

[131] Paulo de Assis reports, that Luigi Nono consistently wrote five dots instead of three before the word *sofferte*. It is therefore possible that the title of the piece is actually '*.....sofferte onde serene...*' Cp. Paulo de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...* (Hofheim: Wolke, 2006), 173.

[132] Luigi Nono, *...sofferte onde serene...*, 2nd ed. (Milan: Edizione Ricordi, 1992).

[133] The works by Luigi Nono are only listed on the website of Casa Ricordi Milano. Nono does not appear on the websites of Ricordi München and Ricordi London.

[134] The first edition is out of print.

[135] Mauricio Pollini, *...sofferte onde serene...* LP (Deutsche Grammophon, 1979).

3.2.2.1 The tape on the recording sounds much brighter

The tape that is delivered alongside the score on a CD sounds strangely muffled, which was noticed not only by me but also by other sound engineers with whom I played the piece. It is also indirectly described by Yong[136] when he compares prominent recordings:

Mauricio Pollini:[137]

> Pollini's 1979 Deutsche Grammophon recording is an exemplary performance not only in the way in which the sound of the recorded and live (which is also studio) piano sound match and are mixed [...]

Kenneth Karlsson:[138]

> Unfortunately, the placement of microphones has meant that there is a very distinct difference between the live piano timbre (present and quite close) and the tape (quite distant and more dull in timbre).

Markus Hinterhäuser,[139] which uses the tape of the Experimentalstudio Freiburg (more on this tape see below):

> Its [...] sound is [...] slightly better than Karlsson's.

A hint for the dull sound can be found in the score, which reads: 'Digitally remastered by Pietro Pellegrini and Alvise Vidolin (1991) using No Noise by Sonic Solutions.'

Noise reduction is a difficult topic and many audiophiles despise it. Steve Hoffman, award winning mastering engineer at Audio Fidelity and DCC Compact Classics labels, says: 'Used gently, it still sounds terrible, and used improperly (what I call 'overused'), it sucks the very life out of the music, kills dynamics, makes everything sound false and weird [...]'[140] And user Billy Budapest on an internet forum named *Albums Ruined by Sonic Solutions' NoNOISE* compares an album without noise reduction to one with noise reduction as such: 'At the very least, the speakers don't sound like they have towels thrown over them.'[141] This comparison of the sound as being dull as if a 'wet-blanket'[142] is covering the loudspeakers is an apt description of what the CD by Ricordi sounds like.

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[136] Yong, "Performance Practices in Music for Piano with Electroacoustics," 218f.

[137] Pollini, *...sofferte onde serene...*

[138] Kenneth Karlsson, *...sofferte onde serene...* CD (Alberdo, 2000).

[139] Markus Hinterhäuser, *...sofferte onde serene...* CD (col legno, 1994).

[140] Steve Hoffman, "Lesson 4 on Echo/Reverb," n.d., accessed 23 February 2012, http://www.stevehoffman.tv/dhinterviews/HoffLesson5.htm.

[141] "Albums Ruined by Sonic Solutions' NoNOISE [Archive] - Page 11 - SH Forums," January 5, 2009, accessed 23 February 2012, http://www.stevehoffman.tv/forums/archive/index.php/t-120870-p-11.html.

[142] Jamie Tate, "[Archive] Page 11 Albums Ruined by Sonic Solutions' NoNOISE Music Corner," 2009, accessed 25 February 2012, http://www.stevehoffman.tv/forums/archive/index.php/t-120870-p-11.html.

That the treatment of the tape with a noise reduction algorithm is the origin of why the tape sounds the way it does is further backed by Vidolin, who recalls in 2008:

> After the death of the Venetian composer, Casa Ricordi [...] wanted to tidy up the tapes that are given out for rental for the musical performances. Towards the end of 1990 they commissioned a Milanese firm to do the analogue-digital dubbing and the audio restoration in order (for the tapes) to be played in the concert hall. I was instructed to follow this work as musical consultant. [...] The work was accomplished with one of the most powerful audio workstations at the time, a Sonic Studio, using the software NoNOISE that allowed excellent results in the field of audio restoration. [...] This work of dubbing and restoration had reached the intended purpose of ensuring a better quality of diffusion in the concert [...], but, given the limits of digital technology in those years, it is not particularly significant for conservation.[143]

The statements of 'excellent results' and 'not particularly significant for conservation' seem to collide but this is easily solved: the NoNOISE technology seemed to achieve brilliant results in 1991 but from the standpoint of today there are many more technological possibilities – or the insight, that no noise reduction technology is actually preferable to any such treatment. In other parts of the article Vidolin hints that 'going digital' was a 'must' in the early 1990s and that there was a certain pressure to use the new tools, which can be understood that he himself would agree today that the results of his dubbing work in those years are dubious.

This concealed acknowledgment by the audio engineer responsible for the dubbing and restoration that the tape sold by Ricordi today is audibly not in the best shape should suffice to explain why the tape on CD sounds as it does. It is then also obvious that some of Nono's remarks about Pollini's playing and what it is that he wanted to capture on the recording are hardly audible. The following is cited from the booklet of the Pollini Edition by Deutsche Grammophon:

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[143] '*Casa Ricordi [...] dopo la morte del compositore veneziano volle mettere ordine ai nastri magnetici che vengono dati a noleggio per le esecuzioni musicali. Verso la fine del 1990 commissionò ad una ditta di Milano il lavoro di riversamento da analogico a digitale e il restauro audio finalizzato alla diffusione in concerto. Fui incaricato di seguire come consulente musicale tale lavoro. [...] Il lavoro si realizzò con una delle workstation audio più potenti all'epoca, la Sonic Studio, utilizzando il software nonoise che consentiva ottimi risultati sul piano del restauro audio. [...] Questo lavoro di riversamento e restauro ha raggiunto lo scopo prefisso di garantire una migliore qualità della diffusione in concerto delle musiche elettroniche [...] ma, dati i limiti della tecnologia digitale di quegli anni, non risulta particolarmente significativo ai fini della conservazione.*' Alvise Vidolin, "I documenti sonori della musica elettronica," *Musica/Tecnologia* no. II (2008): 56ff.

"I was fascinated with Maurizio Pollini's technique", Nono explained: "not just his extraordinary way of playing but also with certain nuances of touch that can barely be perceived in the concert hall. With the aid of microphones, these unusual but barely noticeable details could be amplified and projected in a completely new dimension", thereby achieving, among other things, through electronic processing "a kind of timeless resonance".[144]

In defence of Vidolin, it must be said that the original tape appears to be very noisy. De Assis notes 'the bad sonic quality of the tape (with an unusual amount of noise)'[145] and it was certainly a difficult decision to choose between a noisy or a muffled tape. The latter version is provided on the CD by Ricordi, a noisy version of the tape still exists at the Experimentalstudio Freiburg and is used in its performances – e.g. in the recording with Markus Hinterhäuser described above. This tape, which was sent to the studio by Ricordi on behalf of Luigi Nono, is not manipulated and still 'contains the original noise, but with it also the original wealth of the sonic spectrum (especially in the bass and treble).'[146]

3.2.2.2 *The timings on the tape differ from those in the score*

The apparent inconsistencies in the timings in the score and on the CD are mentioned by Ding: 'The timing of each track may be slightly different'[147] but are not elaborated upon. They can be explained by differing playback speeds of reel tape players. This is confirmed by Vidolin:

Since the playback speed of the analogue tapes is not always constant and since the same tape has been subject to various playings and recordings to go from analogue quadraphonic to digital quadraphonic more than once we found small differences in duration, which we had to fix with various appropriate digital techniques.[148]

Since the timings in the score are in line with the original tape, they are not correct for the supplied CD. The timings differ between zero and two seconds, and they have to be corrected in the score. Since the beginnings of the different *riferimenti* (references) are easy to hear this should not pose a problem – it should nonetheless be noted in the technical notes.

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[144] Paolo Petazzi, "Maurizio Pollini Edition Insights," n.d., accessed 23 February 2012, http://www.deutschegrammophon.com/special/insighttext.htms?ID=pollini-edition&DETAIL=12.
[145] de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...*, 207.
[146] Ibid., 209.
[147] Ding, "Developing a Rhythmic Performance Practice in Music for Piano and Tape," 257.
[148] '*Dato che la velocità di scorrimento dei nastri analogici non è sempre costante e che lo stesso brano è stato soggetto a varie letture e registrazioni per passare da quadrifonico analogico a quadrifonico digitale, più di una volta si sono riscontrate piccole differenze di durata che abbiamo dovuto correggere con tecniche numeriche appropriate.*' Vidolin, "I documenti sonori della musica elettronica," 57f.

What is more confusing is the beginning of the tape, since the electronic part on the Ricordi CD only starts at about 0.65 seconds and it is not clear whether the piano part should commence at the beginning of the tape, right on the first chord from the tape, or even later. De Assis writes that 'Nono never wanted'[149] the tape and the pianist to start exactly in sync, albeit without supporting this claim. However, it is difficult to decide if the gap at the beginning of the tape was intended by Nono or if it is the unintentional result of carelessness in the copying process or even while producing the original tape.

3.2.2.3 *The tape provided with the score is mono*

The findings concerning the muffled sound and the timings still do not answer why the tape on the CD is monophonic. Vidolin, who both oversaw the analogue-digital dubbing of Luigi Nono's archive and the tapes at Ricordi, unfortunately does not say anything about this. Could it be that the stereo 'effect' on this tape is not so important after all? Paulo de Assis demonstrates a compellingly comprehensive analysis of the material and the formation of the final tape and score. Due to the importance of his findings, the essence is given here in its entirety:

> A rough description of the five parts of the tape show that the stereo parts are characterized by many pedal-, string- and piano corpus sounds as well as resonances without attack, whereas the mono parts feature concrete, acoustic piano sounds. This means: The sonic material of the mono parts can well be confounded with the live piano, whereas the material of the stereo parts could not be confounded with the live piano.

> The consequences of these circumstances on the level of <u>spatial</u> projection of the two tracks are very rich: In the stereo parts, the material is heard in a left-right distribution, in the mono parts the sound is coming from the exact centre between the two speakers. However, on this place on the stage stands the piano that is played by the soloist. In the stereo part the sound comes from three sources – from the live-piano, from the left speaker and from the right speaker; in the mono parts the sound comes from the two speakers but is perceived as if it

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[149] *'einen auf Zehntelsekunden genauen gemeinsamen Start [...] hat Nono jedoch nie gewollt'* de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...*, 249.

was coming from the centre of the stage, resulting in an 'utopian' amalgamation with the live-piano.'[150]

It is obvious that this effect of spreading and unity of the piano sounds is not possible with a mono tape. De Assis conclusion is therefore very negative:

> The tape on the CD of Deutsche Grammophon is clearly stereophonic and the allocation of the tracks correlates exactly to those of T 72.[151] This means that Nono composed a stereo tape that was later copied monophonically at Ricordi. The CD that is currently provided by Ricordi with the score for performance is therefore unusable. [...] Therefore – and even regardless of the extremely questionable execution of the manipulation of the sound with No Noise by Sonic Solutions – matches the Digital-Remaster provided [by Ricordi] not the tape that Nono produced and must be called unusable.[152]

De Assis blames Ricordi for having dubbed the tape monophonic, since both the tape at the Experimentalstudio Freiburg from 1988 as well as that on the CD are monophonic and were sent by Ricordi. Nevertheless, there could also be another explanation: Vidolin, as mentioned earlier, not only overlooked the dubbing process at Ricordi but also that of the personal archive of Luigi Nono. He says on those tapes that

> amongst them were one-inch four-track reels, including *Omaggio a Vedova, Ricorda cosa ti hanno fatto in Auschwitz, La fabbrica illuminata, A floresta é jovem e cheja de vida, Per Bastiana - Tai-Yang Cheng, Al gran sole carico d'amore, ...sofferte onde serene...*[153]

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[150] '*Eine grobe Beschreibung der fünf Teile dieses Bandes zeigt darüber hinaus, daß die Stereoteile von vielen Pedal-, Saiten- und anderen Klavierkorpus-Geräuschen sowie Resonanzen ohne den Anschlag charakterisiert sind, während die Monoteile konkrete, akustische Klavierklänge besitzen. Das heißt: Das Klangmaterial der Monoteile könnte mit dem Live-Klavier durchaus verwechselt werden, das Material der Stereoteile dagegen wäre mit dem Live-Klavier nicht verwechselbar.*
Die Konsequenzen dieser Tatsache auf der Ebene der <u>räumlichen</u> *Projektion der beiden Spuren sind sehr reich: Bei den Stereoteilen ist das Material in einer Links-Rechts Verteilung zu hören, bei den Monoteilen kommt der Klang aus der exakten Mitte zwischen den beiden Lautsprechern. An diesem Platz, auf der Bühne, steht aber das vom Solisten gespielte Live-Klavier. In den Stereoteilen kommt der Klang aus drei Quellen – vom Live-Klavier, vom linken sowie vom rechten Lautsprecher; in den Monoteilen kommt der Klang zwar aus den beiden Lautsprechern, wird aber so wahrgenommen, als ob er aus der Mitte der Bühne käme – es kommt zur "utopischen" Verschmelzung mit dem Live-Klavier.*' Ibid., 200.
[151] T 72 is one of the original tapes de Assis analysed at the Archivio Luigi Nono in Venice.
[152] '*Damit – und selbst ohne Berücksichtigung der äußerst fraglich durchgeführten Manipulierung des Klanges mit No Noise der Sonic Solutions – entspricht dieses überlieferte Digital-Remastering nicht dem Zuspielband, daß (sic!) Nono angefertigt hat und muß als unbrauchbar bezeichnet werden.*' de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...*, 209.
[153] '*fra questi c'erano anche diverse bobine a 4 tracce alte 1 pollice, da concerto: Omaggio a Vedova, Ricorda cosa ti hanno fatto in Auschwitz, La fabbrica illuminata, A floresta é jovem e cheja de vida, Per Bastiana - Tai-Yang Cheng, Al gran sole carico d'amore, ...sofferte onde serene...*' Vidolin, "I documenti sonori della musica elettronica," 54.

Of the work for Ricordi, he recalls:

> To carry out the best possible work it was of course decided to not use the tapes that have been given out as rented material [...] but rather the original tapes, or at least those that Casa Ricordi believed to be the originals, of which many were precisely the one inch quadraphonic tapes that came from the personal library of Luigi Nono.[154]

And exactly these quadraphonic tapes posed a problem because

> the Sonic Studio workstation had only one stereo converter so it was not possible to write the original quadraphonic tape directly into the computer. [...] In the case of the quadraphonic tracks the two separate stereo tracks were saved on two DAT tapes (1-2 and 3-4).[155]

Since the two tracks on the CD by Ricordi are not 100% monophonic (this would be the case if they would cancel themselves out if one was phase reversed) it might be possible that Ricordi overlooked the existence of a second DAT tape and used only one of the tapes to produce a CD that in essence has the same material on both tracks. However, no conclusion can be drawn here, since it is not clear why the stereo tape for *...sofferte onde serene...* was recorded on a four-track reel in the first place.

3.2.2.4 Different set-ups in the two editions

The first edition from 1977 included technical annotations by Luigi Nono, which were substituted by 'Technical Notes for the Sound Engineer' by Alvise Vidolin in the second (current) edition from 1992. The description of the set-up differs fundamentally: Nono has the tape machine on the left hand side of the pianist[156] and the sound broadcast by either two or four loudspeakers.[157] The 70 W speakers are located in pairs on the sides of the stage, with the piano offset towards the front. The speakers are placed in such a way, that the axes cross on stage, which means in front of the audience. This set-up works best with the above-described effect of the stereo- and mono parts uniting with the piano work.[158] No further intervention in the course of the tape, like changes in the volume and other things that would have to be done by engineers, is mentioned by Nono.

In the 'Technical Notes for the Sound Engineer' in the second edition, Alvise Vidolin writes about the effect of spreading and uniting the piano sounds with the tape and employs a set-up with two

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[154] '*Per realizzare al meglio il lavoro, ovviamente si decise di non utilizzare le copie date a noleggio [...] bensì di partire dai nastri originali, o per lo meno da quelli che Casa Ricordi riteneva essere gli originali, molti dei quali erano per l'appunto i nastri analogici quadrifonici ad un pollice che provenivano dalla nastroteca personale di Luigi Nono.*' Ibid., 57.

[155] '*la workstation Sonic Studio disponeva di un solo convertitore stereo e quindi non era possibile riversare direttamente su computer l'originale quadrifonico [...] Nel caso di brani quadrifonici si memorizzavano su un altro DAT anche le due coppie separate di tracce stereo (1-2 e 3-4)*' Ibid.

[156] Mauricio Pollini starts the tape himself in performances.

[157] Depending on the size of the hall.

[158] The information in this paragraph originates from de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...*, 244f.

speakers on the side of the stage with 400/500 W each and two smaller speakers with 250 W underneath the piano.[159] He asks the sound engineer to switch back and forth between the speakers, probably to mimic the effect of the lost stereo tape. Since no information is given *where* the sound from the mono tape should be played from the outer speakers and when from the one below the piano, but more importantly *why* this method is employed, such advice is indeed confusing and provides no help.

3.2.3 Current situation

Buyers of the current edition of *...sofferte onde serene...*, receiving the score, a CD claiming to be the 'Riproduzione del nastro magnetic originale'[160] and detailed instructions on how to set up and perform the piece will necessarily believe they have acquired a version of the piece that accurately reflects Nono's intentions. Indeed, a pianist will probably feel inclined to commence learning this enormously difficult piece, which is hard to read, understand and play, exactly because the edition looks so well thought-out and easy to set up.

3.2.3.1 *Erroneous interpretations resulting from the material*

That the edition is indeed full of errors has been sufficiently proven, but since nowhere in the score are any hints about the sound quality or the mono version of the tape the quality of the edition is taken for granted:

> The edition gives clear and adequate instructions for the electroacoustics and provides an up-to-date transfer of the magnetic tape in CD format.[161]

The reader of the score takes the score to be the result of Nono's work and the instructions of Vidolin ultimately as those of Nono:

> Nono asks that the volume of each of the speakers in the ensemble should be adjusted continually [...] Nono specifically asks to con-fondere the sound source of the live piano and the artificial tape, and his particular set-up for the loudspeakers achieves this ingeniously [...] He asks for two smaller speakers [...] and for two larger speakers [...][162,163]

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[159] The loudspeakers in this set-up have five times more power than the original set-up.

[160] *...sofferte onde serene...* CD (Milano: Ricordi, n.d.).

[161] Yong, "Performance Practices in Music for Piano with Electroacoustics," 211.

[162] Ibid., 217.

[163] These citations refer to the instructions by Vidolin in the second (1992) edition of the score. All three details (with the exception of *con-fondere*, which can only be achieved with the stereo tape) are wrong.

However, it is not the performer's fault:

> Concerning the interpreter at the piano: There are no directions to be found in the printed score. That some essential aspects cannot be automatically understood can be noticed in the many performances (even CD recordings) of the piece [...] Most performances on the other hand fail mainly because of deficient objective and factual information on behalf of the publisher.[164]

The reality is that performers today adhere to the text given in the 'Technical Notes' and that an intense interplay between the performer on stage and the sound engineer evolves, which is certainly welcome but in the case of *...sofferte onde serene...* will result in an arbitrary interpretation.

> Nono also asks that, at times, the sound diffusion be used to highlight separation and dialogue between the tape and the piano, which works particularly well at its loudest moments and requires generous amplification of the tape part.[165]

Only after the publication of de Assis' analysis in 2006, his proof that there must exist an original stereo tape and his damning verdict on the second edition of the score by Ricordi have things started to move again: the original tape has been found and is currently at Ricordi Milan. A new edition is bring planned, in collaboration with Paulo de Assis and Angelo Orcalli (Laboratorio Mirage - University of Udine-Gorizia), for the study, the digitalization and the digital restoration of the tape.[166]

As of today though, the work has not started and currently the tape from the CD has to be used.

3.2.3.2   *Intermediate solution: Sound*

Unfortunately, there is no way to undo the NoNOISE treatment applied by Alvise Vidolin in 1991. At this point, all that can be done is to change the tape even more by boosting the bass and the treble regions and using other effects to try to regain some clarity. The recording by Mauricio Pollini on Deutsche Grammophon is the reference to how the tape sounded, but any comparison between the recording and the tape provided with the score will make it clear that it is impossible to get close to the original sound. At least the tape will sound a bit brighter than it does on the Ricordi CD.

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[164] *'Was den Interpreten am Klavier betrifft, so sind auf der gedruckten Partitur keinerlei Hinweise zu finden. Daß einige wesentliche Aspekte zur Aufführung des Klavierparts jedoch nicht automatisch zu verstehen sind, ist an den vielen Aufführungen (sogar CD-Einspielungen) des Stückes zu spüren [...] Andererseits scheitern die meisten Aufführungen dieses Werkes hauptsächlich an mangelnder objektiver, sachlicher Information von Seiten des Herausgebers.'* de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...*, 252.

[165] Yong, "Performance Practices in Music for Piano with Electroacoustics," 217.

[166] This information was transferred in a private conversation by e-mail with Michael Zwenzner of Ricordi München on February 16, 2012.

3.2.3.3   Intermediate solution: Timings

Since the references to align the tape and the playing are easy to hear, only the timings in the score have to be changed to match the audio on the tape. These references and two more are described by Ding[167] and do not need to be repeated here. In case of doubt, it is again the recording on Deutsche Grammophon which one should turn to.

3.2.3.4   Intermediate solution: Set-up

It is clear now that Vidolin's set-up is an attempt to recreate a stereo effect from the mono tape. Since no indication is given as to where the tape should be played from the outer speakers and the ones under the piano, and since the power of the speakers as recommended by Vidolin is much higher than the original[168] it remains a futile attempt.

Having the reconstruction of where the tape is stereo, the production of a tape containing fake stereo parts is possible. This effect, which is often found in cheap home stereos and called 'Wide Stereo' or 'Super Stereo', can be achieved in many different ways, some of which are described on websites like that by Maningo.[169] Using the information by de Assis and the original recording at Deutsche Grammophon a slightly better tape with the stereo effect could be pre-produced or played 'live'.[170] This effect certainly does not turn the tape into the original stereo tape, and sounds that were originally only on one channel will still appear on both channels. As for the widening and closing of the audio field, it can nonetheless be useful. A patch by Roland Kuit turning a mono signal into a fake stereo is depicted below. I added a three-band equalizer to make up for the bad sound quality on the CD by Ricordi.

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[167] Ding, "Developing a Rhythmic Performance Practice in Music for Piano and Tape," 357.
[168] The tape part on the Pollini recording is noticeable, but all in all rather subtle
[169] Emerson Maningo, "Developing Wide Stereo Ambiance Sound in Your Recording," 2008, accessed 27 February 2012, http://www.audiorecording.me/developing-wide-stereo-ambiance-sound-in-your-recording.html.
[170] For a detailed description along with descriptive audio clips see Ben Vesco, "FX Tips - Delay: Extra Wide Stereo," 2008, accessed 27 December 2012, http://www.benvesco.com/blog/mixing/2008/fx-tips-wide-stereo/.
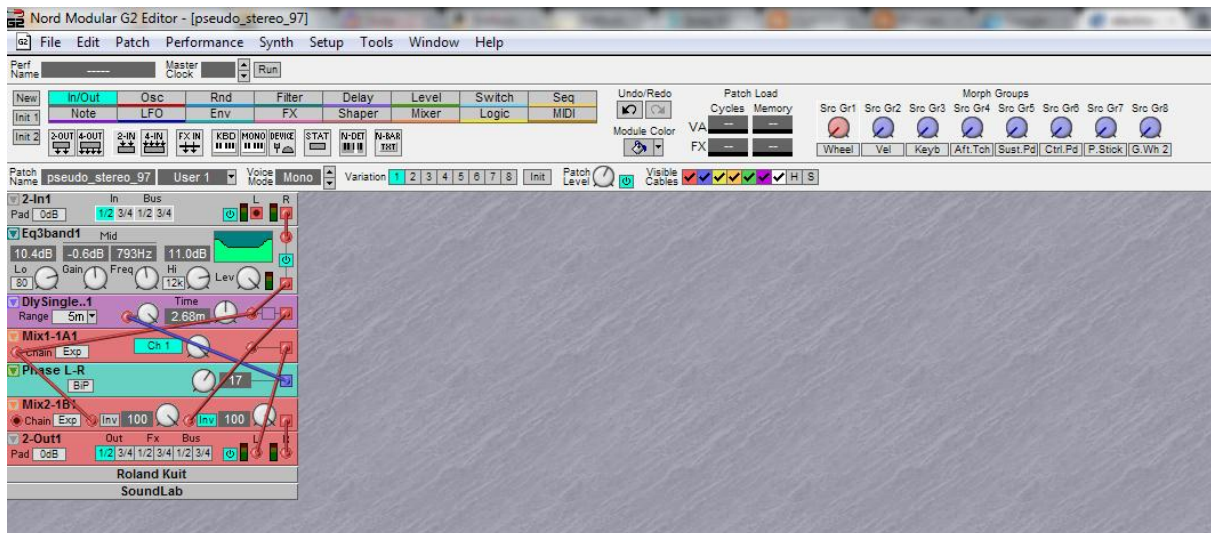
Figure 9: Patch for *...sofferte onde serene...* for a Clavia Nord G2 synthesizer.

3.2.4 Summary

The findings in this chapter are almost tragic:

- The eminent publishing house Ricordi[171] tries to publish a 'perfect' edition of *...sofferte onde serene...* in which a digitized version of the tape is part of the score[172] and commissions Alvise Vidolin, a close friend and collaborator of Nono's, for the work

- Vidolin finds a very noisy and possibly mono tape and starts reconstruction work with the means of the latest technology: a digital audio workstation with noise reduction algorithms

- Ricordi therefore gets back a muffled sounding CD and technical instructions that try to make up for the missing stereo tape

- Ricordi publishes an edition that appears to be complete and reliable but which is in fact misleading

- this edition is now used by pianists and the musicological community for over two decades, which unknowingly produces interpretations and performances of the piece that are far from those intended by the composer

Although the bad audio quality of the CD was noticed, it cannot be asked of the performer to do the kind of analysis de Assis performed: a book like this is a musicological work and it took many years to

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[171] Ricordi is part of Universal Music Publishing Classical, a global corporation which is 'giving music a universal perspective' (Universal Music Publishing Classical, 2009) and the same corporation that publishes the score of Scelsi's *Aitsi* (cp. chapter 3.1). It must be said though that the editions of *Aitsi* and *...sofferte onde serene...* were published before Ricordi and Salabert were taken over by Universal.

[172] As opposed to lending a reel tape, which not only eases the administrative process but which also deteriorates with every playing.

write it. It is also questionable if the performer has to read foreign language musicological books and articles – after all, there *is* an edition of the work by one of the leading publishers in the world.

In any case, the tape provided by the publisher is unsatisfactory and cannot serve a compelling interpretation. Being mono and with such bad audio quality it is questionable if the piece is served well if played with the current material. The intermediate solutions given only slightly better the current situation and it is indeed a hard decision that needs to be done by pianists and promoters alike if the piece should be played like it is or not.[173]

The Experimentalstudio Freiburg of course uses its own tape, but it is not available to the public. But releasing a hissing tape which is still mono would not make much sense either, since it needs to be 'played' by an expert, which in this case is the former head of the studio André Richard, who has long worked on this piece:[174] 'André Richard played the sound projection as if it were an instrument, sensitively responding to what Pollini was doing and showing that there's much more to this than simply playing a tape.'[175] It must be noted though, that such an elaborate set-up and an almost exclusive expert sound engineer to play his piece was never the intention by Nono: his set-up was as easy and pragmatic as possible.

Alvise Vidolin himself admitted that his work from the early 1990s is not 'particularly significant for conservation' (cp. footnote 143). De Assis' verdict on Vidolin therefore is damning:

> The content of Alvise Vidolin's text projects his own conceivabilities but not those of Nono. [...] A personal opinion [...] has become the pivotal direction on how to interpret the piece. Whoever is still trustingly buying the Ricordi score today must believe to have acquired the piece as it is meant to be. He will read and learn many things though that were never conceived by Nono.[176]

Unfortunately, it is this very score that forms the basis of almost every performance today.

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[173] In my own experience the piece is so strong, that it always made the biggest impression on the listeners even in this lesser set-up when the electronic part is cared for by a seasoned musician like Hans Tutschku or Hannes Seidl. In fact, it proved to be very effective even in the outdoor performance described in chapter 4.2 (cp. footnote 331)

[174] Information given in a private conversation by e-mail on February 2, 2012 by Wolfgang Motz, a pupil of Nono and Vidolin, and author of Wolfgang Motz, *Konstruktion und Ausdruck: Analytische Betrachtungen zu "Il canto sospeso" (1955/56) von Luigi Nono* (Saarbrücken: Pfau, 1996).

[175] Doundou Tchil, "Classical Iconoclast," 2008, accessed 27 February 2012, http://classical-iconoclast.blogspot.com/2008/05/nono-sofferte-onde-serenepollini.html.

[176] de Assis, *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...*, 251.

3.3 Richard Festinger: Head over Heels

Head over Heels[177] is a composition by Richard Festinger from 1992. Festinger teaches music theory and composition and has directed the electronic music studio at San Francisco State University since 1992. He is also a research affiliate of the Center for Computer Research in Music and Acoustics at Stanford University.

Head over Heels is described as 'for MIDI keyboard, Macintosh computer and synthesizer'.[178] After an initial inquiry the composer sent a bound book with the score followed by a CD-ROM about a month .

3.3.1 Condition of the material (score and electronics) upon delivery

The bound book does not contain information other than the score. The CD-ROM contains a patch for Max/MSP,[179] which must have been an update of the original Max[180] patch that was used in the premiere in 1992.[181,182] It also contains a readme document in rich text format from 1995, which a current version of Microsoft Word would not open , but which can easily be opened with a lesser program,[183] albeit with a few added arbitrary symbols to the text. The readme document contains very valuable information on the interaction between keyboard and synthesizer, on the mixing and for the keyboardist. It also made clear that the synthesizer mentioned in the instrumentation is a Yamaha TG-77 synthesizer, a rack version of the Yamaha SY-77, which was in production from 1989 until about the mid-90s.[184]

With the information I extracted from the score, the patch, and the readme, I still did not exactly know how to set up the piece. This difficulty was boosted by the fact that the Yamaha TG/SY synthesizer series is an obsolete piece of electronics by now and hard to come by. Setting up a preliminary rehearsal situation with the patch controlling a different synthesizer did not work since the patch, running from within my version of Max/MSP, would not send any MIDI data. It was therefore necessary to contact the composer to find out more about the origins of the piece.

3.3.2 First assessment of the problem

The discussion on how to replicate the piece started about four months before the planned performance in March 2011, which seemed to be ample time to reproduce a composition with a

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[177] Richard Festinger, *Head over Heels* (Manuscript, 1992).
[178] Richard Festinger, "Solo Instrumental Works," n.d., accessed 9 August 2011, http://www.rafestinger.com/Cat%20Solo%20Works.html.
[179] *Max/MSP* (Cycling '74, 2012).
[180] *Max* (Opcode Systems, Inc., n.d.).
[181] Commissioned by *Earplay* the composition was premiered by pianist Karen Rosenak on October 23, 1992.
[182] It must be an update since MSP only was marketed in 1997.
[183] Microsoft *Notepad.*
[184] Matt Friedman, "Yamaha SY-77 | Vintage Synth Explorer," n.d., accessed 8 October 2011, http://www.vintagesynth.com/yamaha/sy77.php.

technical set-up of a MIDI master keyboard controlling a Max/MSP patch, which then controls an external sound generator.

Initially it seemed that two problems had to be solved to make the piece work again: *Head over Heels* had not been played for a few years and both software and hardware had not been updated. This concerned the sound generating device, the above-mentioned Yamaha synthesizer, and the software controlling the synthesizer, which was a patch for an early version of Max/MSP.[185]

As for the sounds of the synthesizer, the composer is not adamant that this very machine must be used: '[...] the sounds themselves are not so critical, as long as they have the same general characteristics as the original ones.'[186] A possible solution is to use another stock synthesizer or software capable of producing similar sounds. Since no recording of the composition can be heard on CDs or the composers' website and since I never heard the piece this option wasn't followed through.

The patch for Max/MSP controlling the synthesizer was still on the original 5.25-inch floppy disks from the 1990s. Having data on floppy disks poses a problem in itself since floppy disk drives, especially the 5.25-inch version, are obsolete today. With this comes the problem of data deterioration on the disk or the disk itself breaking. It was therefore good news that it was still possible to extract the data from the old carrier and copy it onto a new one in late 2010. Richard Festinger then successfully opened the patch: 'My copy of Max/MSP (which is version 4.07 I think) opened the main patch just fine, though I didn't attempt to run it – there's no reason it shouldn't work, though.'[187]

3.3.3 Working with the material

It would seem that having found the old hardware and having a working patch the piece is ready to go. However, it proved to be only the tip of the iceberg because of the many dependencies between soft- and hardware.

First, having the synthesizer is not equivalent to having the sounds it is supposed to play. The sounds of the synthesizer, which were programmed by the composer, are stored in a file for a program used

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[185] Using the Max part of the program only.
[186] Festinger, personal communication by e-mail, December 29, 2010.
[187] Ibid.

to edit the synthesizer. This editing program for synthesizers called Galaxy Editor[188], by the now defunct firm Opcode, was only for Mac OS 9 and is copyrighted proprietary software.[189,190,191]

Using this program and uploading the patch to the synthesizer would require:

- finding the program, which was distributed on floppy disk drives
- finding the serial number for the program[192]
- finding a floppy disk drive
- finding a driver for the floppy disk drive
- finding a Macintosh Computer with OS 9
- finding a MIDI interface working with the computer
- finding a driver for the MIDI interface

Luckily, another solution was found by saving the complete data from Richard Festinger's synthesizer in California and uploading it into the machine in England. This MIDI dump could only be performed because the original patches were still loaded in Richard Festinger's own TG-77.

The Max/MSP patch from 1992, which would open seamlessly on the composer's computer, refused to send out MIDI data on my own computer. A search for eventual bugs in the patch, the set-up and the drivers began and, due to the disbelief of the composer that the old patch would not run on newer machines, many hours of testing several patches took place. Since Mr. Festinger ran older hard- and software than I did, patches that would work on his machine would not work on my machine.[193] This process was slowed down severely by us living in different cities and the exchange of patches and information took place via Skype and e-mail and on different computer platforms (Apple OS 9, Apple OS X, Windows 7). Exchanging files between the platforms sometimes changed the file headers, which also happened sending the files via certain e-mail providers and via Skype. This made the files unusable.

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[188] *Galaxy Editor* (Opcode Systems, Inc., n.d.).
[189] MIDI Classics, "OBSOLETE - Opcode Galaxy Plus Editors," n.d., accessed 8 November 2011, http://www.midi-classics.com/p9524.htm.
[190] This is not to say that using open source software from the mid-1990s would make it any easier. Only the copyright problem would be solved, but none of the technical difficulties.
[191] The patches for *DW 16 Songbook 1* by Bernhard Lang (Bernhard Lang, *DW 16 Songbook I* (Manuscript, 2005).), which uses the same synthesizer, are stored as patches for another editor, the Emagic Sounddiver (*SoundDiver* (Emagic, 2001).). Emagic, which also produced the sequencer program Notator (*Notator* Atari (Emagic, 2002).) which is needed in Karlheinz Stockhausen's *Oktophonie* (Karlheinz Stockhausen, *Oktophonie* (Kürten: Stockhausen Verlag, 1990).)(cp. Bernardini and Vidolin, "Sustainable Live Electro-Acoustic Music."), immediately stopped support for both programs after having been bought by Apple in 2002. The two widely used programs are now obsolete as well.
[192] Or whatever copy protection is used.
[193] The composer used OS 9 and Max/MSP 4 whereas I had an OS X computer running Max/MSP 5.

After finally realizing that the differences between the systems were much more fundamental than expected and that the Max/MSP patch could not simply be patched but had to be adapted to the newer system the piece had to be cancelled from performance and it was decided to try once again later that year.

After a few months, another effort was made to make the composition playable. With the lessons learned from the first effort and the performer demanding a tested Max/MSP version that would run on a current computer everything went smooth: Richard Festinger updated his system to OS 10.6 with Max/MSP 5 and managed to rewrite the old patch until it would communicate with the TG-77 at his home. This version of the patch would finally work in the practicing set-up set up by the performer.

3.3.4 Current state of the material

Head over Heels can now be played again as it was conceived 20 years earlier provided a working Yamaha TG-77 or a similar model can be found and the MIDI dump be uploaded. Considering that this synthesizer model ran out of production almost 20 years ago this can only be an intermediate solution.

As mentioned above the sounds of the synthesizer can probably be mimicked, but in order to do this the original sounds need to be heard or described. There is a possibility that this could prove to be more difficult than expected due to the specific sound synthesis of the machine, which can only be found in the SY/TG -77 and -99 models from that time.

However, with the sounds of the TG-77 recallable again they can be sampled, using for example automated sampling software like AutoSampler.[194] The sampled sounds are then automatically saved into a file that can then be played using a sample player. In this case, they were saved into a file readable by Native Instrument's Kontakt Player,[195] which is a common program and longevity and transformability of the files can therefore be hoped for. However, this set-up has not been put to a test yet and if everything will work as seamlessly as projected remains to be seen.

3.3.5 Summary and Conclusion

The piece and the documentation as it was notated in 1992 by Richard Festinger is almost exemplary: the set-up was easy to do with the then easily obtainable synthesizer and to program the synthesizer with the Opcode Galaxy Editor did not pose a problem either – many owners of the TG-77 would have that editor program anyway. Working closely with the pianist who was to premiere the piece

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[194] *AutoSampler* (Redmatica, 2011).
[195] *KONTAKT 5 PLAYER* (Native Instruments, 2012).

practising needs by the interpreter were met with an extra practising patch which lets the pianist easily choose from where to practise. The readme accompanying the patch lists all the necessary patches for Max/MSP and the synthesizer, a description of the set-up and hints for the pianist and the amplification. The only things that could be improved would be a drawing of the set-up instead of a description in writing since it is easier to visualize and perhaps the possibility to practise with the patch in a slower tempo than the fast final tempo.

In the seemingly easy set-up of *Head over Heels*, which can be described as master keyboard, computer with Max/MSP and Yamaha TG-77 synthesizer keyboard, it seems to be sufficient to organize the obsolete hardware. What is easily overlooked though is the amount of additional software that is needed to provide connectivity between the devices:

MIDI keyboard
MIDI interface featuring same hardware connection as computer
MIDI interface firmware working with computer's MIDI driver
Driver for Midi interface
Computer hardware
Operating system
Software (Max/MSP and Galaxy)
Driver for 2nd MIDI interface (if different than above)
2nd MIDI interface firmware working with computer's MIDI driver (if different than above)
2nd MIDI interface featuring same hardware connection as computer (if different than above)
Yamaha TG-77

Figure 10: Dependabilities in a Keyboard -> Computer -> Synthesizer set-up[196]

The set-ups of computers, software, controllers and external sound generators seem to be so modular that theoretically everything should be exchangeable. This interchangeability works best when all parts of the chain are current, even if the old hard- and software is possibly in a perfect working state. In this case, the differences between the operating systems OS 9 and OS X, which are

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[196] If this list looks at first glance overly accurate then it must be reminded that a computer running OS 9 will most likely expect a MIDI interface with a d-sub serial connector, which will, if found, itself ask for digging up 10-year old drivers in driver repositories.

fundamentally different and changed MIDI implementation in Max/MSP with version 5, demanded that part of the code had to be adapted.[197]

In conclusion, it can be said that finding the old hardware was much easier than getting the software running. Trying to install and run old software generates a whole string of problems, which in this case eventually stalled the planned performance of the piece. To find a concrete date where a program is outdated is impossible and will always be decided on a case-by-case basis. That a performer will have a running version of OS 9, Max/MSP 2-4 and the Opcode Galaxy Editor will nonetheless be rather rare and will become rarer.

There are a few archiving issues with this piece as well, such as the code still stored on the original floppy discs. Sound samples of the TG-77 sounds used would have helped in trying to reprogram the sounds with another synthesizer, but would not have solved the problem with the Max/MSP patch. On the other hand, it is foreseeable that, unless Yamaha will develop an emulator of the machines one day, the Yamaha TG/SY-series will soon be found in museums only and being able to recreate the sound will then be indispensable.

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[197] Using a current computer with OS 9 and Max/MSP 4 running in virtualization software might have solved the problem of the patch not sending out any MIDI data, but at the same time would have added another layer in Figure 11. The difficulty of physically attaching old hardware and the above mentioned changed file headers remain. It is e.g. not possible for an OS 9 system to read USB sticks that were written on in OS X.

3.4 Orm Finnendahl: Wheel of Fortune

Wheel of Fortune[198] is a composition by Orm Finnendahl originally composed in 1993-1995. Finnendahl is professor of composition and electronic music and directs the electronic music studio at the University of Music Freiburg.

Wheel of Fortune was commissioned by the festival Inventionen[199] and was premiered in 1994. In 1995, it was revised to make full use of the Experimentalstudio der Heinrich-Strobel-Stiftung[200] (now Experimentalstudio des SWR) and this version, described as 'for MIDI-Piano, Sampler, Computer and Live Electronics',[201] was premiered in Freiburg in the same year. The premiere of the revised version was dissatisfactory because of technical problems and the piece has never been played since.

Having found a recording of the revised version in the archives of the University of Music Freiburg[202] I pressed the composer for several years for a version I could take on tour and perform independently. We started to discuss things in earnest early February 2011.

3.4.1 Condition of the material (score and electronics)

In a project description by the composer from 1997 the set-up of the piece and the patches needed for the 1995 Freiburg version are described and depicted:
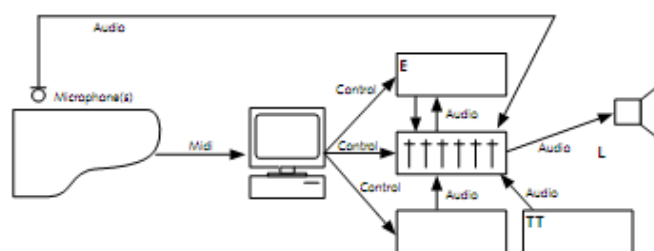
Figure 11: *Wheel of Fortune* by Orm Finnendahl: Set-up Freiburg 1995[203,204]

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[198] Orm Finnendahl, *Wheel of Fortune* (Manuscript, 1993).
[199] http://www.inventionen.de/
[200] http://www.swr.de/orchester-und-ensembles/exp/-/id=788792/1m0oaep/index.html
[201] Orm Finnendahl, "Wheel of Fortune - Description of the Project" pdf, 1997, 1.
[202] Sven Thomas Kiebler, *Wheel of Fortune* DAT (Institut für Neue Musik Freiburg, 1995).
[203] Finnendahl, "Wheel of Fortune - Description of the Project," 4. Reproduced with kind permission of the author.

Schaltung Vorspiel und Introduktion I
Version 1.

vom Akai (geregelt) vom Akai (direkt) vom KF Mixer1 (ADAT) vom Mikrophon (Klavier Original)

p Filter1A p Filter1B p Filter2A p Filter2B

p Hall1A p Hall1B p Hall2A p Hall2B

2x4 zum Halaphon (KF Mixer2) I zum LS am Klavier
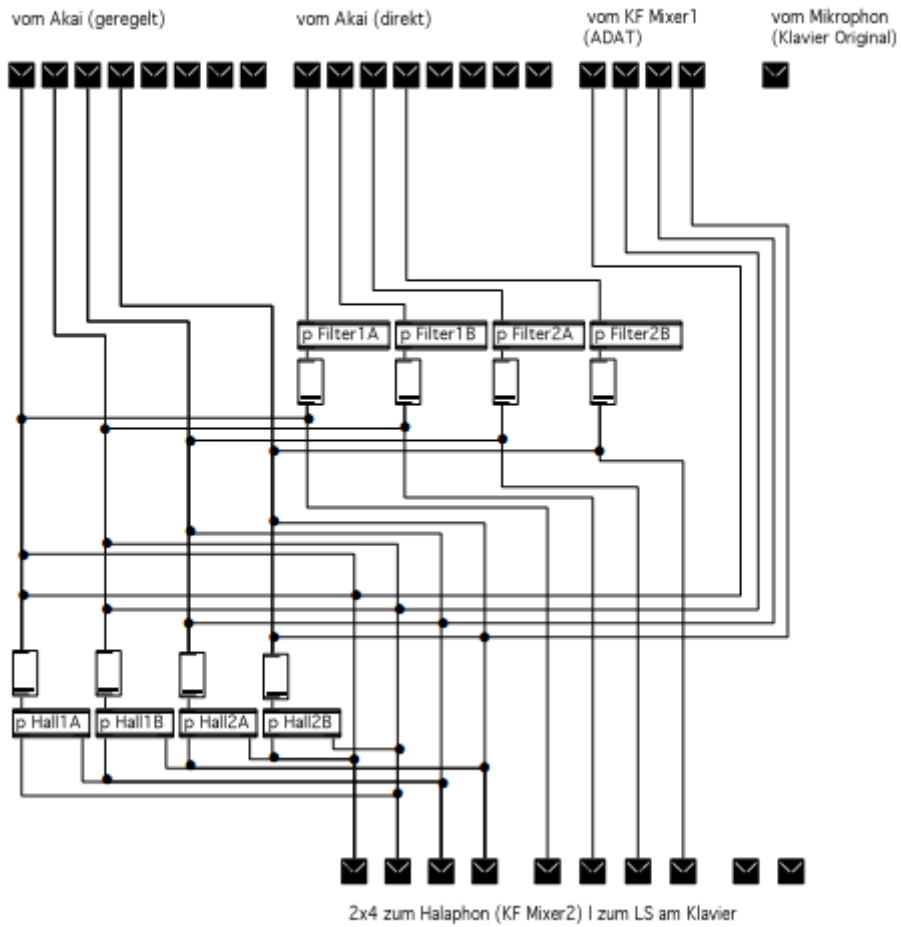
Figure 12: First patch for *Wheel of Fortune* in the 1995 version[205]

From this information we can extract some of the set-up: a Macintosh computer, which in 1994 is likely to have run Mac OS 7, several patches for Opcode Max, the predecessor of Max/MSP, an AKAI S1000 sampler, 2 ADAT tape decks, the Halaphon (see below), a 64x64 mixer and several hardware effects like filters and reverberation.

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[204] Figures 11-16: Reproduced with kind permission of the author.
[205] Finnendahl, "Wheel of Fortune - Description of the Project," 5.

The score of the 1995 version is closely interwoven with the electronics and makes it clear that the piece was indeed a piece for piano and electronics in the sense that the electronics had to be run by another musician (cp. Figure 13).

Figure 13: Excerpt from the 1995 score of *Wheel of Fortune* (Beginning)[206]

3.4.2 First assessment of the problems

At the time of the first meeting no playable version of the piece existed: the digital data (programs, patches and samples) was scattered on several computers in several cities on floppy- and hard disc drives, not to mention the hardware which was partially custom made obsolete hardware of the Heinrich-Strobel-Stiftung and probably stored in their archives.

We discussed three methods to restore the composition:

1. using the old computer to run the software and emulating the hardware of the Heinrich-Strobel-Stiftung.

2. virtualization of the old computer and emulating the hardware.

3. rewriting the composition with new code.

3.4.2.1 Using the old hardware

Going back to the old hardware is only an option if the studio has an archive for all their old equipment and this archive would be infinitely available. In this case, it would need most of the machinery of the Heinrich-Strobel-Stiftung of the year 1995. It would also include a PPC Macintosh

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[206] Finnendahl, *Wheel of Fortune*, 1.

computer and old software like Opcode Max, the MAX external Pyrite written by James McCartney[207] and several other custom Max externals written by Orm Finnendahl himself to calculate real-time Markov chains and the sprouting of self-scheduling events. It would finally require peripherals of that time (1995) like non-USB MIDI interfaces, samplers, SCSI hard drives and the old software including valid licences.

Even if this was possible, it is nonetheless prohibitive since it would turn a small-scale project into a rather difficult and big co-operation with a studio, making the production dependent on the will of the studio (and the financing means of the producer). This will most certainly result in fewer performances, if the studio would ever show an interest in such a production.

It can finally be assumed that at some point the old machinery will cease to function properly unless it is constantly maintained, which is again prohibitively expensive. What is also often forgotten is the fact that working every system requires some training and the knowledge of some tricks and quirks.

3.4.2.2   Virtualization

Emulating the old operating system solves only part of the problems and adds a few more. It is questionable if all programs could be persuaded to accept the new interfaces. It might be necessary to write new drivers, which are most likely a closed source, to make the new hardware communicate with the software that is running in the virtual machine. It would also include asking software makers for permission and information on how to bypass the copy protection of their programs in order to make it run, since the licence might be linked to obsolete hardware,[208] and probably trying to find a loophole in the copy protection by reverse engineering in software that is no longer produced. Once everything works, it would still require the knowledge of how to work with the old operating system. All this amounts to data archaeology, which tries to access 'digital materials where the media has become damaged (through disaster or age) or where the hardware or software is either no longer available or unknown.'[209]

3.4.2.3   Recoding

Recoding, in this case, would need a complete virtual rendition of the state and devices of the Heinrich-Strobel-Stiftung from 1995 including the above mentioned effect devices and most notably

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[207] James McCartney, "SuperCollider: A New Real Time Synthesis Language," in *Proceedings of the International Computer Music Conference 1996* (presented at the International Computer Music Conference 1996, Hong Kong: International Computer Music Association, 1996), 257–258.

[208] For instance older versions of Max/MSP are protected in this way.

[209] Seamus Ross and Annette Gow, *Digital Archaeology: Rescuing Neglected and Damaged Data Resource* (Glasgow: Humanities Advanced Technology and Information Institute (HATII), University of Glasgow, February 1999). Cp. also chapters 5.1 and 5.2.

the famous Halaphon,[210] the studio's custom made early surround sound matrix. It would also need the disassembling of protected software and recoding them in today's code, which again approaches the field of data archaeology.

3.4.3 Working with the material

3.4.3.1 Remuneration of the composer

After discussing the several possibilities, it became clear that many man-hours of work would be necessary to rebuild the piece[211] and Orm Finnendahl made it clear that some form of remuneration had to be found. Several possibilities were discussed:

- a grant for the composer by a studio to recode the piece.

- I myself would pay the composer for recoding the composition and making it easy to set up.

- indirect financing the composer by hiring him as sound engineer for the concerts and therefore getting some financial remuneration.

None of the options discussed above were feasible. No studio has a program for composers whose compositions have to be recoded (not to mention making the studio obsolete for this composition in doing so). The pianist, in view of the fees that are paid for concerts of contemporary music, cannot possibly pay the cost. Hiring the composer as sound engineer, as desirable as that would be, would not only double the artists' fee but also incur expenses for travelling and accommodation, which few organizers would be willing to pay.

An agreement was therefore made and contracted that the work of the composer would be rewarded with the pianist playing the composition at least ten times if no other pianist started playing the piece and thereby reducing the number of venues, as well as making an audio and a video recording.

This agreement would enable the pianist to play a composition he thinks is a tangible asset to his repertoire and provides assurance for the composer that his work will not only be rewarded by just one performance.

3.4.3.2 Recoding

Since the composer has already digitally simulated most of the 1990s hardware of the Experimentalstudio for performances of pieces by other composers written in that time (*Arcade* by

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[210] Hans Peter Haller, "Raumklang_Klangraum," n.d., accessed 27 March 2012, http://www.hp-haller.homepage.t-online.de/heft2.html.
[211] Which is probably not as interesting as composing a new one.

Günter Steinke[212] and *Das atmende Klarsein* by Luigi Nono[213]) he decided to rewrite the electronic part of the piece.
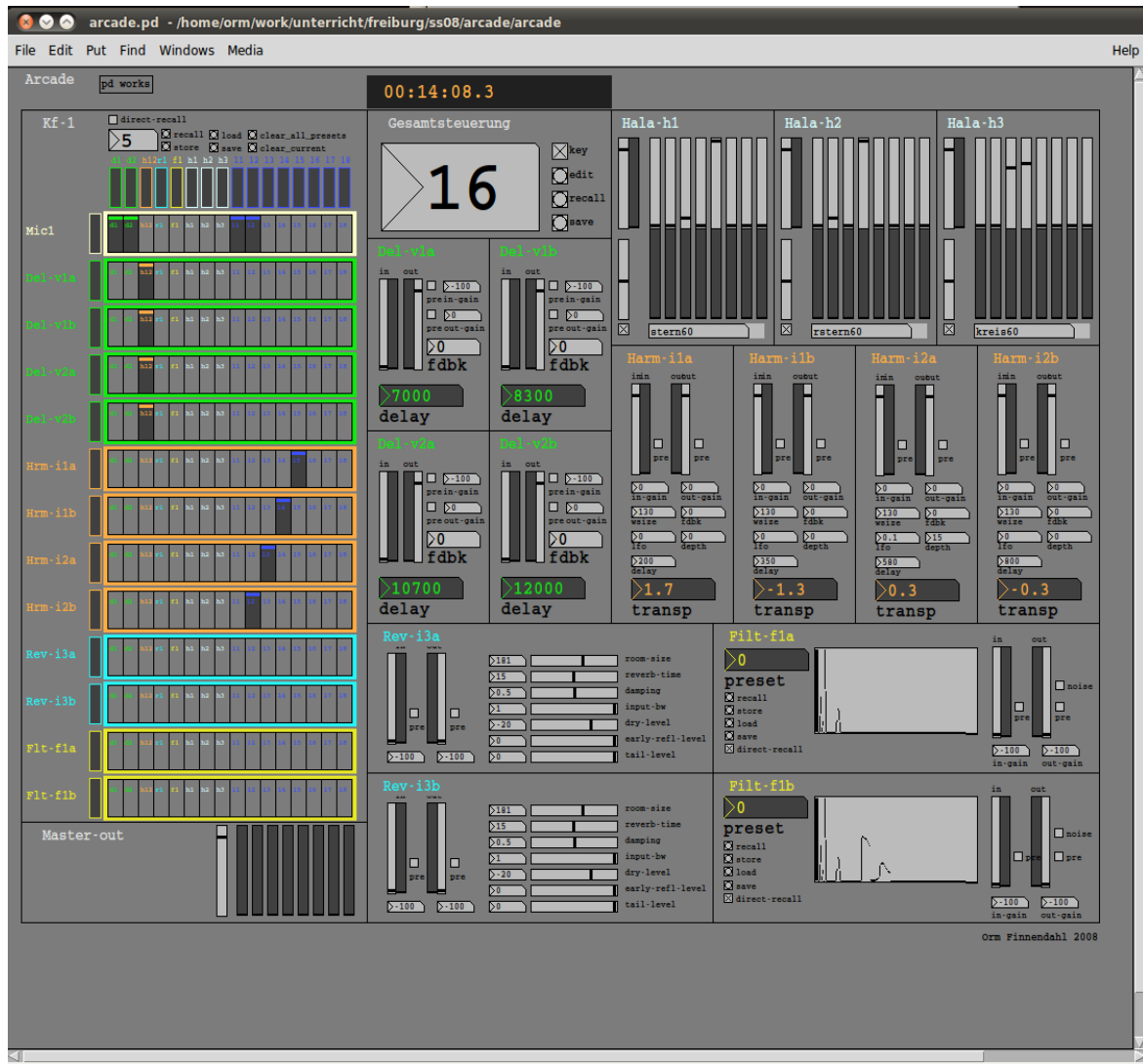
Figure 14: Virtual rendition of the Experimentalstudio des SWR for *Arcade* by Günter Steinke

Only the open source software Pure Data is used in order to maximize the portability and likelihood of future realizations, wrapping everything into a written representation (printing out programs and patches as text files and the score as postscript/pdf).

After retrieving all the old data and running into similar problems as described in 3.2 Orm Finnendahl started to recode (and partially recompose) the piece on his computer running the Linux operating system. He then tested the code on a virtual machine running Apple OS 10.5. Unfortunately, this

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[212] Günter Steinke, *Arcade* (London: Boosey & Hawkes, 2000).

[213] Luigi Nono, *Das atmende Klarsein* (Milan: Edizione Ricordi, 1987).

proved to be a very inefficient way to produce a running version of the composition's electronics: countless hours were spent bug fixing to port the Pure Data patch from the virtual emulation to my (hardware) computer running OS 10.6.[214]
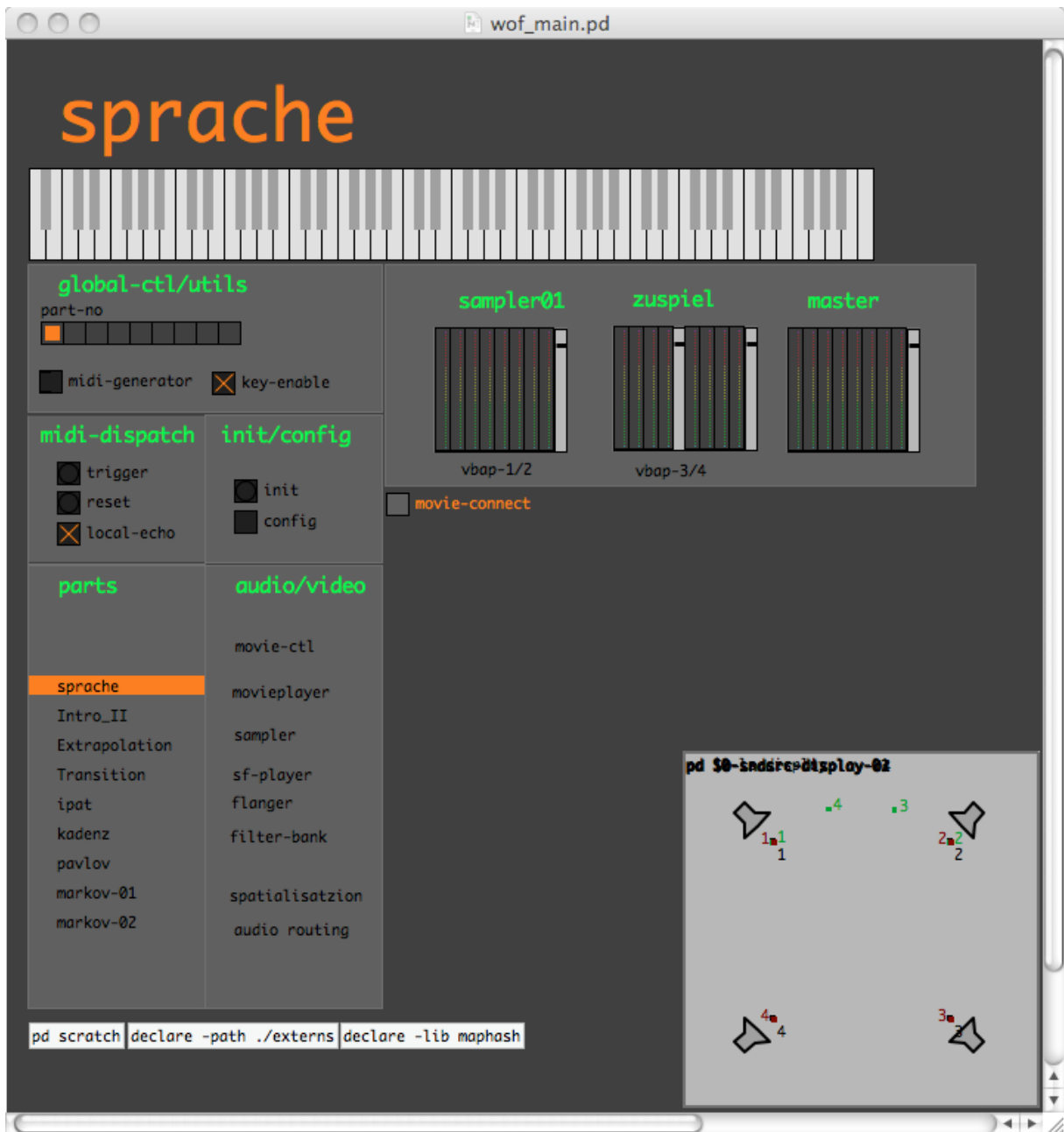
Figure 15: Main window of the 2011 version of *Wheel of Fortune*

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[214] It was beforehand agreed that the patch has to run on my computer to guarantee replacability that can be done by myself (for example in the case of the computer breaking on a tour).

The piece was re-premiered at the piano+ festival at the Zentrum für Kunst und Medientechnologie (ZKM) on November 26, 2011 and ran almost until the end of the piece before stalling at an uncritical point. This bug is currently being worked on.

3.4.4 Current state of the material

At present a rather stable version of the electronics exist: the patch, which is an extraordinary feat of programming including Pure Data being able to display a musical score, runs on a current OS X machine and has only a few minor bugs left.
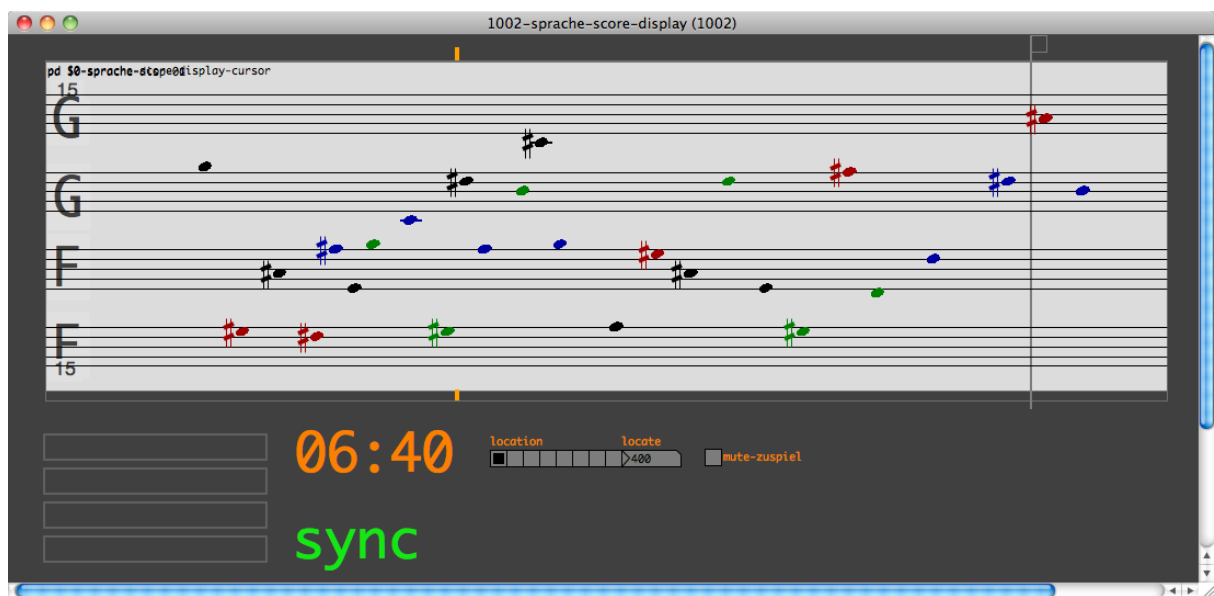
Figure 16: Screenshot from *Wheel of Fortune* in the 2011 version

The score, where it is not to be read from the computer (cp. Figure 16), is still a makeshift score consisting of printed material given to me by the composer, but containing countless hand-written annotations in the score and on additional sheets. At this point, the piece cannot be handed over to other performers since too much information is needed to play with the patch. This information can, at this time, not be found in the score but is spread in e-mails, handwritings and my memory.

3.4.5 Summary and Conclusion

Transferring a composition for soloist and live-electronics from 1994 to 2011 produced the same amount of work needed to write a completely new composition. However, unlike premieres, which are often commissioned by the organizers, older compositions do not get the same attention. In this case, this led to a composition, although at the time received favourably and a performer wanting to play the piece, not being performed for over 15 years. Looking for financial aid proved to be fruitless and only delicately discussing other options provided a solution. A solution like this certainly is only possible under certain circumstances, like the composer being able to recode the work himself and

the pianist, being a soloist, enjoying relative freedom in the choice of his repertoire. It nonetheless offers a direction of thought that might prove successful in other co-operations as well.

Three stages can be identified in the restoration of the piece:

1. retrieval of the old data (samples, patches).
2. restoration and reprogramming of the patch in pd.
3. bug fixing on the target computer system.

Stage 1 could have been avoided if a proper archiving system had been implemented and stage 3 would require that the electronic community agrees on a common hard- and software computer platform or at least have it at their disposal for testing purposes. Here and in the case of Festinger (cp. chapter 3.3) it proved to be unduly time-consuming to export the task of patch testing to the performer, who spent hours writing bug reports without being able to practise the music.

3.5 Enno Poppe: Arbeit

Arbeit is a composition from 2007 by Enno Poppe 'for virtual Hammond organ'.[215] It was commissioned by the Westdeutscher Rundfunk (WDR) and was premiered in 2007 at the Wittener Tage für Neue Kammermusik 2007.

The composition was ordered in August 2009 and arrived in book form. It contained the score and one page of performance notes.

3.5.1 Condition of the material (score and electronics) upon delivery

In the performance notes I found the information on the required electronics, namely the required hardware, the software, the dynamics and how hard- and software relate to each other and the score.

In section 2 the software is given as

- B4 II by Native Instruments (or a similar Hammond organ plugin)
- Max/MSP patch 'Ernstorgel' (to be obtained from the publisher)

After an inquiry to the publisher for the patch, I got an e-mail from Ricordi a good two weeks later stating, 'the patch is not in its final version yet'[216] and supplying an e-mail address of the composer Enno Poppe. Enno then contacted Ernst Surberg, the pianist of the premiere, who sent me the required patch. Almost a month after receiving the score I received a mail with a download link.

3.5.2 Genesis of the material / Assessment of the problems

The set-up of the piece is comparable to that of *Head over Heels* described in 3.3: a MIDI keyboard sends data to a Max/MSP patch which in turn controls the sound generator. The sound generator in this piece is a virtual Hammond organ, meaning that it is not a hardware device like the synthesizer used by Richard Festinger but a software instrument. However not only one instance of the software is used but six:

> The virtual Hammond organ that I use now is tuned in twelfth tones, i.e. each semitone is divided again into 6 parts. This means that I have to run the same software six times and each of the 6 organs, which run simultaneously, is tuned differently.[217]

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[215] '*für virtuelle Hammondorgel*', Enno Poppe, *Arbeit* (München: Ricordi, 2007).

[216] Jürgen Schneider in a personal e-mail on September 9, 2009.

[217] '*Die virtuelle Hammondorgel, die ich jetzt benutze ist in 12tel Tönen gestimmt, d.h. jeder Halbton ist noch einmal in 6 Teile geteilt. Praktisch sieht das so aus, dass ich halt 6-mal die gleiche Software laufen lassen muss, und jede dieser einzelnen 6 Orgeln, die gleichzeitig laufen, ist unterschiedlich gestimmt.*' Michael Iber, "WDR3open 'Studio Elektronische Musik': Virtual Machines," November 19, 2008.

The organ used in *Arbeit* is the second version of a virtual rendition of the famous B-3 organ by Laurens Hammond, manufactured by Native Instruments and aptly named B4 II. The software is not used as a standalone but rather as a plugin for Max/MSP.[218]

Considering that the piece was only two years old and the Max/MSP patch processes only MIDI, it was expected that the set-up would go seamlessly. The only difference in the set-up between the original set-up by Ernst Surberg, who also was the programmer of the patch, was that the patch was written on a computer with OS X whereas the author had a Windows computer at the time. However, Max/MSP patches without externals should easily work across platforms[219] and I thus tried to do the set-up.

3.5.3 Working with the material

After installing the organ and running the patch error messages in Max/MSP appeared and an extremely tedious search for the origins of those errors began. About a dozen phone calls between Ernst Surberg and me soon focused on the differing operating systems. Ernst coded several versions of the patch to make it work as an executable patch, to set the search path for the organ plugin[220] and to make it run on a Windows computer. After two weeks trying to run the program on the Windows computer, a test installation on the Mac computer stalled as well. This meant that about a week before the planned concert at the Huddersfield Contemporary Music Festival there was still no working set-up.

On arrival in Huddersfield, another round to tackle the problem began. Several fellow PhD students looked at the patch and several MIDI drivers were tested. The organ was installed on two more computers, which sounds like an easy task but poses two problems: the installation itself and the licencing.

Installing the organ is very tedious because it requires five steps to do so:

1. installing an older version of the organ.

2. installing a registration program.

3. updating the registration program.

4. updating the organ.

5. updating the organ once more via the registration program.

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[218] This means that the program is not being started by itself but by the Max/MSP patch.

[219] "Windows and Mac Patch Compatibility « Cycling '74 Forums," 2011, accessed 28 March 2012, http://cycling74.com/forums/topic.php?id=31991.

[220] Max/MSP looks up certain storage locations for plugins. The program is being told where to look by predefined 'search paths'.

This set-up procedure is extreme but makes it clear that installing a program can include installing more than one program and possibly several drivers and other updates.

The other problem is the licencing since the software licence of the B4 II is restricted to a limited amount of computers:

> The end user license agreement (EULA) for Native Instruments products allows the simultaneous installation on two computers (three computers for all versions of KORE and KOMPLETE), as long as only one installation is used at any given time.
>
> It is not necessary to 'deactivate' an existing installation to activate the product on any further machine, but due to the license agreement it is required to uninstall the product from the previously used computer.
>
> Please note that Native Instruments reserves the right to disable an account or serial number if it has reason to believe that the license agreement is violated.[221]

By now, the organ was installed on four computers that were worked on simultaneously.

The problem was eventually found and it turned out to be a single missing space character: the organ plugin installs itself as 'B4 II', which is unreadable in Max/MSP because the program does not accept space characters in the search paths. To solve this problem Ernst Surberg had simply renamed the plugin to 'B4_II', but this was not mentioned in the performance instructions in the score nor in a readme file. It was briefly mentioned in one of the many telephone conversations between Ernst and me but got overlooked because the focus was on the different operating systems. Renaming the plugin immediately solved all the problems and the patch even ran on the Windows computer. With three more days to practise with the sounds as intended, the performance at the Huddersfield Contemporary Music Festival went smoothly.

At another concert at the Zentrum für Kunst und Medientechnologie (ZKM) in Karlsruhe a shortcoming of the patch was noted. Setting up *Arbeit* requires the tedious process to go through all the volume levels of about 50 different organ registrations to adapt the sound to the acoustics in the concert hall. These settings can be stored for the performance but will reset on starting the program.

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[221] "Do I Need a Second Licence to Install My NI Product on a Second Computer?," n.d., accessed 29 March 2012, http://www.native-instruments.com/knowledge/questions/475/Do+I+Need+a+Second+Licence+to+Install+my+NI+Product+on+a+Second+Computer%3F.
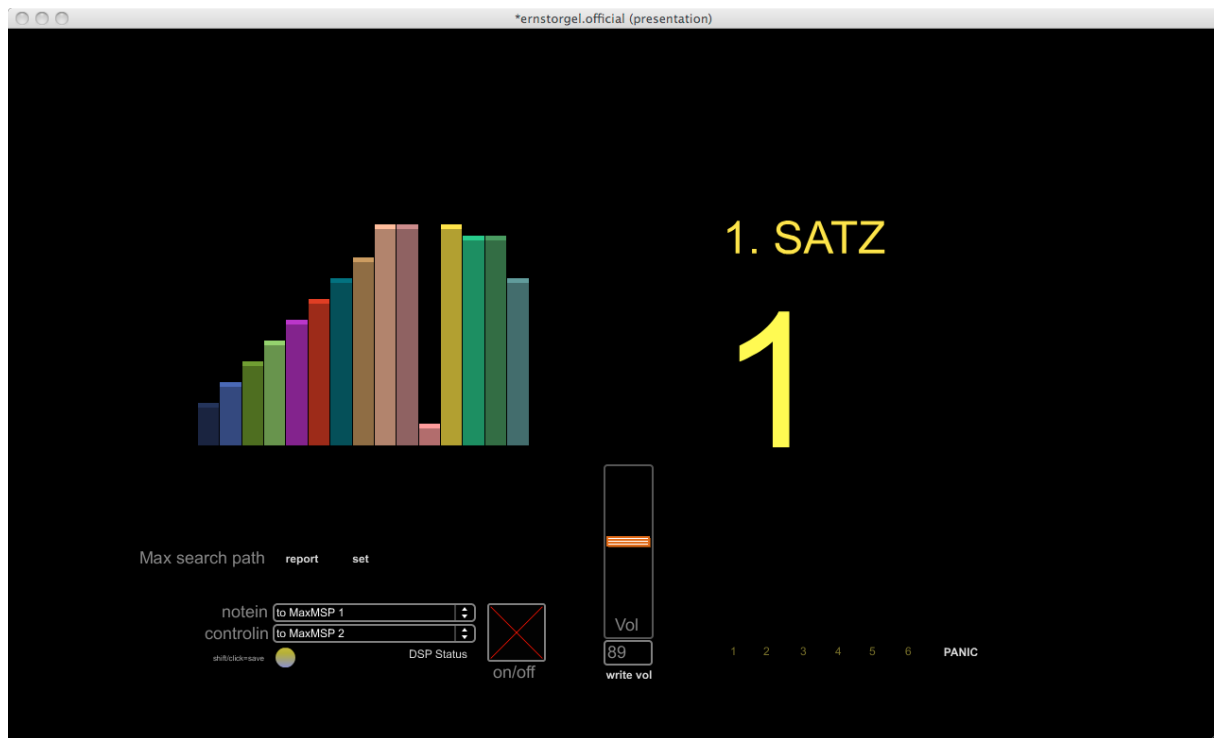
Figure 17: Max/MSP patch by Ernst Surberg for *Arbeit* by Enno Poppe[222]

The set-up for a concert was completed about two hours before the concert and all machinery was left powered on and ready to go. On starting to play the piece it was found that the sustain pedal of the MIDI keyboard would not transmit MIDI messages and the Max/MSP program was closed and started up again. The pedal then worked again but all the information on the volume levels was lost and the piece started at an extremely quiet volume level. The sound engineer slowly raised the volume up a full 12db during the course of the performance but it was nonetheless an unsatisfactory performance.

3.5.4 Current state of the material

In order to perform the piece the following material is needed:

- score with performance instructions

- Native Instruments B4 II organ

- microtonal presets for the organ

- patch for Max/MSP, which is distributed as an application[223]

- a readme file on how to set up the electronics

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[222] Reproduced with kind permission of the author.
[223] This means that the patch acts like a program and does not need any version of Max/MSP installed.

Currently only the score is distributed by the publisher. The patch and the presets can be obtained from the programmer, alas with no readme file. The B4 II organ has been taken off the market in autumn 2009, meaning that the program is out of production and cannot be bought anymore. In the performance notes, it says that 'a similar Hammond organ plugin'[224] can be used, but the fact is that currently the piece works only with the B4 II: Ernst Surberg confirmed that replacing the B4 II with another plugin would require countless hours of programming and would be most tedious.[225]

3.5.5 Summary and Conclusion

The process to make the composition work was stalled by a seemingly low-level incident: The plugin had to be renamed in order for Max/MSP to find and load it. Since electronic equipment does not tell by itself where the error occurs, looking for faults is like looking for a needle in a haystack, and to solve the problems required countless hours of work and the help of six people. This could have been easily avoided if a tech rider for the installation of the electronics had been provided. Since there are so few people playing a composition like this it is probably thought that it is more practical to provide the patches and the knowledge on how to install the electronics in an informal way from the person who knows it best: the programmer and performer of the premiere. Nonetheless, the troubles depicted above show that an archiving scheme is needed where the information is already collected in a comprehensive manner.

This leads to another major ethical and commercial question: with whom lies the responsibility for the patch? The publisher sells the score but does not provide the patch and provides contact to the composer. The composer then transfers the performer to the author of the patch, with whom the performer has no 'business' connection and is therefore dependent on his goodwill. Although Ernst Surberg cannot be lauded enough for his kindness and his selfless and patient efforts it remains a relationship where the performer can only ask so much, let alone of additional programming like the storable volume settings that were needed in the concert in Karlsruhe.

The patch is described as not in its final version and the readme file for the electronics is missing. The reason for this is that the piece could theoretically be played on any tuneable organ plugin but that it was only programmed for the Native Instruments B4 II. The reason for the latter then is twofold: Enno Poppe chose exactly this instrument because it is 'the most beautiful I have heard'.[226] On the other hand programming the retuning was not possible from inside Max/MSP but had to be done in the organ program itself with the means of programmed presets. As far as I know there is no comparable virtual organ on the market and it is questionable if somebody would program the

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[224] '*ein vergleichbares Hammondorgel plugin*', Poppe, *Arbeit*.
[225] '*Mordsakt*', Ernst Surberg, personal communication via e-mail, July 13, 2011.
[226] '*die schönste, die ich gehört habe*', Iber, "WDR3open 'Studio Elektronische Musik': Virtual Machines."

around 300 parameters in that software instrument. At this point all that can be done is to wait until this possibility exists, even more so since the B4 II is not in production anymore.

It must be accepted that a virtual instrument like the B4 II has a limited life span. Until there is no virtual organ with the same sonic qualities of that of the Native Instrument's B4 II and whose tuning can be programmed using the Max/MSP patch there is little hope and indeed no use to reprogram either the Max/MSP patch or another organ. Considering the relative longevity of the Max/MSP software, the possibility of storing the tunings in a patch would be the optimum. Until then there are several options:

- keeping a computer system with the instrument and the patch running as long as possible.

- an often-cited alternative is to use a powerful computer with a virtualization of the older platform. The problems concerning this solution have been discussed in chapter 3.4.

- it is also imaginable that Native Instruments would hand out a copy of the obsolete program for this special occasion. This would of course require a platform which the program could run on.

- a sampling solution like the one mentioned in 3.3. Most of the sounds of the piece are static and it seems possible for them to be sampled and played with a sample player. In the second movement there are sounds whose sonic qualities are changed with the turn of a knob on the keyboard controller. These sounds could probably be sampled in their complete length including the change in timbre. It is then a philosophical question if the instrument is still a 'live' instrument or just an imitation and if the change in the timbre that was earlier produced by the turn of a knob – itself recalling analogue instruments – should be mimicked by turning a fake knob.

As for the search for the error in the set-up, it is certainly a valid point to say that it would have been easy with a proper tech sheet. It is remarkable though that two weeks were lost discussing the differences between the differing operating platforms until a test showed that the patch does not run on an Apple machine either.[227] Most people feel helpless on a computer system other than their own and it is even more difficult to check for errors then. That said it would have been much easier if the author had owned a Mac computer to begin with since the patch was written on a Mac computer. For a more thorough discussion the reader is referred to chapter 5.3.3.

To find out the source of the problem of the malfunctioning sustain pedal at the concert at the ZKM would require a level of technical expertise that a simple storing function in the patch would be the much easier solution. The author of the patch or another knowledgeable person who can code in Max/MSP could do this, but it would also open up the question to who owns the patch and is legally

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[227] To remind the reader why it took so long to test the electronics on another machine I want to mention again the tedious set-up process and the above-cited licencing agreement by Native Instruments.

allowed to change it. The solution to this problem thus lies in solving the problem as described earlier or by bringing tested hardware to the venue. In the case of an 88-key MIDI keyboard certainly no small feat, on the other hand not different from that of a double bass or tuba player.

3.6 Scott McLaughlin: Dissolution / Bifurcations in a Continuous System

Dissolution[228] (2006/2010) and *Bifurcations in a Continuous system*[229] (2011) are two compositions by Scott McLaughlin for piano and electronics and keyboard and electronics respectively. The composer and I have worked closely on the two compositions in the course of this study, preparing them for their premieres. Although the liaison was never intended to result in collaborative compositions,[230] two intense discussions unfolded. These discussions are interesting since they both revolved around the electronics but triggered different results: *Dissolution* received a somewhat unsuccessful first performance, whereas the collaboration on *Bifurcations in a Continuous system* resulted in a successful premiere. The discussion in this chapter engages less in the technical difficulties in the production of electroacoustic music but is more concerned about the different possible modes of collaboration between the composer and performer dyad. Two varyingly successful collaborations are exemplified in this chapter and it is interesting, that the challenges in chapter 3.7 result partly from the same discussion.

3.6.1 Dissolution

Dissolution by Scott McLaughlin is a piece for 'any equal-tempered plucked/struck instrument'[231] and live-electronics, here in the form of a Max/MSP patch for Max/MSP 5. The composition is described by the composer as this:

> A wall of white noise is steadily taken apart by the performer. Each note on the instrument corresponds to a band of noise, but the bands are less than a semitone wide so non-tempered pitches must be used in order to completely remove the noise.[232]

The version of *Dissolution* for piano and electronics works in this way: the music starts with the white noise played by the electronics. The pianist first plays from a score containing all 88 notes of the piano. Each note takes away the respective note from the band of white noise, thus 'perforating' it and leaving the non-tempered fragments of the noise wall only. These fragments are then also taken away by playing inside the piano and finding the non-tempered pitches by ear. The piece ends when the wall of white noise has turned into silence.

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[228] Scott McLaughlin, 'Dissolution" (Huddersfield, 2010).
[229] Scott McLaughlin, *Bifurcations in a Continuous System* (Manuscript, 2011).
[230] As described for example in Heather Roche, "Dialogue and Collaboration in the Creation of New Works for Clarinet" (PhD, University of Huddersfield, 2011).
[231] McLaughlin, *Dissolution*.
[232] Ibid.

Unfortunately, the patch for this piece never worked before the concert and has not been worked on since. Realizing in the dress rehearsal that we would not have a working patch on the day of the concert a discussion commenced focusing on how to save the piece for the concert by making it technically work and to produce nonetheless an interesting work. This led to the decision that the composer would mimic the computer part at the concert, but also, after the pianist realized that any kind of tape could be used, to the decision to replace the white noise sound file with a sound file by controversial US-American radio host Glenn Beck.[233] The sound file was taken from a video documenting an enraged Glenn Beck mocking and yelling at a woman calling into his show.[234] This changed the aesthetics of the piece quite drastically:

> The piece, which was originally intended about the process of cancelling sound bands out of white noise and focusing on the frequencies that were left over could be heard now as well as a political piece where the conservative agenda of Glenn Beck got cancelled out.[235]

Reviewing the collaborative process[236] Scott McLaughlin and I came to the following results:

- the aesthetics of the composition were heavily altered in that a passive background sound was changed into an 'active' one without altering the piano part.
- the version of the composition played in the concert was not the version intended by the composer.
- the aesthetics were altered after the intervention of the instrumentalist.
- neither the pianist nor the composer were satisfied with the outcome.
- the electronics cannot be handed over to other performers at this time.

It is therefore clear that, starting from a technical problem, the discussion on how to save the piece for the concert turned the piece upside down after the interpreter suggested changes in the aesthetical domain. It is debatable if this is 'allowed' since time pressure forced a speedy resolve of the problem and the composer did not resist the intervention. All in all it must be said that the help to turn a half-working piece with a half-working patch into a working piece using the same patch resulted in a technically successful performance, albeit one with a different aesthetic as originally intended by the composer.

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[233] Linda Feldman, "Glenn Beck Leaving Fox: His 10 Most Controversial Statements (so Far) - Beck: 'The President Is A Marxist'; 'I Think That We Are Setting Up A Class System.' - CS Monitor.com," 2011, accessed 4 July 2011, http://www.csmonitor.com/USA/Elections/2011/0407/Glenn-Beck-leaving-Fox-his-10-most-controversial-statements-so-far/Beck-The-President-Is-A-Marxist-I-Think-That-We-Are-Setting-Up-A-Class-System.

[234] "Beck 'Lose[s]' His 'Mind;' Screams at Caller: 'Get Off My Phone You Little Pinhead!'," July 15, 2009, accessed 10 February 2012, http://mediamatters.org/mmtv/200907150016.

[235] Scott McLaughlin and Sebastian Berweck, "Dissolution" (presented at the RMA Study Day: Collaborations in Practice Led Research, Leeds, n.d.).

[236] Ibid.

3.6.2 Bifurcations in a Continuous System

The composition *Bifurcations in a Continuous System* was composed expressly for a concert on October 27, 2011 by the author at the University of Huddersfield. The composer writes about the piece:

> In writing this piece, I wanted to create something pianistic for the performer, but where the musical argument was alien to the keyboard. So here the pitch content is a linear mapping of the duration between keystrokes, producing a sound that is constant and lacks the characteristic envelope of the piano sound. Similarly, other attributes of performance such as key-release, dynamics, notes etc., are mapped to timbre using histograms and averaging.[237]

Practically this means that the pitches of two synthesizers are triggered by the speed by which the keyboarder is playing, e.g. playing quarter notes results in one pitch, playing eighth notes results in another pitch and alternating quarter and eighth notes result in the two pitches sounding together.

Unlike the patch for *Dissolution,* this patch was programmed using the support of another computer programmer[238] and the music needs to be practised a little longer by the performer. After a very brief demonstration of the patch in August 2011, the score and a working patch for Max/MSP along with rudimentary information about how score and patch are linked together was sent by e-mail three weeks before the concert.
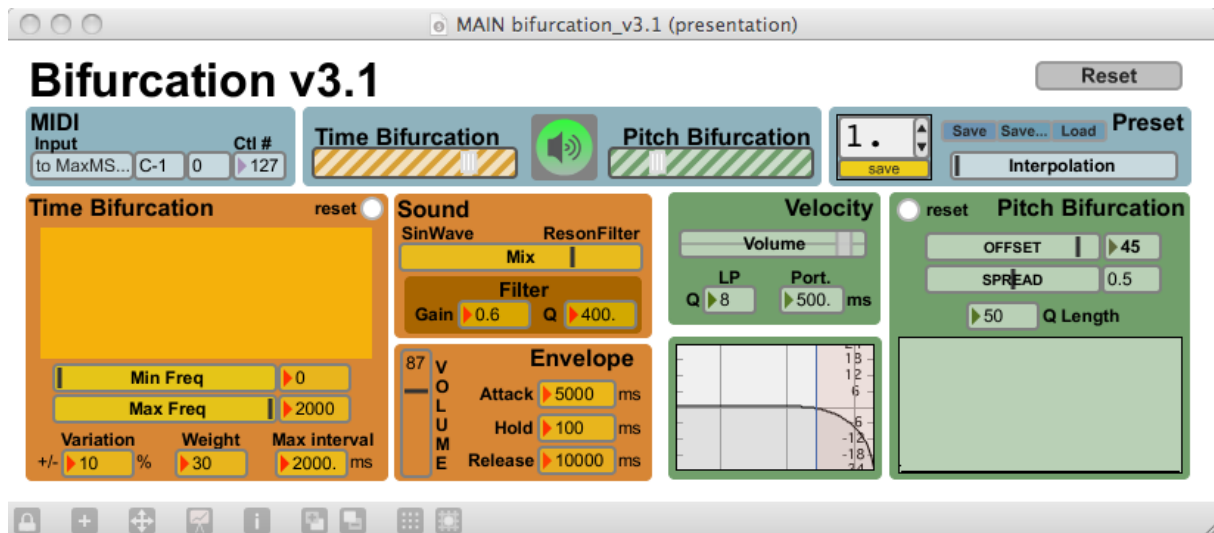
Figure 18: Max/MSP patch for Bifurcation in a Continuous System by Scott McLaughlin, v3.1[239]

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[237] McLaughlin, *Bifurcations in a Continuous System*.
[238] Dominic Thibault.
[239] Figures 18-21: Reproduced with kind permission of the author.

Picture 25McL v3.2a.tiffSince no further explanation on how the patch works and what outcome should be expected was to be found neither in the score nor in the e-mail, a phone call from performer to the composer triggered another version with a much reduced user interface.
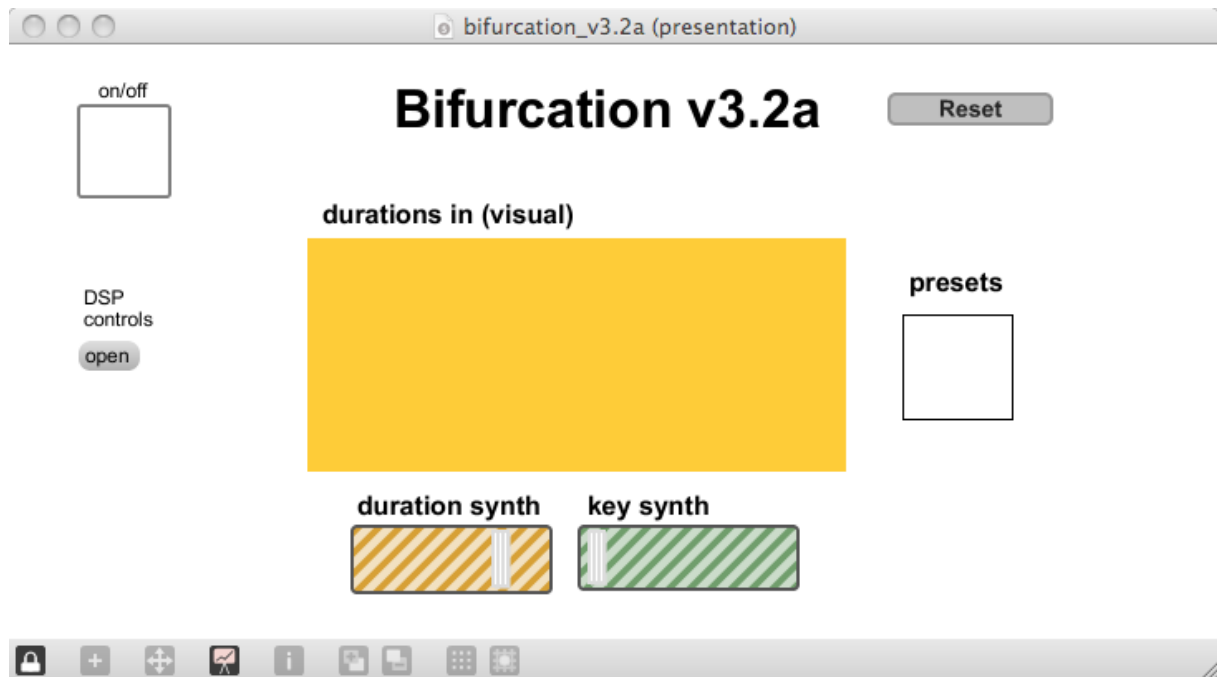
Figure 19: Max/MSP patch for *Bifurcation in a Continuous System* by Scott McLaughlin, v3.2a

On request from the performer, the user interface was changed one more time shortly before the concert and version 3.2b not only included an audio test signal that can be triggered from the computer keyboard but also a way to quickly change presets.

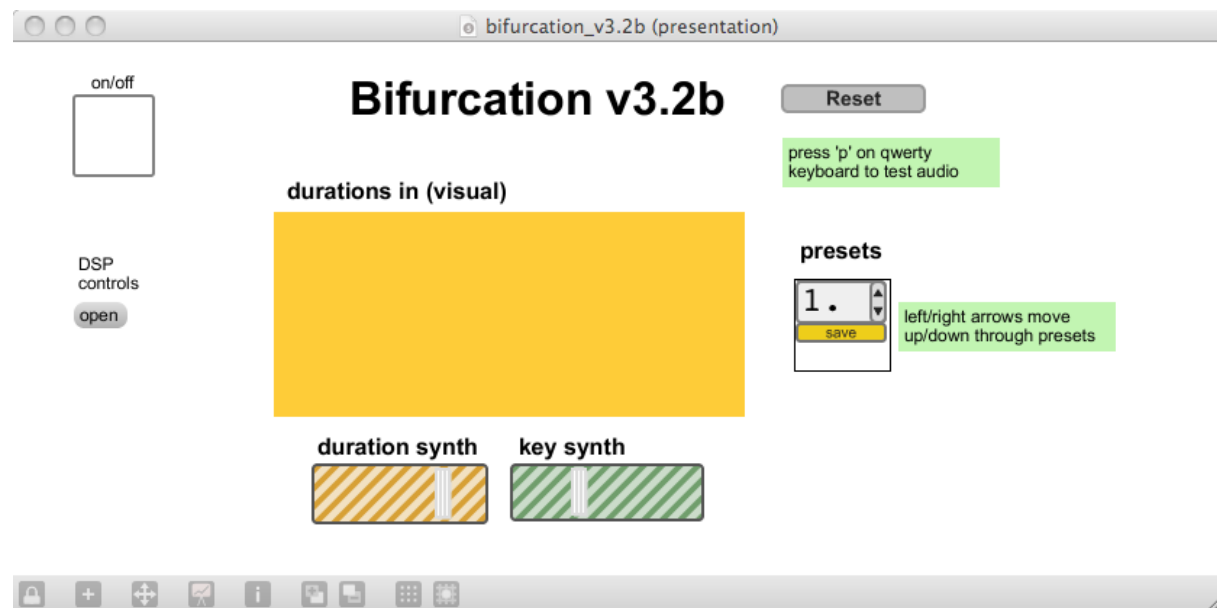**Figure 20: Max/MSP patch for *Bifurcation in a Continuous System* by Scott McLaughlin, v3.2b**

With this version of the patch and the original score as well as the composer present at the dress rehearsal, the performance at the concert proved to be successful as far as the performer was concerned. Unfortunately, the composer, although not dissatisfied, noticed a small imbalance in the levels of the synthesizers as well as a drop in the pitch at one point in the performance. The imbalance is a patching problem outside the realm of the interpreter. The drop in the pitch though results directly from the playing of the performer, who has to maintain a strict speed of a quarter note = 75. Although the score gives the instruction to play the piece strictly in this tempo it was not realized by the player that even deviations in the span of milliseconds already change the pitches. Although this information was probably mentioned in the brief demonstration a few months earlier, it came as complete news to the performer, who solely relies on the score to give him all the information that is needed to play a piece.

The necessity to have all relevant information neatly written in the score by the composer has several reasons:

- performers often play a multitude of compositions in a short time. I myself was very busy preparing for over a dozen compositions in October 2011 alone, and the concert where *Bifurcations in a Continuous System* was premiered featured eight other compositions that were new to me.

- in my own experience, the strain of playing a concert often results in lapses of memory as far as non-musical events are involved. The brain is so occupied with memorizing the score and concentrating on the performances that any side information is easily forgotten.

- information given in an e-mail, probably hidden amongst other topics, is likely to be forgotten as well if not printed out, highlighted and put inside the score immediately – a task the performer might easily forget.

It is understandable that not all information is written in the score in preparation for a premiere: the composer might not realize what information must be communicated or simply omit something. Nevertheless, it is the composer's responsibility to make sure the performer has all information necessary to perform the piece before the premiere. The composition must be in a state whereby the piece can be played by a performer without the need for additional information by the composer, firstly because composers forget themselves what needs to be said a few years after the writing and secondly because the composition might want to be played after the demise of the composer.

In the case of *Bifurcations in a Continuous System* the performer must know, that deviations in the span of milliseconds from the required tempo are not allowed. This information can be distributed in the technical notes but more musically by simply notating the desired pitches into the score. This

would certainly accommodate the work of an instrumentalist the most and would at the same time facilitate the reconstruction of the patch if needs be.

Picture 27McL v3.4.tiffThe discussion about the experiences in the concert and the interface eventually triggered a revised score that now contains an abstract as well as a tech rider. A new version of the patch's user interface gives even more control relevant to the performer.
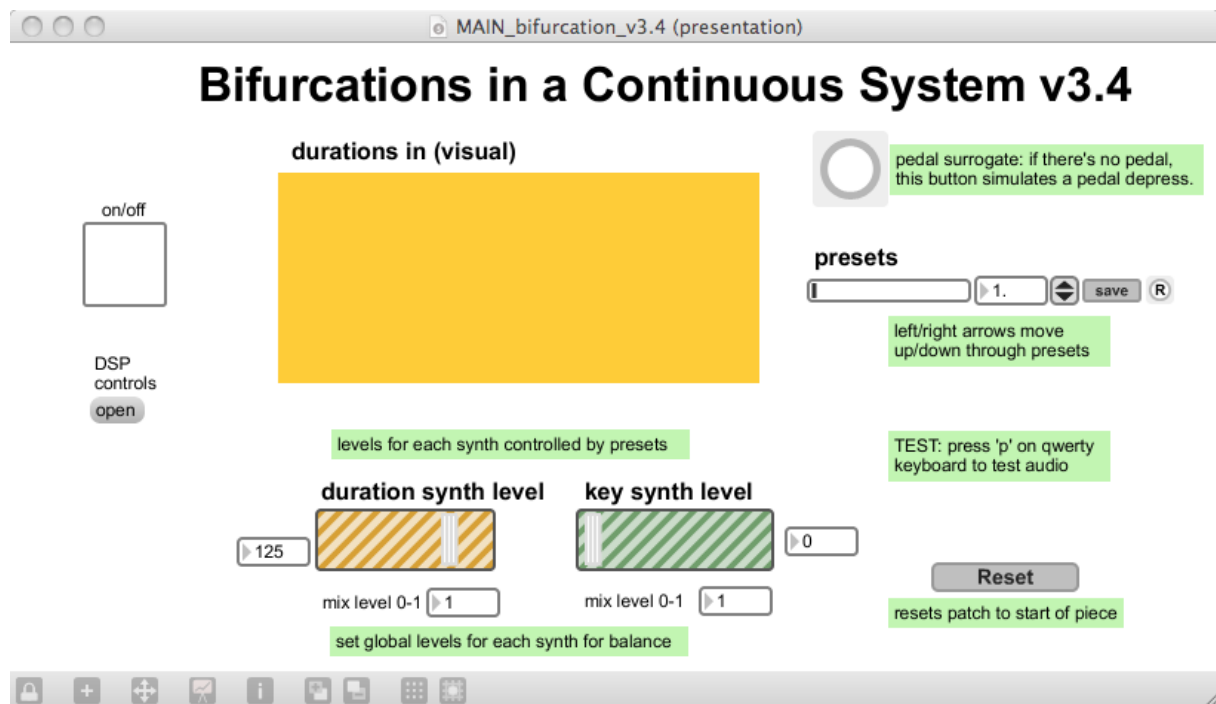
Figure 21: Max/MSP patch for *Bifurcation in a Continuous System* by Scott McLaughlin, v3.4

3.6.3 Conclusion

The works on *Dissolution* and *Bifurcations in a Continuous System* represent two different collaborations between composer and performer. Although both discussions find their origin in the electronics of the pieces, their content and course are different.

In *Dissolution,* the border between composer and performer was blurred and the performer suggested aesthetic decisions, which were necessarily uninformed: the collaboration was not planned as such and therefore the performer did not have enough understanding to give knowledgeable input. In other artistic disciplines, it is not uncommon, that the interpreter changes the piece quite drastically, for example in theatre. In music, it is very rare that cuts or other drastic changes are made to the finished artwork, just as it would be considered heresy to alter da Vinci's

Mona Lisa. The work to save the premiere of *Dissolution* gives a good example of why such an intervention on behalf of the interpreter might be questionable.

The collaboration on *Bifurcation in a Continuous System* on the other hand was a strictly technical one in that the performer received a score and a Max/MSP patch and replied by expressing needs or wishes for improvement. The composer then changed the interface himself or asked the programmer for help. Here the performer stayed strictly in his field of expertise, which is playing instruments, and could give sound information of what the interface of the patch has to accomplish. The composer on the other hand was in full control of the aesthetic decisions and relied on external expertise to build the instrument that the performer was then to play.

The differences between the joint work of Scott McLaughlin and I on the two compositions could, according to Dillenbourg et al., be described as the difference between collaboration and cooperation. Following this definition cooperative work is 'accomplished by the division of labor among participants, as an activity where each person is responsible for a portion of the problem solving...'[240] and collaboration as '...mutual engagement of participants in a coordinated effort to solve the problem together'.[241]

It is not the intention of this chapter to indicate that an aesthetic collaboration between composer and performer does not work. It constitutes a different kind of work and the collaborative work on *Dissolution* failed because it was not planned as such. The cooperation on *Bifurcations in a Continuous System* on the other hand worked perfectly. However, the making of the final score for a premiere seems often to be viewed as collaboration between composer and performer and the section on this composition tries to show that the responsibility to deliver all the information on a composition in a comprehensive and coherent manner lies squarely with the composer. It is nonetheless the experience of the author that this information is often scattered in numerous e-mails or transmitted orally outside the rehearsal space, which sometimes results in mistakes in the performance.

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[240] Dillenbourg et al., "The Evolution of Research on Collaborative Learning," in *Learning in Humans and Machines: Towards an Interdisciplinary Learning Science*, ed. Peter Reimann and Hans Spada (Oxford: Pergamon, 1995), 189f.
[241] Ibid.

3.7 Dodo Schielein: N381

N381[242] is a composition by Dodo Schielein from 2008. Dodo Schielein is a composer from Hamburg and having heard and seen several compositions by her, I asked her to write a piece for piano.

N381 is described as for 'Klavier solo'.[243] After several months of discussing a piece and its notation, I received a score of five separate sheets and a cover.

3.7.1 Condition of the material (score and electronics) upon delivery

The composition is characterized by the exclusive focus on the sound of the mechanics of the piano. This means that, although the pianist plays at all times on the keyboard, at no time in the piece does a hammer touch a string: 'The intention of N381 is therefore *not* to let the piano sound.'[244] The sounds produced by the mechanics are naturally very quiet and therefore demand amplification. At the date of delivery, the amplification was regarded not as an integral part of the piece though but as a mere means by which to make the piece heard.

3.7.2 Genesis of the material / Assessment of the problems

N381 has a predecessor in a piece for amplified ensemble and video projector from 2004 called *Fluida.*[245] In this piece, commissioned by the Ensemble Zwischentöne and their leader Peter Ablinger in 2004, the players play the instruments as *piano* as possible and the noises generated by the instruments are amplified and dispersed into the room. For this piece, the composer could rely on the expertise of the technical team at the Ballhaus Naunynstraße in Berlin, where the piece was premiered.

N381 was composed in the composer's home on an electro-mechanic piano, a Yamaha CP-80. The Yamaha CP-80 has the same action of a grand piano with hammers hitting vertically arranged strings. Since *Fluida* worked well and the sounds for *N381* are similar, amplification was not deemed difficult to do.

3.7.3 Working with the material

After learning the composition, a technical rehearsal was undertaken with a grand piano and amplification. In this setting the microphone was attached to a microphone boom and hung inside the piano over the dampers. Some feedback did occur but could be controlled with the right

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[242] Dodo Schielein, *N381* (Manuscript, 2007).
[243] Ibid.
[244] '*Im Stück N381 geht es also darum, das Instrument gerade nicht erklingen zu lassen.*' Violeta Dinescu, ed., *Begegnungen - mit Musik unserer Zeit* (Saarbrücken: Pfau, 2011), 311.
[245] Dodo Schielein, *Fluida* (Manuscript, 2004).

microphone setting and finding a suitable amplification level. A digital tool for preventing feedback[246] proved to be efficient but added too much colouring to the sound. It was taken with us though as a backup to the planned premiere on August 8, 2009 at the Leibniztempel in Hannover/Germany.

Unfortunately, due to the open-air location and the strong wind that day the premiere did not take place. A more in depth analysis of the concert organization and the reasons leading up to the cancellation can be found in 4.2. The mishap made clear though that not only had the location of the concert posed problems: pianist and composer agreed that more research into the amplification would be necessary in order to reach a set-up that could be done without the help of a seasoned technician.

Advice by a sound engineer and availability of these microphones led to a choice of miniature microphones[247] with which the composer and I tried out different positions on two grand pianos and professional amplification. The long time experimenting with the now proficient means resulted in the microphones lowered right between the hammers into the mechanics and almost onto the soundboard. There the miniature microphones, now working more like a sonic microscope than mere amplification, bring out a much broader palette of sounds that could not possibly be heard using a microphone on a boom. This means that the aesthetics of the piece have somewhat changed and the piece should probably be described to be 'for amplified piano' now.

3.7.4 Current state of the material

The score is now complete with the music and a tech rider and can be passed on to other performers. However, it has not been premiered yet and the description of the sound resulting from the amplification in the tech rider is somewhat different from what I remembered to be the 'result' of the tryout. However, this is part of the process of developing the piece and it is likely that the composer will have to hear it again before being able to make a final decision.

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[246] A Behringer Shark DSP110.
[247] A DPA *IMK4061*.

Vorbereitung für **N381**
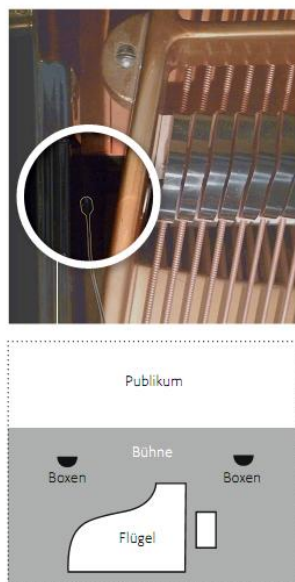
Um die leisen Klänge des Klavierstücks N381 hörbar zu machen, muß das Instrument tontechnisch verstärkt werden. Dafür eignet sich am besten ein „DPA IMK 4061 Omni-directional, Lo-Sens" Mikrofon, da es sehr klein ist und für den Klavierklang optimiert wurde.

Die Platzierung des Mikrofons befindet sich links am Bass-register zwischen dem Gussrahmen und dem Flügelkorpus (siehe Abbildung). Dabei soll der Mikrofonkopf nach unten zeigen und kurz über der Mechanik hängen, so dass er nicht von den Hämmern beim spielen berührt wird.

Zur Fixierung des Mikrofon-Kabels kann am Gussrahmen der Magnethalter des Mikofons oder ein Klebestreifen verwendet werden.

Das Monosignal soll auf zwei Boxen verteilt werden (Position der Boxen, siehe Zeichnung).

Mit Hilfe eines Mischpults wird das Soundsignal so ausgepegelt, dass keine Rückkupplungen entstehen (d.h. die Verstärkung soll den Klängen im Raum eine zarte, aber klare presens verleihen).

Während der Aufführung bleibt der Flügeldeckel offen.

Figure 22: Set-up for *N381* by Dodo Schielein[248]

3.7.5 Discussion

Only a rudimentary tech rehearsal and no tech rider – it would be easy to dismiss the turbulent history of *N381* as one of neglect and incompetence. However, since both things happen quite regularly for various reasons this is no sufficient explanation and the situation needs more investigation into why a seemingly unprofessional attitude is employed. Alongside *N381* by Dodo Schielein, three other pieces will be examined: *daily songs 1* (2006/07) by Michael Maierhof,[249] *Karaoke exotique* (2007) by Alan Hilario[250] and *Piano Grinds* (2011) by Chris Ruffoni:[251]

- *Daily songs 1* uses miniscule vibrations of single piano strings as exciter for vibrations of several objects like plastic cups. These vibrations worked well on the composer's own grand piano and reasonably well on that of the performer. Unfortunately, it did not work at all on a grand piano at Hamburg's Kampnagel, where the piece was premiered in 2007. A subsequent

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[248] Reproduced with kind permission of the author.
[249] Michael Maierhof, *daily songs 1* (Manuscript, 2006).
[250] Alan Hilario, *Karaoke Exotique* (Manuscript, 2007).
[251] Chris Ruffoni, *Piano Grinds* (Manuscript, 2011).

recording at the Hessischer Rundfunk in Frankfurt was cancelled because it just could not be guaranteed beforehand that the piece would work on that piano.

- *Karaoke exotique* was scheduled to be premiered at the same concert in Hamburg. In this piece, the performers are asked to amplify miniscule sounds from the piano with microphones, which are on the other hand also used to produce feedback by holding them in the direction of nearby speakers. Since the sounds from the piano were so quiet the microphones had to be amplified strongly, which led inevitably to constant feedback. The piece was cancelled for technical reasons on the afternoon of the concert and has not been performed since.

- *Piano Grinds* was premiered in the fall of 2011 using a new Steinway D model. The composition uses a children's lap harp, which is played with an e-bow.[252] Since the harp is lying on the strings of the piano, its vibrations are transferred onto the piano, which then starts to drone colourfully. This set-up has been tested on several minor grand pianos and it was therefore unexpected that it would not sound as good on the biggest and newest instrument in a reverberant hall.

In *daily songs 1* and *Piano Grinds* the physical interaction between the playing on the strings (inside the piano) and the reactions of the piano as a whole are different from instrument to instrument. Performers of immobile instruments like grand pianos and organs deal for centuries with the differences between instruments and find a way to make up for their individual shortcomings. These pieces are different though in that it is impossible for the performer to make up things that just do not work and are thus comparable to playing on a defective instrument. If the possibility of a crash reminds one of certain works by Alvin Lucier – e.g. *Clocke*r,[253] which is controlled by a galvanic skin response sensor (GSR),[254] or *Music for Solo Performer,*[255] which is controlled by an EEG and where Lucier himself says that 'I was determined to make a live performance work despite the delicate uncertainty of the equipment, difficult to handle even under controlled laboratory conditions'[256] – it is important to remark that the crash is likely a result of the performer not being able to control their emotions on stage in such a way that a state of deep relaxation is reached. However, this is

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[252] An E-bow is a hand-held device mostly used by Guitar players which emits an electromagnetic field exciting the strings without touching them.

[253] Gisela Gronemeyer and Reinhard Oehlschlägel, eds., *Alvin Lucier - Reflexionen/Reflections*, MusikTexte 003 (Köln: Edition MusikTexte, 2005), 450ff.

[254] 'A GSR is designed to measure differences in skin resistance caused by changes in emotional state.' Cp. booklet for Alvin Lucier, *Clocker* CD (Lovely Music, 1994).

[255] Gronemeyer and Oehlschlägel, *Alvin Lucier - Reflexionen/Reflections*, 294.

[256] Anne Welmer and Peter Adriaansz, *Everything Is Real: Alvin Lucier in Den Haag* (Amarillo: TAG Publishing, 2010).

equivalent of a performer making a mistake in a performance and not to a set-up not working. Compositions where it is just not clear if the intended results are feasible on the majority of instruments seem to be a relatively new development.

The situation with *Karaoke exotique* by Alan Hilario is different from the above: here the composer sees himself as the 'inventor' of the music but not responsible for the technical feasibility. Similar to Alvin Lucier, who has always had technical support to realize his ideas such as that provided by the ingenious Nicolas Collins, Alan expected a studio or the performers to realize the electronics required to perform the piece. Since the composition was commissioned by a duo consisting of a singer and a pianist this support could not be provided and effectively fell through. It is therefore interesting to see that neither of the parties, neither the performers nor the composer, felt the responsibility to care for the electronics.

The same thing happened with *N381* where the performer expected the composer to come up with a viable way to amplify the piano and the composer possibly thinking that this is the job of the performer. We can see that even in the case of simple amplification there is a hole in the chain of responsibilities because the usage of electronics creates a new task and the traditional division of labour between composer and performer does not hold anymore.

3.7.6 Conclusion

Whether it is pieces that cannot be played on every instrument – and it remains to be seen if *N381* falls into this category – or the gap in responsibility regarding the realization of the composer's intentions, these are undefined areas where the involved persons behave perfectly reasonably and professionally but whose actions nonetheless can lead to a catastrophic result. Since there is no immediate solution to this the only direct response is to be aware that even the slightest need for electronics can pose problems that fall out of the general work routine and therefore this needs to be discussed extensively between the parties.

3.8 Hans Tutschku: Zellen-Linien

Zellen-Linien[257] is a composition for piano and live-electronics by Hans Tutschku, composition professor and director of the electroacoustic studios at Harvard University. It was commissioned by the festival Inventionen for the wave field synthesis array at the Technische Universität Berlin. The piece was premiered in July 2008 at the opening concert for the Sound and Music Computing Conference, which was held in conjunction with the festival that year.

Having asked Hans Tutschku about an earlier piece of his for piano and electronics called *Das bleierne Klavier*[258] a collaboration on the new piece for this concert, which was not written yet, was agreed upon.

3.8.1 Condition of the material (score and electronics)

As in the cases of Schielein (cp. chapter 3.7), McLaughlin (cp. chapter 3.6) and essentially Finnendahl (cp. chapter 3.4), *Zellen-Linien* was not a finished piece but a composition in the making. While writing the piece Hans Tutschku sent small fragments by e-mail and little by little the whole score arrived to practise with. During this time, the electronics were coded by the composer but I did not hear the whole piece before the first rehearsal, which happened a few days before the concert in Berlin. There we had extensive musical and technical rehearsals adapting the patch to the large hall where the wave field synthesis array was situated. Due to the meticulous planning of Hans Tutschku, everything went smoothly and the piece was successfully premiered.

After the premiere, the score and the patch were revised by Hans Tutschku, and after a few more rehearsals, the piece was ready to be played without the composer's presence.

Zellen-Linien uses a Max/MSP patch, a sustain pedal to control the patch, and a piano which is captured by two microphones. The patch for the piece evolved gradually to the current version 1.27,[259] which is a Max 5 application: this, as well as a version for PPC Mac and a Max 4 application guaranteeing backward compatibility, are supplied on the composer's website. A version for Windows computers, which proved to be more difficult to install, was taken off the website once I – having obviously been the only performer using Microsoft Windows – changed to Mac OS X as music production platform.

The score, also downloadable from the website, is provided in .pdf-format containing a very extensive section on how to set up the electronics in different settings (4-, 6- and 8 channel) complete with schematics and a list of preferred machinery like Neumann KM 184 microphones.

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[257] Hans Tutschku, *Zellen-Linien* (Manuscript, 2007).
[258] Hans Tutschku, *Das bleierne Klavier* (Manuscript, 1999).
[259] As of April 2012.

With this information, a seasoned sound engineer can provide a microphone with the desired characteristics. For practising purposes, a stereo version can be easily set-up.
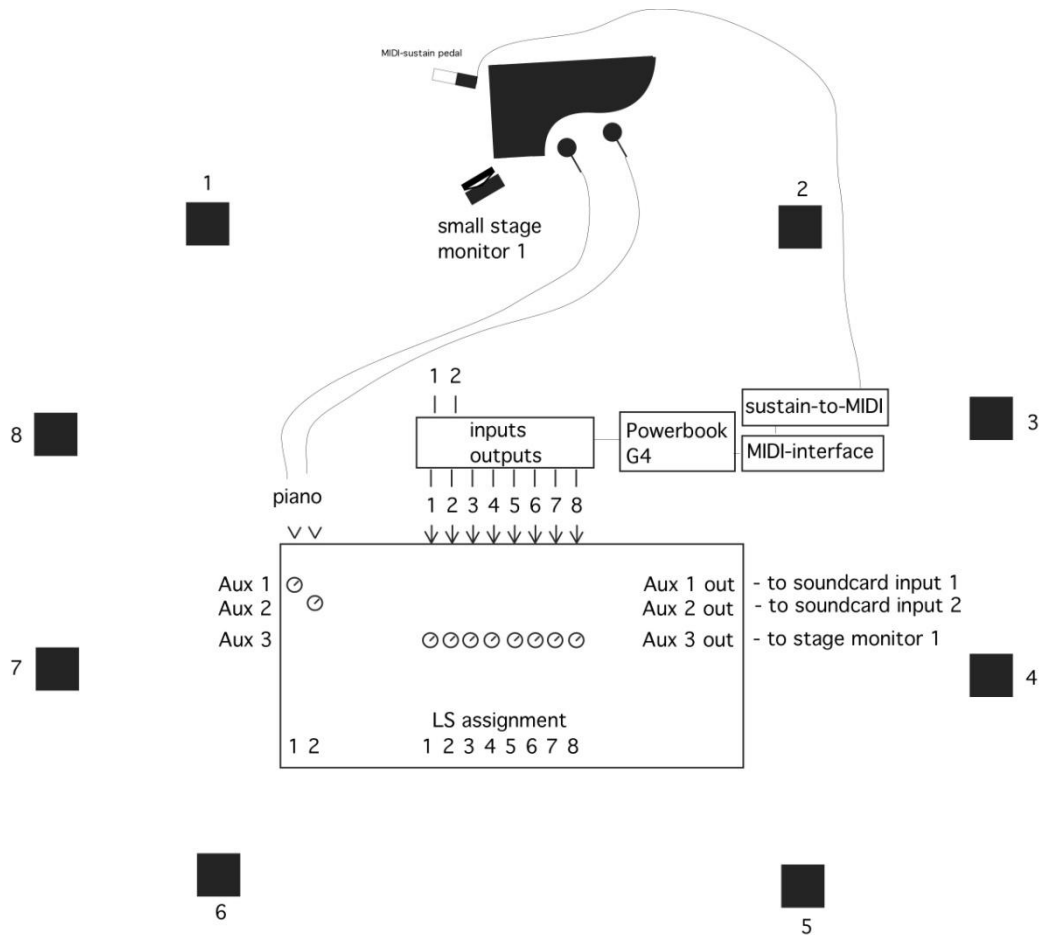
Figure 23: Set-up for *Zellen-Linien* by Hans Tutschku for a performance with eight loudspeakers[260]

Once the hardware is set up, the patch opens with a foolproof walk-through in nine steps, including considerate items such as test signals, pedal polarity and tuning. Figure 24 depicts the patch with the set-up walk through on the left side and the spatial movement of the sound (here in a 4-channel set-up) on the lower right side. Additional windows show the current and the next (prepared) event in large numbers, doubling the information in the main patch window. Once the loudspeakers and the mixing console are ready, the set-up time of this composition, which features a multitude of live-electronic techniques and effects, is about 15 minutes.

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[260] Figures 23 and 24: Reproduced with kind permission of the author.

Overall, we can say that the provision of the patches and the score as well as the set-up routine can only be called exemplary.
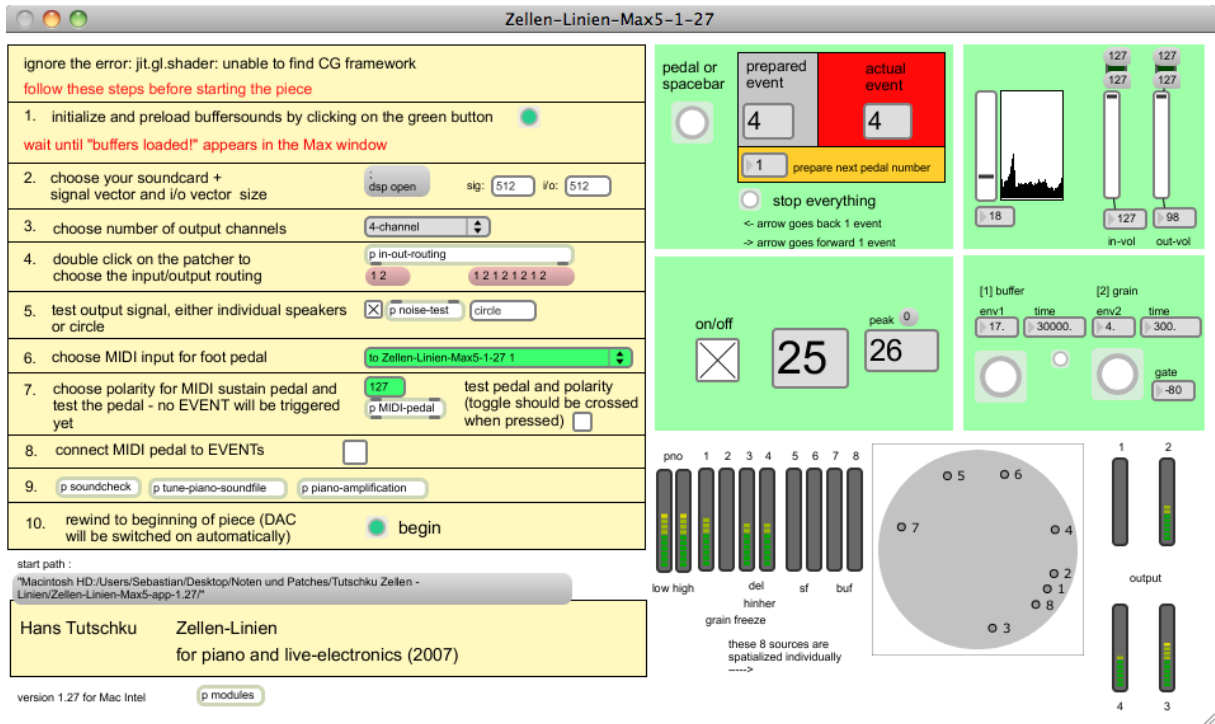
Figure 24: Max 5 application for Zellen-Linien with the walk-through for the set-up

3.8.2 Working with the material

The set-up of *Zellen-Linien* is that of a pianist whose piano is picked up by two microphones and the signals are processed by a Max/MSP patch. This patch is remote controlled by a foot pedal, with which the pianist signals the computer to advance to the next setting. If we compare the piece with the other compositions employing computers so far discussed the differences between them might appear subtle, but the effects on the pianist are pronounced:

- Enno Poppe's *Arbeit* uses a virtual instrument and for the performer it is as if they were playing a keyboard with an organ sound, although one tuned in six tones per halftone.

- *Dissolution* by Scott McLaughlin produces a sound wall from which the pianist little by little carves out frequencies, using first the score and then the ears only. The patch is left untouched throughout the piece.

- Richard Festinger's *Head over Heels uses* a Max patch, which controls a synthesizer. Although the patch uses some randomized patterns to vary the notes the synthesizer is playing, the amount of variability is reduced and the part of the synthesizer is notated. The score thus looks like that of a duo.

- *Bifurcations in a Continuous System,* again by Scott McLaughlin, uses a pedal and a MIDI keyboard to control the computer, albeit without making use of the pitch information of the keyboard. The pitches result from the speed with which the performer is playing. Although this is unusual, the score is so easy to play that the player can follow what is happening in the electronics. The performer therefore controls the playing with the ears, listening to the pitches that result from the playing speed.

- The electronics in *Wheel of Fortune* by Orm Finnendahl are, like in the patch by Hans Tutschku, the result of most sophisticated programming. The interaction between player and computer system is extremely close and indeed bidirectional: the use of Markov chains for example means that the computer is directly reacting to the input from the performer. The computer then prints music in real-time for the performer to react to. From the players' perspective, the rules by which the computer acts are easy to understand. Furthermore the performer actively decides when to go on to the next part, and 'tells' the computer to go on – this is very different from trigger signals integrated in the score. Finally the piece makes use of a MIDI piano and is thus a hybrid between a piece for keyboard and computer and a piece for piano and live-electronics.[261]

In all the above cases, the pianist knows very well how the computer will react. However, in *Zellen-Linien* it is unclear to the pianist what the computer will do and considering the density of the electronics it would also be very difficult to notate. Pierre Boulez's notion of making the computer react to the player and not the player to a tape[262] is solved in this piece very elegantly by elaborate algorithms, with which the player controls the computer. Using the foot pedal, the pianist enjoys indeed a lot of freedom while interpreting the piece. Nevertheless, the computer remains a black box and the player has to learn the reactions from the computer by playing the piece often. This detachment between the player and the electronic part stands in the IRCAM tradition of pieces like *Pluton* by Philippe Manoury[263] or *...explosante-fixe...* by Pierre Boulez.[264] It differs from these two pieces though in that they require an additional dedicated sound engineer as performer and interpreter of the piece. It must be made clear therefore that *Pluton,* which is described to be *'pour piano et dispositif électroacoustique en temps réel'*[265]*,* is indeed a duo for performer and sound engineer and that the sound engineer in *...explosante-fixe...* acts as full member of the ensemble. Tutschku, in line with his solo performances of *Das bleierne Klavier,* endeavoured to write a piece for

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[261] If we use live-electronics in the strict sense that sounds from an instrument are being processed in real-time by a computer.

[262] 'I had had bad experiences myself in the 1950s with electronic technology. If you did something electronic [as a composer], you had something on tape. Then [as a performer] you had to follow the tape; you were absolutely squeezed into coincidence with the tape. It was completely detrimental to the performance. Therefore I pushed the research in IRCAM towards live electronics and live computer systems, so that the computer would be geared towards the concert situation, so that the computer would have an instant response to the performer.' Pierre Boulez, Andrew Carvin, and Joshua Cody, "Boulez Interview," *Paris New Music Review*, n.d., accessed 6 April 2012, http://www.paristransatlantic.com/magazine/interviews/boulez.html.

[263] Philippe Manoury, *Pluton* (Paris: Durand, 1988).

[264] Pierre Boulez, *...explosante-fixe...* (Vienna: Universal Edition, 1991).

[265] Manoury, *Pluton*.

solo performer who can set-up and perform the piece with the help of a sound engineer, but not necessarily as a rehearsed musical duo.[266,267]

3.8.2.1 'The forgotten pedal'

However, one problem remains and it leads to the miserable situation that the playing of the performers on stage now needs to be checked and corrected by another person. It is described by Hans Tutschku as 'the forgotten pedal': 'The forgotten pedal seems to be in the nature of things and happens time and again – not only in my own composition but also in performances of other pieces that use a pedal.'[268] It has thus become common practice that the composer or a sound engineer sits in front of the computer to check if the performer on stage triggers the pedal correctly – a situation belittling the performer and detrimental to the original idea, that the musician on stage controls the performance just as a player of an analogue instrument does.[269] Since it is 'the nature of things' that performers, who are experts in delivering trained processes, forget to depress foot pedals it must be found out *why* they do so.

First, it is of note that performers do not forget the pedals in every piece but only in some. Speaking from my own experience the pieces where I forget the pedal are for example that of Hans Tutschku, Per Bloland's *Elsewhere is a Negative Mirror*[270] and *Of Dust and Sand,*[271] Ali Gorji's *Irrealis*[272] and Maximilian Marcoll's *hundert rahmen, hochkant.*[273] However, I do not forget the pedal in *venus_5* by Martin Schüttler[274] or the above named *Arbeit* and *Aitsi* by Poppe and Scelsi. Why is that so?

Researching difficulties in musical man-machine interfaces, Tychonas Michailidis and I found that

> the relationship between a performer and their acoustic instrument is bidirectional.[275,276,277] Physical interaction with instruments allows performers to express and

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[266] If we make a distinction between a single rehearsal and the long term process of practicing and rehearsing a composition for performance.

[267] *Un clou, son marteau, et le béton* by Pierre Alexandre Tremblay (Pierre Alexandre Tremblay, *Un clou, son marteau, et le béton* (Manuscript, 2008).) is another example of a live-electronic piece for soloist and computer, which can be performed like this.

[268] *'Das vergessene Pedal scheint in der Natur der Sache zu liegen und passiert immer einmal - nicht nur in meiner eigenen Komposition sondern auch bei Aufführungen anderer Stücke, die ein Pedal verwenden.'* Hans Tutschku in a personal communication by e-mail on March 26, 2009.

[269] We will not go into detail here about the general problem that the on stage performers in electroacoustic music have more or less lost the acoustic control over the music since the sound is most often controlled from the FOH. This pressing issue needs further research at another time.

[270] Per Bloland, *Elsewhere Is a Negative Mirror*, Manuscript, 2005.

[271] Per Bloland, *Of Dust and Sand* (Manuscript, 2012).

[272] Ali Gorji, *Irrealis* (Manuscript, 2005).

[273] Max Marcoll, *hundert rahmen, hochkant* (Manuscript, 2005).

[274] Martin Schüttler, *venus_5* (Manuscript, 2002).

[275] Chris Chafe, "Tactile Audio Feedback," in *Proceedings of the International Computer Music Conference 1993* (presented at the International Computer Music Conference 1993, Tokyo: International Computer Music Association, 1993), 76–79.

understand music based on the nature of the instrument. Through instrumental practice, the performer is able to learn and internalize the responses inherent in the mechanical production of sound. The instrument reacts to the energy it receives from the performer by producing both audible and tactile feedback. Instrumental feedback and the way it responds influence the quality and the expressivity of sound.[278] However, current electronic musical input devices, instruments and interfaces lack the ability to provide similar haptic feedback to the performer. The missing feedback information introduces practical problems in performances and compositions of live electronic music.[279]

The missing feedback is not only apparent when practising the music without the electronics but also when playing with the electronics, since the foot pedal might not trigger immediate audible information or no audible information at all – for example when the foot pedal is triggering the start of a recording sequence inside the computer program. If we consider that music is memorized by ear (aurally), sight (visually) and touch (kinaesthetically)[280,281,282,283] then it becomes clear that the mere pressing of a foot pedal is a hollow action since only the kinaesthetical strategy can be used.[284] What is more, trained concert pianists – as opposed to beginners – rely on kinaesthetical memory the least, as research by Linda Noyle[285] shows. What seems to be the simplest activity – the pressing of a foot pedal – is therefore conflicting with professional performance practice.

It would lead too far away from the topic of this study to go further into the matter of the psychology and methodology of learning music. But if we agree on the following statement by the eminent

[276] Sile O'Modhrain and Chris Chafe, "Incorporating Haptic Feedback into Interfaces for Music Application," in *Proceedings of ISORA* (presented at the World Automation Conference, Maui: World Automation Conference, 2000).

[277] A. Tanaka, "Musical Performance Practice on Sensor-based Instruments," in *Trends in Gestural Control of Music*, ed. Marcelo Wanderley and Marc Battier (Paris: Ircam, 2000).

[278] N. Castagne et al., "Haptics in Computer Music: a Paradigm Shift," in *Proceedings of EuroHaptics 2004* (presented at the EuroHaptics 2004, Munich: EuroHaptics Society (EHS), 2004).

[279] Tychonas Michailidis and Sebastian Berweck, "Tactile Fedback Tool: Approaching the Foot Pedal Problem in Live Electronic Music," in *Proceedings of the International Computer Music Conference 2011* (presented at the International Computer Music Conference 2011, Huddersfield: International Computer Music Association, 2011).

[280] Tobias Matthay, *Musical Interpretation: Its Laws and Principles, and Their Application in Teaching and Performing* (Boston Music, 1913).

[281] Tobias Matthay, *On Memorizing and Playing from Memory and on the Laws of Practice Generally* (Oxford University Press, 1926).

[282] Edwin Hughes, "Musical Memory in Piano Playing and Piano Study," *The Musical Quarterly* 1, no. 4 (1915): 592–603.

[283] Walter Gieseking and Karl Leimer, *Piano Technique* (Mineola: Dover, 1972).

[284] I omit recent research into the importance of analyzing the musical material for memorizing since this technique does not replace the former. Cp. Rita Aiello, "Memorizing Two Piano Pieces: The Recommendations of Concert Pianists," in *Proceedings of the Sixth International Conference on Music Perception and Cognition* (presented at the International Conference on Music Perception and Cognition, Keele: Keele University Department of Psychology, 2000).

[285] Linda J. Noyle, *Pianists on Playing: Interviews with Twelve Concert Pianists* (Lanham: Scarecrow, 1987).

Austrian music theorist Heinrich Schenker: 'Assuming knowledge and mastery of the instrument, the study of significant, good compositions must begin immediately with their expressive performance'[286] then it is easy to see that this ideal is hard to reach when the mere manual action of pressing a pedal without any feedback is practiced. In fact, this also holds true for the common usage of a keyboard player with a muted MIDI keyboard to trigger the electronics in pieces for ensemble and electronics like in Tristan Murail's *Winter Fragments.*[287] Here the keyboard players are completely reduced to pressing a button at a certain time without performing or interpreting. This is not only in contrast to their self-image as musicians but these rather easy scores are surprisingly also very stressful to play, because the performer needs to imagine playing a real instrument in order to be able to perform the task.

We can now answer the question, why performers do not 'forget' a pedal in some compositions but in others: In *Arbeit, Aitsi* and *venus_5* the pedal triggers an immediate sonic result and therefore feels like an extension to the instrument. In the pieces by Marcoll, Bloland and Gorji though using the pedals feels more like clicking a computer mouse: Everyone who has ever used a mouse and sees the computer not immediately reacting to the click knows how irritating this can be and how often this leads to clicking the mouse again.[288] The argument is enhanced when realizing that in *venus_5* by Martin Schüttler the pedal is used as an effects pedal and a keyboard as controller for the computer: Here it was not the pedal that was forgotten, but the *record* key on the keyboard.

Figure 25: A keyboard set up for *venus_5* by Martin Schüttler

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[286] Heinrich Schenker, *The Art of Performance* (Oxford University Press, 2000), 75.
[287] Tristan Murail, *Winter Fragments* (Paris: Éditions Henry Lemoine, 2000).
[288] An example is clicking on a file to open it and clicking on it again when the computer does not react immediately, only to be prompted to rename the file.

3.8.2.2 Approaches to the problem

Oftentimes it is not clear if it is the performer who does not press the pedal or if it is the computer that does not receive or correctly process it. In order to get at least some confirmation from the foot pedal that it was depressed, I soldered an LED light to the switch. A cable was attached to the mechanism inside the foot pedal that would end in an LED light getting the energy from a nine-volt battery. The LED lights up as long as the foot pedal is pressed. The cable itself is long enough to be positioned anywhere inside the piano or the music stand.

Figure 26: Sustain foot pedal off

Figure 27: Sustain foot pedal on

However, the attempt proved futile. Although the LED lamp is quite bright (and using a brighter lamp would result in glaring), I could not see the lamp in my peripheral vision and had to concentrate on looking at the light when pressing the pedal. Since it is not always possible to look at the light in the moment of pressing the pedal, for instance in dense piano passages, this method did not work.

Using computer screens where the information is displayed in bigger letters works better: Having played a few concerts with a computer screen standing right next to the piano's music stand proved to work better than the small light, because the information was displayed longer and I had the time to check on the screen when I was not busy looking at the score or the fingers. Nevertheless, it remains an unmusical task to check if the printed number in the score is the same as the one that is displayed on the computer screen.

A solution to this could be a vibrating pedal. Although this does not fulfil all three reactions we expect an instrument to give (aural, visual, and haptic),[289] it does at least give immediate feedback on its activation without the need to look somewhere else. Tychonas Michailidis[290] and Lauren Hayes[291] are currently researching the feasibility of such devices, both unfortunately not yet in a state in which they can be handed over to others.[292]

3.8.3 Summary and Conclusion

Hans Tutschku's preparation and deployment of *Zellen-Linien* is as good as it currently gets. The patch can be set-up in little time, it has been tested on many computers and everything is readily downloadable from the internet and can be installed without further conditions and dependencies. The tech riders are complete and the piece can be set-up in multiple settings (4- , 6- and 8 channel) as well as practiced with a stereo patch. Although the patch cannot be opened for editing in case of something unexpected happening,[293] it is probably too complicated to be quickly changed anyway. Finally, I found Hans Tutschku extremely open to ideas on how to improve the patch and to be prompt investigating reports on malfunctions of the patch.[294]

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[289] We demand the same threefold reaction from other man/machine interfaces for example like car blinkers and the computer mouse as well.

[290] Michailidis and Berweck, "Tactile Fedback Tool: Approaching the Foot Pedal Problem in Live Electronic Music."

[291] Lauren Hayes, "Vibrotactile Feedback-Assisted Performance," in *Proceedings of the International Conference on New Interfaces for Musical Expression 2011* (presented at the International Conference on New Interfaces for Musical Expression 2011, Oslo, 2011).

[292] Tychonas Michailidis' device is still unreliable and Lauren Hayes' device is too closely connected to her own Max/MSP patches.

[293] The patch is provided as application only.

[294] E.g. after the author reported a pedal double-triggering malfunction which subsequently led to patch v.1.21. Currently a way to inconspicuously test the set-up after loading the patch and starting the performance is being discussed.

However, the problem of the performer not being able to control the performance remains in this piece as vivid as ever and not only because the performer does not sit in the acoustic *sweet spot*. The issue at stake is that the performer controls the computer in such a way that it is not clear for the performer if the computer has actually received that information. This is especially problematic since an unsuccessful operation of the electronics is often much more damning for a performance than for example the playing of a wrong note. Whereas the playing of a wrong note is a momentary lapse and immediately vanishes into the past, the non-triggering of the start of a recording has consequences for the future course of the piece. Since it is common that the performers on stage miss a cue, they are now checked by someone at the mixing console, which very much undermines the intended idea to free the performer.

Having a computer monitor on stage to confirm the pressing of the foot pedal proved assuring. Although not always in a position to check the pedal press at the moment of pressing, it can be checked at other places and gives the performer a feeling of security. It must be said though that the checking of the computer screen gave at least one member of the audience the feeling that, since I was looking at the screen, something must have gone wrong. More research is required here before a conclusion can be made.

Playing with a vibrating pedal, which unfortunately could so far only be tested in rehearsals, was another reassurance, which felt very natural and the development of such a pedal would be very promising.

If a score follower like *antescofo*[295] is indeed the ultimate solution remains to be seen. Here again the performer can only guess what the computer duo partner is actually doing. This means that the computer does not take the role of the fourth member of a string quartet but more like that of an improvisation partner. Nevertheless, these are probably thoughts that will only persist until we look at computers as persons in their own right, like *HAL 9000* in Stanley Kubrick's *2001: A Space Odyssey.*

Summing up it can be said that *Zellen-Linien* works and it works very well: it is played extensively by many performers who frequently reprogram it. This owes not only to it being a musically and pianistically compelling piece but also to a great part to the thought that Hans Tutschku gave to enable performers to practice and set-up the piece easily. At the same time, it must be said that the above-described troubles describe the state of the art today and where we are in the quest to enable the performer to play with electronics just as they can with a chamber music partner. More research

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[295] Arshia Cont et al., *Antescofo~* (IRCAM, 2007).

needs to be done until we find a good way for live-electronics to be convincingly controlled from the performers on stage.

4 Concert Organization

In this thesis, I define *concert organisation* as the process of grouping compositions together, organizing the set-up and performing them in a sequence. Organizing the set-up requires for example listing all the devices needed, writing a tech sheet, drawing a stage plot and making sure all the technical information that is needed for the venue to prepare for the concert is transmitted. It includes the set-up process itself as well.

Oftentimes, a specific programme is only played once, which means that the set-up of the day is often the first time the composition is being played in these very circumstances. Most often, a concert will be set up in the hours before the concert, which makes it crucial that everything works right away. This is important not only because there is no time for error but also because the performers need to concentrate on the performance.

In this chapter several concerts employing live-electronics that were played during the course of the study are examined. In all cases, it was believed that the concerts were well-planned. If something nonetheless went wrong, and in the first concerts many things did, the ultimate factors as to why these mishaps occurred were sought. Wherever possible the Why-Because Analysis (cp. chapter 2.3.2.) was employed, because all too fast a judgement can be made on why a concert failed without thoroughly examining the real cause. What is being sought out are therefore not the errors of individuals but misconceptions or incorrect assumptions made in the preparation of the concerts which were all planned and executed by experienced personnel.

The concerts are being discussed in chronological order, with chapters 4.1 to 4.4 outlining the journey toward a method that would allow concerts to be set up without stress, 4.5 employing this method and 4.6 showing the boundaries of what at this time one performer alone could do and where reasonably the help of additional personnel must be called in.

If the description of the mishaps sometimes appear lengthy, like the meticulous description of a search for drivers for a MIDI interface on the internet, this is done to make clear that these are not only singular mishaps but happen frequently.

As a reminder, it must be said that there is basically no excuse for a failed concert. The ominous computer error is only an explanation, but cannot be the reason why a concert is not played with the same flow of an acoustic piano recital. The aim is to make concerts failsafe, not only in the sense that all compositions that are programmed on that date are played but also that everybody involved is as relaxed and focused on the music as possible, without the hassle of solving hard- or software failures. Solving failures with the electronics must be equivalent to a classical musician's instruments

constantly breaking and it is probably understandable that such a situation is unacceptable for both the musicians and the listeners.

4.1 University of Huddersfield, Phipps Hall, 22.01.2009

4.1.1 Organization / Timeline

For my first concert in the context of my studies at the University of Huddersfield, I chose a programme with four different kinds of electronics: live-electronics; piano and tape; piano and cheap analogue devices; and virtual instrument with video. I had played all the compositions numerous times and although I considered the concert not entirely easy to set up because of the many devices needed, it did not seem to be a risky set-up either.

The concert itself went seamlessly and the programme order was like this:

Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics[296]

James Saunders: *#220109* (2003) for piano, CD, e-bow and Dictaphones[297]

Maximilian Marcoll: *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.* (2007) for piano and recordings[298]

Terry Riley: *Keyboard Study #1* (1966) for keyboard with an added video by Jan-Peter E.R. Sonntag[299,300]

Although the concert went without problems the preparation for *Keyboard Study #1* in the days before the concert proved to be much more difficult than expected and forms the basis for the analysis.

Keyboard Study #1 and *Keyboard Study #2*[301] by Terry Riley are two compositions from 1966. When I was first asked to play the pieces in a concert in 2000 not much information was available on the internet and only two recordings of the pieces existed at that time, albeit only of the second study: Terry Riley playing on a reed organ on his very first LP – of which only 1000 copies were printed[302] –, and a recording of the *Keyboard Study #2* by Gerard Frémy and Martine Joste on the BYG label.[303] When I bought the score in 1999, the music was only available from a now defunct one-man publishing house in Cologne which sold the photocopied sheet music on behalf of Terry Riley. This

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[296] Tutschku, *Zellen-Linien*. Cp. chapter 3.8
[297] James Saunders, *#[unassigned] - Version for Sebastian Berweck* (Manuscript, 2003).
[298] Maximilian Marcoll, *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.* (Manuscript, 2007).
[299] Terry Riley, *Keyboard Study #1* (Manuscript, 1966).
[300] The video by Berlin artist Jan-Peter E.R. Sonntag was commissioned in 2004 for a performance of the same piece at the Hamburg Planetarium.
[301] Terry Riley, *Keyboard Study #2* (Manuscript, 1966).
[302] Terry Riley, *Organ of Corti 2 - Reed Streams* LP (Mass Art., 1966).
[303] GERM, *Keyboard Study 2 / Initiative 1 (+ Systèmes)G* LP (BYG Records, 1968).

score from 1999 looks partially different from the score that can be bought today from Schirmer,[304] though the content seems to be the same.[305]

The composition consists of patterns that span over a ninth between d-flat and e-flat' and the tempo is 'AS FAST AS CAN BE COMFORTABY [sic] PLAYED'.[306] In an attempt to interpret the pieces on modern equipment I programmed a Kurzweil K1000 synthesizer[307] for easy playing. In order to be able to play the Keyboard Studies very fast I split the keyboard at f' and transposed the upper part two octaves lower. As a result, the right hand is comfortably situated two octaves higher on the keyboard than the left hand, but is actually triggering the same keys the left hand plays. This way it is possible to play the study at a much higher tempo than if the hands would be stacked on top of each other and I was happy to get the endorsement of Terry Riley for this version.[308]

Since the K1000 weighs 30 kilogram in a flight case and since it is also a rather old machine it is often not possible to bring the instrument to a concert. When I play the piece at places further away, I either program the keyboard available there if I have enough time or alternatively use a patch I made for a Windows program called MIDI-OX which allows me to remap any MIDI keyboard in the above described fashion[309]

For the sound, I used Pianoteq,[310] a virtual piano then in its first version with only limited MIDI mapping capabilities. However, since the mapping was done with MIDI-OX I only had to install virtual MIDI patch cables. For this, I used another program called MIDI Yoke[311] and the MIDI signal flow was like this:

MIDI keyboard -> MIDI interface -> MIDI-OX -> MIDI Yoke -> Pianoteq[312]

The audio signal from the Pianoteq software would then be routed to an audio interface and from there to the loudspeakers. This way any MIDI signal coming into the computer would be

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[304] Terry Riley, *Keyboard Studies #1* (New York: Associated Music Publishers Inc, print on demand).

[305] A score that can be found on the internet and depicted at "Aspen No. 9, Item 10: Dream Music/Keyboard Study #2," n.d., accessed 23 April 2012, http://www.ubu.com/aspen/aspen9/dreamMusic.html#rile. is a page of the Keyboard Study #2 that is not part of the published score.

[306] This mistake is in the Schirmer edition only, which reprints the performance notes as a facsimile of Riley's handwritten notes.

[307] The Kurzweil K1000 is a ROM-based sample player/synthesizer from the late 1980s.

[308] 'I was delighted to get the recording you made of Keyboard Studies one and two. It sounds quite brilliant and a very good interpretation of these pieces, especially Study one.' Terry Riley in a private conversation by e-mail, October 18, 2000.

[309] Jamie O'Connell, *Midi-ox*, 2011.

[310] *Pianoteq* (Modartt, 2012).

[311] Jamie O'Connell, *MIDI Yoke*, 2007.

[312] The equivalents in the Mac world would be for example SoundFlower (Cycling '74 and Tim Place, *Soundflower*, 2012.) for MIDI Yoke and MIDIPipe (Nico Wald, *MidiPipe*, 2012.) for MIDI-OX.

automatically transformed in the desired way and triggering the sounds from the sound producing software.

This set-up was considered safe for two reasons:

- the MIDI signal can be transformed either by programming a MIDI keyboard or by using the preconfigured set-up.

- in my version of the piece, the sound is not as important as in other pieces and mostly any piano or percussion sound will do.

This means that the set-up was actually a modular one and I felt prepared for any combination of set-up from using a keyboard with its own sounds to a master keyboard sending on any MIDI channel in combination with my computer.

Knowing that a whole two days were scheduled for the preparation of the concert and that the University of Huddersfield, being a university that teaches music technology, has a big assortment of devices at its disposal, I flew to Huddersfield with my computer and all the analogue items I needed for the concert. For example, I brought items such as the portable CD player, the Dictaphones and the e-bow for the piece by James Saunders as I felt I had to stick to my own devices in order to feel safe in the concert. Since I trusted the multitude of devices to choose from at the University and since I had to transport so many small devices that my luggage was already overweight, the audio/MIDI interface was left at home.

At the university, no combined audio/MIDI interface could be rented. As master keyboard a Yamaha SY-99 was supplied, one of the biggest synthesizers of the 1980s and a full-blown workstation with an impressive feature list including exotics like *zoned aftertouch*. Considering that the SY-99 can do everything I need and more to play the piece by Riley I tried to program the machine using both its audio and master keyboard features but soon realized that it would have taken too long to read through and understand the manual of this mighty machine.[313,314] I thus had to go back to the set-up using the SY-99 as a MIDI keyboard and mapping its MIDI data in the computer. For this, I rented out a MIDI interface and an audio interface respectively. Downloading and installing the drivers for the MIDI interface was easy but the audio interface, being a device by MOTU, requires the user to log onto the MOTU site with a user account. Since I did not have a user account and the registration

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[313] Yamaha Corporation of America, "Yamaha SY99 Music Synthesizer - Operating Manual" (Yamaha Corporation of America, n.d.). The manual has over 250 pages.
[314] It's probably worth mentioning that the SY-99 features non-weighted keys and that the keys are a bit smaller than regular piano keyboards, making it thus not the most desired master keyboard in the first place (Information from Robert Skerjanc, "Green Box: Yamaha SY99 - Vintage Synths - AMAZONA.de," May 1, 2010, accessed 23 April 2012, http://www.amazona.de/index.php?page=26&file=2&article_id=2836.)

process can take quite a while[315] I could not be sure if I would eventually be able to download a driver in time. I thus decided to look for an easier and faster way and rented out another audio interface from the studio. After another two hours spent on the internet to find the drivers for that soundcard I finally found a website that confirmed that there was no compatible driver for the Windows Vista operating system I was using. At this point, I was thinking about borrowing an Apple computer only to find out that the sound software I was using, Pianoteq, worked only on Windows computers.[316]

After renting out a fourth interface the driver installation finally succeeded. Unfortunately, the installation of many non-functional drivers must have ruined the MIDI configuration of my computer and MIDI-OX and MIDI YOKE did not work anymore. I therefore had to download and reinstall these two programs again as well as reprogramming them. It is worth mentioning that obtaining the drivers and the information was not as trouble-free as one would expect from using the internet: I could not go online directly with my computer because the university's wireless internet system was down that day and I had to find access to a wired computer on another floor every time I wanted to download something and copy it via an USB stick onto my computer.

Overall, it took eight hours to install the interfaces, re-install the required programs and generally get the set-up running.

4.1.2 Analysis

What makes this case interesting is the fact that I came seemingly well prepared with a modular set-up that was intended to suit any circumstance. Nothing that was planned to do in these two days is considered unusual, using another audio/MIDI interface or hiring a master keyboard is common practice for a number of reasons.

A master keyboard, especially a good one with hammer mechanics, can easily exceed a weight of 12 kg and requires a hard shell case for transport, which adds another 10 kg to the weight. An 88-key keyboard needs an estate car to transport and a device of this size and weight should not be transported by one person alone. On flights, it would have to go as over-sized baggage if one would dare to ship it as cargo. If taken into the cabin it is likely that an extra ticket would have to be bought, thus doubling the airfare. Apart from this, it is considered easy to plug in a MIDI keyboard since it does not require any special software like drivers,[317] although from my experience not many people

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[315] An e-mail needs to be generated by the host site, which might, as it is machine generated, end up in the spam folder. This e-mail has then to be confirmed in order to finally get access to the site.

[316] It has since been ported to OS X.

[317] Unfortunately this has changed with the rise of the USB MIDI Keyboard: even some small controllers like the Korg NanoKontrol do not work without drivers anymore.

use MIDI in any other way than just connecting two devices and hoping that it works. And although this simplistic approach often does work,[318] success cannot be guaranteed as the incidents described in chapter 4.4 make clear as well as another incident at a concert on July 7, 2007 in Kassel, where the MIDI keyboard triggered *note on* messages on both depressing and releasing the keys.

Another audio interface is often used when it is considered more cumbersome to connect more than one interface to the mixing console, although several computers are being used. It is unavoidable when the concert hall uses more than eight channels, a limit for most prosumer audio interfaces, or when it is using special arrays like wave field synthesis or other unusual formats of sound diffusion.

It is thus interesting to see why the concert would have been missing the *Keyboard Study #1*, if only a regular set-up time of two to six hours would have been available.

As can be seen in the Why-Because Graph (cp. Figure 28), there were both audio and MIDI problems. The audio problems were a result of the difficulties that arose installing a new soundcard: not all audio drivers are readily available on the internet and not all soundcards work with every operating system, but the most time-consuming factor is the fact that although this information is likely to be found on the internet, it takes a longer time to actually find it than one might think. Often interesting information can only be found in user forums, which on the other hand are generally less reliable than 'official' information from manufacturers and often filled with hearsay. However, manufacturers are often short-lived themselves and the drivers for e.g. the Terratech Producer FW24 audio interface can only be found on a rather obscure ftp-server after Terratech chose to give up their professional audio production line. The information on where to find the drivers is very hard to find on a website that now is a showcase for other products and for a while it was not there at all. What is worse, installing the wrong drivers can ruin a computer set-up, as demonstrated with the MIDI programs that had to be re-installed.

Although several MIDI set-ups were catered for, finding a set-up that works was difficult. The university provided a full-blown workstation from the 1990s as a master keyboard, which is inherently difficult to understand in a short time. Nevertheless, a good master keyboard will have many possibilities as well and the more possibilities the more parameters there are which interact differently in every machine. If we take the aforementioned Kurzweil K1000 – which has excellent master keyboard functions – it is easy to see how complex already a machine from the early ages of digital music making can be.

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[318] It works only since most devices boot up in omni mode and will receive whatever message is being sent to them.
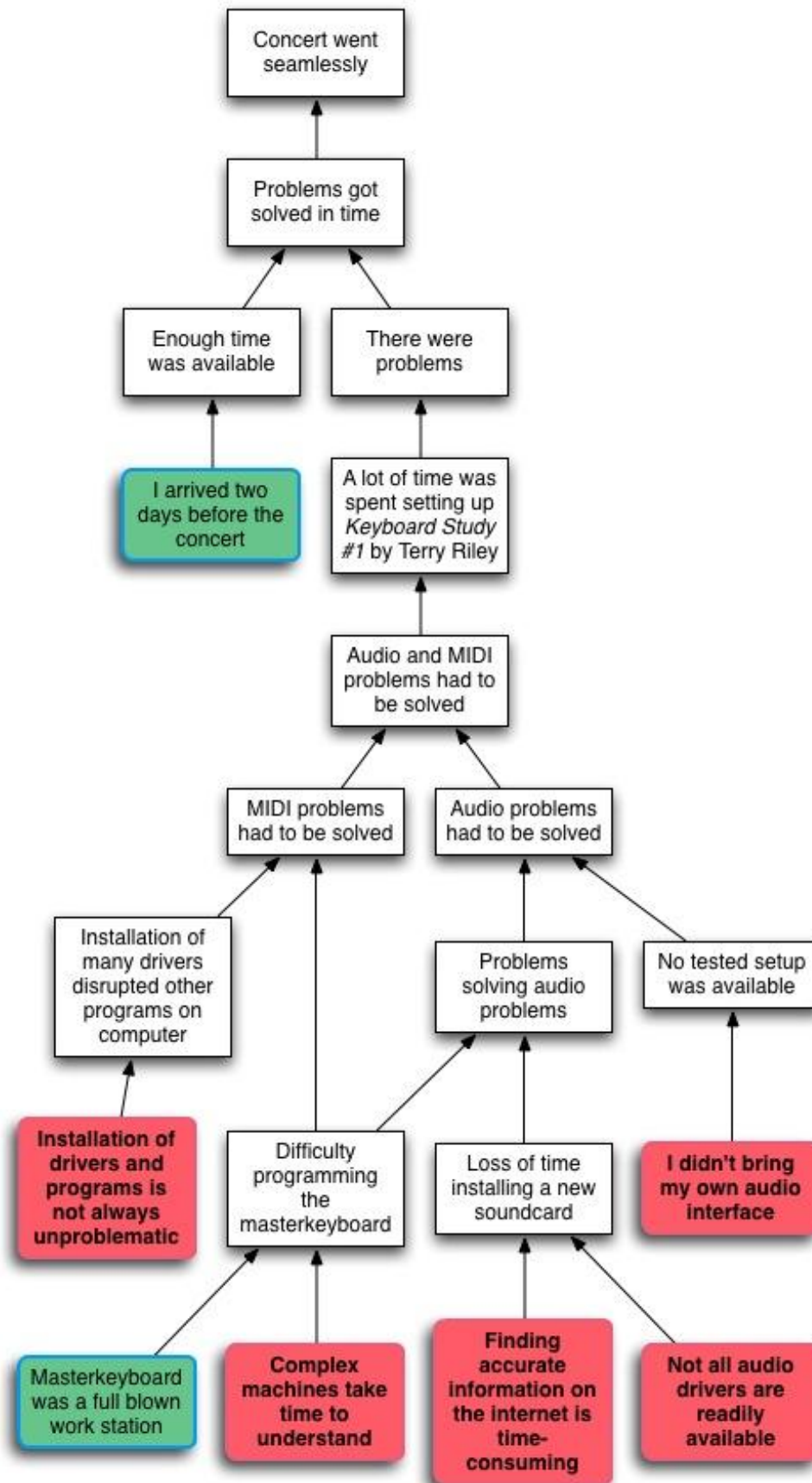
Figure 28: Why-Because Analysis 15.08.2009

The MIDI functions can be found in three layers: in the *global* or *master* layer, which stores general information on the machine, in the *program* layer, which can override the settings in the *global* layer and that actually consists itself of up to four *layers* that produce the sounds. The settings in the *layers* will also override the *global* settings but will themselves be overridden by the *program* settings.[319] The names *global, program* and *layer* are arbitrary words chosen by the manufacturer of the machine. The order of the settings from *program* to *layer* to *global* is less arbitrary since it has to follow a certain logic, but another machine could follow another logical design and they are thus not generalizable.

Moreover, there is yet another problem: when a machine is borrowed from a studio, it is not known what the previous user did with that machine and it is therefore necessary to check and understand every single parameter. This is indeed unlikely to happen unless the user knows the machine thoroughly. It must be said that if somebody arrives at a quick solution in a complex machine then it was more or less luck and using this device is a gamble.[320]

Summing up the results of the Why-Because Graph it can be said that for the audio problems the difficulty to find information on the internet can be extremely time consuming. Furthermore, not all drivers are downloadable and not every device works with every operating system. The only solution to this problem is therefore always to bring a tested computer/audio interface set-up to the concert and not make a 'shortcut' by borrowing an interface.

The same is true for the MIDI interface with the added difficulty that large master keyboards are hard to transport. It is then necessary to tell the owner of that keyboard exactly what is needed and trust that they will indeed program the keyboard. The only other option is to find out exactly what device is being used, download the manual and dry run the set-up. That this solution is more prone to errors is understood. It is a grey area though to say who is obliged to program the keyboard: is it the responsibility of the player to program it to their needs or is it that of the studio? As we can see from the description of the multiple layers of a Kurzweil K1000, it would be reasonable to say, 'Whoever owns the keyboard should also program it.' But this solution proves to be doubtful as well: ownership is vaguely defined when the keyboard is collectively owned by a studio like the electronic studios of the University of Huddersfield or the ZKM Karlsruhe and nobody is personally assigned (and in whatever way rewarded) to take care of this one device. This issue will therefore have to be discussed every time a situation like this arises.

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[319] Kurzweil Music Systems, "Musician's Guide - Kurzweil K1000 Keyboard" (Kurzweil Music Systems, 1988), 19.
[320] Several more examples of where seasoned personnel fail to work with seemingly easy to understand devices which they are not accustomed with can be found in 4.4.

However, not only are the factors that led to a difficult situation interesting but also the factors that one assumed were contributing. These are for example the breakdown of the University's Internet link: since the decisive factor is that information is hard to find and results cannot be guaranteed it is of no importance if one can access the internet speedily or not.[321]

The operating system is another factor that did not play a role. Although the drivers for one soundcard were incompatible with the used operating system and the installation of incompatible drivers likely destroyed the working MIDI configuration of the computer it cannot be guaranteed that with a different operating system everything would have worked without problems. Nevertheless, even if it were so, it is again ignorable since the program used to generate the sounds, Pianoteq, worked on Windows machines only, which made using this operating system a necessity.

What was eventually also irrelevant was the fact that the prepared set-up was seen as being modular and therefore as flexible as possible to react to any occurring situation. As we have seen, this played no role in the resolving of the situation and is therefore no substitute for actually bringing a tested set-up to the concert.

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[321] It must also be noted that access to the internet is generally restricted and that it is often not possible to get a guest login quickly.

4.2 Herrenhäuser Gärten, Leibniztempel, 15.08.2009

4.2.1 Organization

Musik 21 Niedersachsen,[322] a corporation promoting contemporary classical music, was one of the partners of the New Music Network[323] of the German Federal Cultural Foundation[324] to promote contemporary music in the years 2008 – 2011.

To make the activities of the corporation known in Hannover and its vicinity a *fête de la musique*-like happening was installed from August 13 – 16, 2009, the Musik 21 Festival 2009: Farben.[325] On these days, numerous performers and music groups played outdoors all over Hannover. For my concert three pieces were chosen: two compositions from my repertoire and a premiere:

Luigi Nono: *...sofferte onde serene...* (1976) for piano and tape[326]

Michael Maierhof: *splitting 28.1* (2007) for grand piano[327]

Dodo Schielein: *N381* (2008) for amplified piano[328] (premiere)

This programme was to be performed at the Leibniztempel, a temple-like structure located in the baroque gardens of Herrenhausen and it was understood that this outdoor concert promoting new music would acoustically not be comparable to a concert hall situation.

Since I had played the pieces by Maierhof and Nono a few times already the set-up for these pieces was clear. For the premiere of *N381* by Dodo Schielein several rehearsals took place, but since the piece was an offspring of a larger ensemble piece that already received a successful premiere a year before[329] there were no particular worries as for the technicalities.

About a month before the concert, the set-up was discussed with the technical director of the festival, Wolf Bock. Since the set-up was small and mobile, it was decided that I would bring the entire set-up with me to the concert. This means that different from the previously discussed concert all the technical devices with the exception of a few more microphones (see below) were coming from one place.

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[322] http://www.musik21niedersachsen.de/
[323] Netzwerk Neue Musik.
[324] Kulturstiftung des Bundes; http://www.kulturstiftung-des-bundes.de/cms/en
[325] http://www.musik21niedersachsen.de/fileadmin/user_upload/PDF-Dokumente/M21N_FARBEN_web.pdf
[326] Nono, *...sofferte onde serene...* Cp. chapter 3.2
[327] Michael Maierhof, *splitting 28.1* (Manuscript, 2007).
[328] Schielein, *N381*. Cp. also chapter 3.7.
[329] Cp. chapter 3.7.

Figure 29: The Leibniztempel in the Royal Gardens of Herrenhausen[330]

The set-up consisted of:

- a portable audio player

- two loudspeakers (active)

- microphone and microphone boom

- digital feedback killer acting also as a microphone preamp

- several adapters and sufficient cable

The organizers on the other hand would care for the grand piano and power.

To have some choice in the microphones it was agreed that the composer, Dodo Schielein, would bring another regular microphone with her and that Wolf Bock would provide a special boundary microphone (PZM).

For this small and easy set-up, which only required the placing and wiring of two speakers, preparing the piano and trying out the best microphone for the piece by Dodo Schielein two hours set-up time seemed ample. Since there was no guard for the equipment available, the musicians had to stay at

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[330] http://upload.wikimedia.org/wikipedia/commons/5/59/Leibniztempel_2010.jpg

the venue after the set-up. In order to minimize stress and enjoy the concert it was agreed to have one hour of buffer and meet three hours before the concert at the venue.

4.2.2 Timeline

Present for the set-up of the concert were the composer Dodo Schielein, the technical director Wolf Bock and myself. However, due to traffic congestion and a most complex route through the baroque gardens to the venue I, and with me the whole set-up, arrived about an hour later at the venue.

While the piano was prepared for the piece by Michael Maierhof, the speakers were plugged in and wired. After setting up the loudspeakers several microphones for *N381* were tested and, since the day proved to be exceptionally windy, a lot of noise was picked up by the microphones and hardly any of the quiet piano sounds. The backup solution with a digital feedback killer, which was intended to be able to further amplify the volume if the microphone would not pick up enough sound, proved to be useless because the microphones picked up more wind noise than sound from the piano.

Closing the lid and using the boundary microphone did not help either because the boundary microphone together with the active speakers I provided produced a lot of hum.

Trying different set-ups and microphones to save the piece for the concert took a lot of time and when it was eventually decided to let go of the piece only ten minutes remained to set up for Luigi Nono's *...sofferte onde serene...*

Summing up it must be said that, although we felt well prepared for this concert, it was not only incomplete in that *N381* by Dodo Schielein was not played, but also that the stress caused by the situation resulted in a strenuous performance of the other two pieces, albeit unnoticed by the public and the critic.[331]

4.2.3 Analysis

The analysis is broken down into two parts: Analysis of the technical failure of *N381* and a stress analysis resulting from it. This stress analysis stands *pars pro toto* for similar situations where the set-up does not run as smoothly as projected, even if the worst case scenario, the cancellation, is not reached.

4.2.3.1 Technical analysis

N381 by Dodo Schielein uses only the noises of the mechanics of the piano. Although the piano's mechanical noise is rather quiet, it is still quite noticeable and a piece using these sounds can

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[331] Christian Tepe, "Die Natur als geheimer Mittelpunkt," October 2009, accessed 25 April 2012, http://www.nmz.de/artikel/die-natur-als-geheimer-mittelpunkt.

possibly be played in a concert hall with good acoustics without any amplification. Generally, basic amplification to get above the noise floor is preferable though.

Since the outside location of the Leibniztempel has a much higher noise background, the piece needs to be amplified accordingly. Heavy amplification on the other hand carries the danger of feedback. In order to cater for both the elevated feedback danger as well as the higher background noise we brought a combined feedback eliminator/noise gate device with us.

Unfortunately, the wind that day was so strong, that the microphones picked up a lot of wind noise – in fact so much that the signal from the piano was at times weaker than the wind. In this situation, a noise gate does not help; in fact, it reverses the desired effect.

Shielding the microphones from the wind, e.g. by laying the microphones inside the piano and closing the piano lid would not help, because then the microphones would not pick up enough sounds from the piano.

The boundary microphone did not work with the active loudspeakers I brought with me and produced too much hum to be usable.

This means that the original set-up and all the backups we brought with us to fall back upon failed with the known consequences.
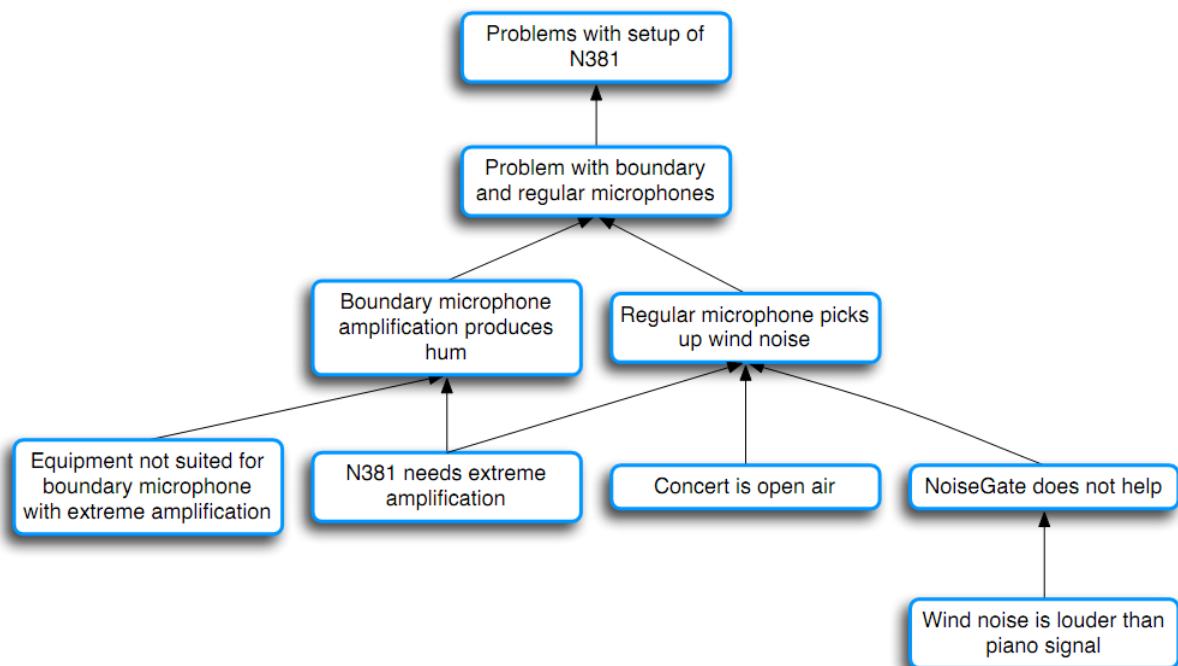

Figure 30: WBG Hannover Leibniztempel: Equipment

The graph in Figure 30 answers the question as to why the technical set-up failed but does not yet answer why there was a failure. Since none of the technical devices broke, it follows that the preparation was insufficient. It could reasonably be argued that choosing this piece to be played in an outdoor location was a mistake in the first place. However, the reason for these analyses of concerts is not to simply pinpoint mistakes but to ask why mistakes have been made. In this case, the composer and I had a combined 30 years of experience and nonetheless we made this mistake, or rather, we thought the piece could be played at this very venue. It was therefore not unprofessionalism or incompetence but a belief that the set-up would hold. This belief stemmed from the fact that:

- a similar set-up by another ensemble worked only a year before,

- a test set-up on lesser equipment just a few days earlier worked well,

- we brought two backups in case of difficulties (noise gate/feedback eliminator and boundary microphone).

Finally, technical expertise at the venue itself was provided by the technical director of the festival.
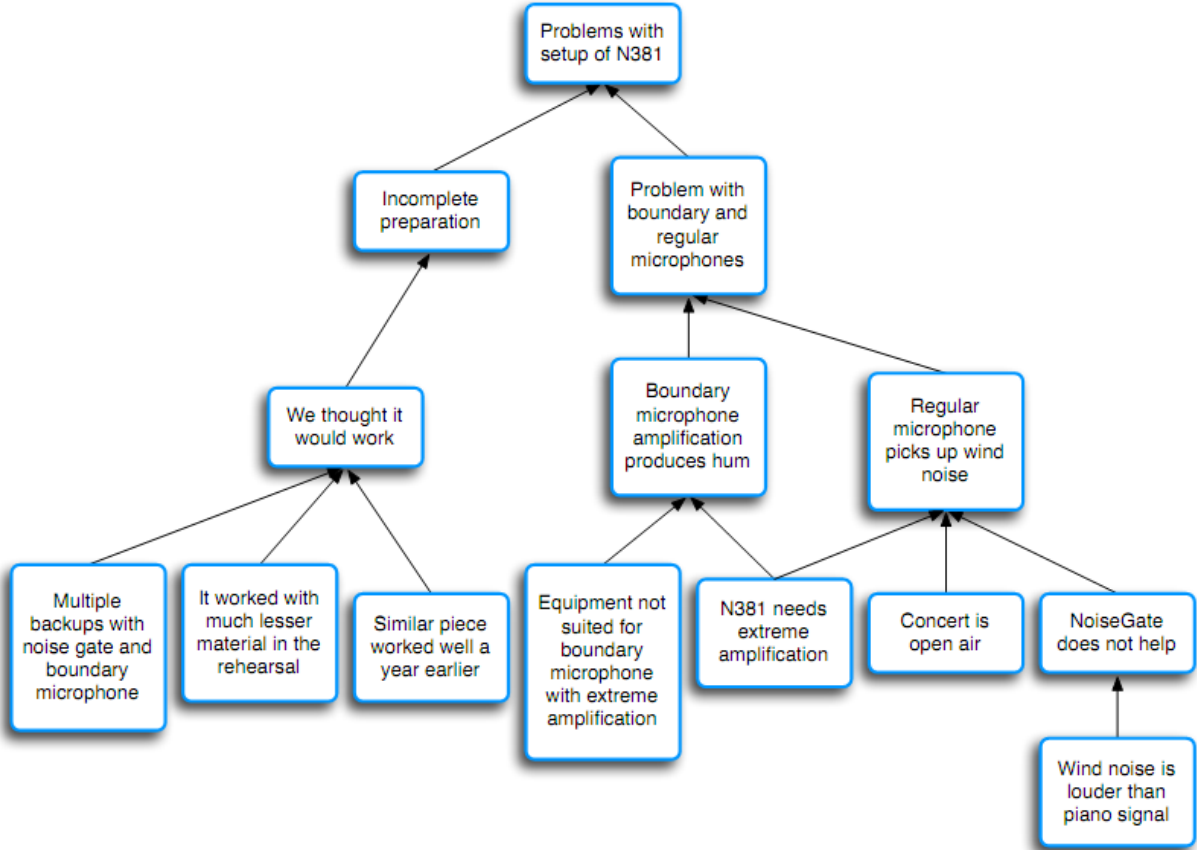

Figure 31: WBG Hannover Leibniztempel: Preparation

Nonetheless, it must be conceded that the set-up did not work. It can be followed that the difficulty of the set-up was underestimated and that this underestimation might have been prevented by persons that are more knowledgeable. However, this is only an illusory solution, because there is no way to predict when an underestimation will occur. The only viable solution to prevent a mishap like this is therefore to try out the exact same set-up under circumstances that resemble the concert situation as closely as possible.

4.2.3.2   Stress analysis

Since the initial requirements for a successful concert state that a concert with electronics should produce no more stress than a concert without electronics the stressfulness of the concert situation needs to be analysed. While it is obvious that the cancellation of a premiere causes stress, it is often overlooked to what amount this stress piles up and why. The Why-Because Analysis suggests at what point an earlier intervention would have drastically diminished the pressure. After all, even if the situation would have eventually been solved, the drain on the performer's concentration is enormous.

The graph (cp. Figure 32), which analyses the level of stress at the beginning of the concert, shows two strains: physical and emotional stress. The physical stress is a direct result of the non-fulfilment of basic bodily needs: rest and food.

The emotional stress is fed by a feeling of unpreparedness. This is caused by both the knowledge that no rehearsal has taken place as well as the awareness of the physical stress. It is also fed by the stress that occurred before the concert: The stressful rehearsal situation and the painful 'confession' to the organizer that a premiere will not be played.

Five factors contributed to the stressful situation:

- no time to rest

- no time to eat

- no dress rehearsal

- hectic rehearsal situation

- cancellation of *N381*

Four of these nodes share a common causal factor, the delayed time schedule. It is thus the most important factor in the build up of the stress.
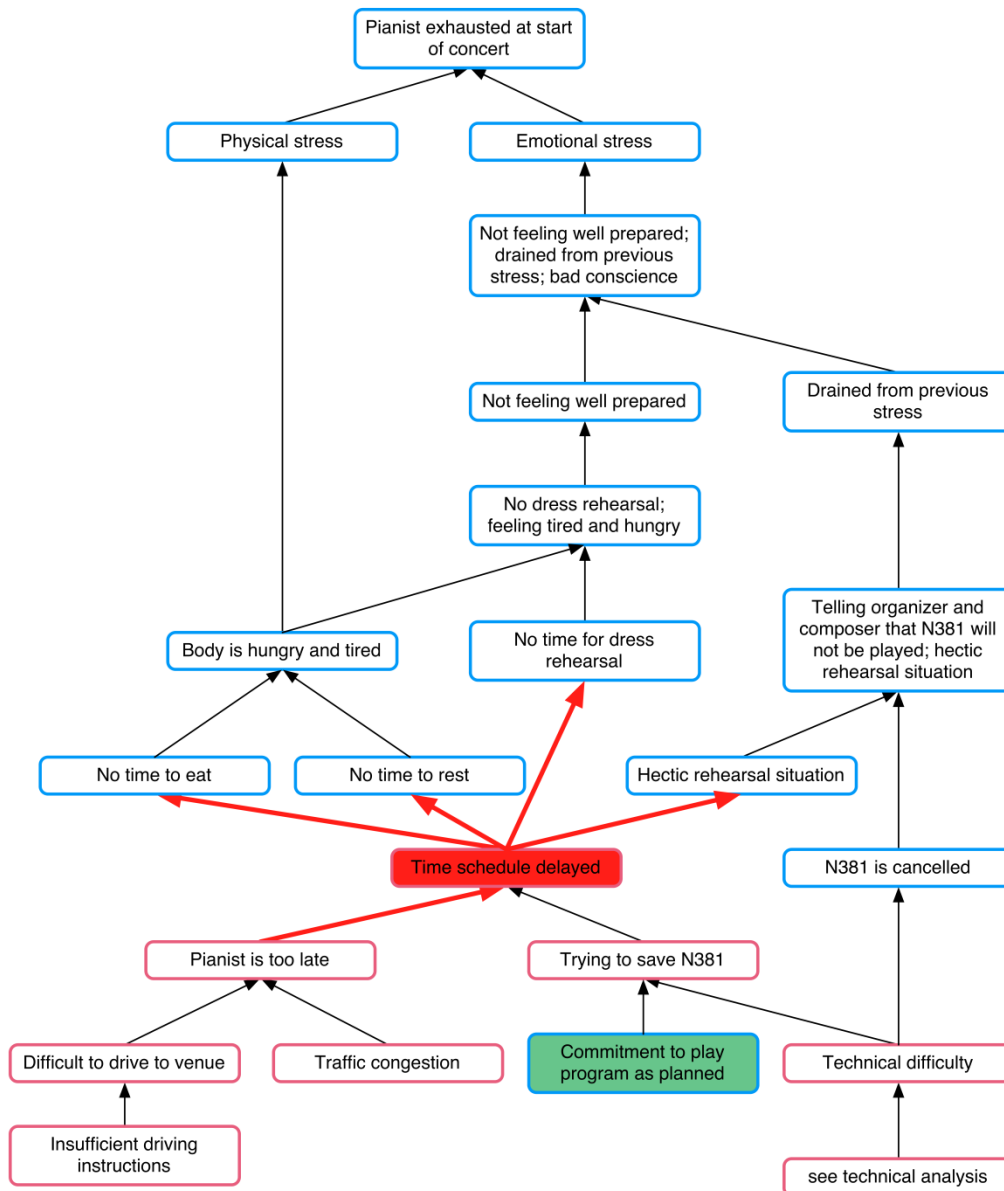
Figure 32: Stress analysis

The time schedule was delayed by the lost buffer time due to the late arrival of the pianist and by trying to find a working set-up.

The late arrival of the pianist due to traffic congestion and finding the remote location of the Leibniztempel could have partially been solved by a more thorough preparation of the journey: GPS navigation systems do not guide the car driver on off-road pedestrian ways in highly artificial baroque gardens and 20 minutes were lost to eventually find the way to the venue.

However, a more decisive factor was probably the absence of a time schedule for the set-up: finding a solution for the microphone needed much more time than planned and the cancellation of the

piece happened at a time when it was too late to properly prepare for the remainder of the programme. Although it is understood that the trials to save the premiere of *N381* took a lot of time, it should not have happened that *...sofferte onde serene...* had to be set up in only ten minutes time with the start of the concert immediately afterwards. Since it is difficult to keep a constant eye on the clock in the more and more desperate attempts to save the piece, a time schedule not only for the concert as a whole (the stipulated time of two hours plus a one-hour buffer) but for each of the pieces of the concert needs to be prepared. This time schedule would have relieved the situation, in that the actors would not have to constantly decide on the fly what to do next, but also by allotting the necessary time for rehearsal, refreshment and rest that too easily is given up in times of stress. Unfortunately, such a schedule for each piece is often unreasonable since a concert with several pieces of electronics is set up in a more general manner and would ideally follow this order:

1. transport of equipment to the venue

2. set-up

3. line check

4. sound check

5. rehearsal

Therefore, the rule to follow must be to allot a certain time for troubleshooting for each piece while setting up and, if the error cannot be found in that time frame, abandon the piece until all the other pieces have been set up.

4.2.4 Conclusion

The case study of the concert on August 15, 2009 is another example where a well-planned and thoughtful concert preparation did not work. Different from the first case study, all the technical devices except the backup microphones came from one hand and two backup set-ups were planned. Unfortunately, exceptionally strong winds and the untested second backup with the boundary microphone rendered this backup scheme futile.

It could probably be called bad luck when two backup schemes fail, but the amount of stress that results from the cancellation of the piece as well as the breach of contractual obligation by not playing the premiere of *N381* by Dodo Schielein make clear that the assumptions made in this case were not good enough.

It is impossible though to define clearly which of our assumptions will hold since they are by nature forecasts into the future - something we naturally cannot do. On behalf of *N381* though we must say that we made assumptions on untested material and certain negligence must be admitted. It makes a difference to practise 20 times with the same set-up and expect it will hold a 21st time at the concert (and bringing two backups to the venue) and to test a set-up once with certain devices and make the assumption that it will work with other devices as well. This understanding led to a further investigation on the technicalities of the piece and is described in chapter 3.7. What follows for concert organisation is that the exact same material that is being used in a concert must have been tested exhaustingly in the preparation period and that a time-table for the preparation must be set up.

4.3 Huddersfield Contemporary Music Festival, 24.11.2009

4.3.1 Organization / Timeline

In 2009, I was invited to play a concert at the Huddersfield Contemporary Music Festival to present the first CD of the University's new Huddersfield Contemporary Records (HCR) label. The programme consisted of a mix of pieces with and without electronics:

Michael Maierhof: *splitting 28.1* (2007) for piano, guitar strings and sponge cloth[332]

Benjamin Lang: *ABDucensparese* (2001) for grand piano[333]

Thomas Wenk: *Taurus CT-600* (2002/03) for two cassette recorders[334]

Johannes Kreidler: *Klavierstück 5* (2005) for piano and 4-channel tape[335]Enno Poppe: *Arbeit* (2007) for virtual Hammond organ[336]

Klavierstück 5 by Johannes Kreidler uses a four-channel tape, which requires a fifth channel sending a click-track to the performer. *Arbeit* by Enno Poppe uses six microtonally shifted instances of the virtual organ B4 II by Native Instruments, which are being macro-controlled by a Max patch. The performer uses an 88-key master keyboard with a pedal and a fader box to play and change the sounds.

HCMF is one of the major festivals in England and is run by a professional organizational and technical team. The technical side is cared for by TG Events,[337] an event management company based in Huddersfield. The information for the technical set-up was done with the means of a tech rider from my side and a three-page technical questionnaire from the organizational team. A few more details were cleared up in e-mails and it was decided that, since there was another concert with electronics just a few hours before this concert that used equipment from the university, the set-up would consist of a mix between devices from the University, TG Events, and the things that I would bring to the concert myself. The core audio set-up consisting of the MacBook Pro by Scott McLaughlin, on which the patch for the piece by Enno Poppe finally worked (cp. chapter 3.5.3), a master keyboard by the university and a MOTU Traveler audio/MIDI interface also by the university was tested extensively for two days using headphones in an extra rehearsal room that was set up for the concert.

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[332] Maierhof, *splitting 28.1*.
[333] Benjamin Lang, *ABDucensparese* (Manuscript, 2002).
[334] Thomas Wenk, *Taurus CT-600* (Manuscript, 2002).
[335] Johannes Kreidler, *Klavierstück 5* (Manuscript, 2005).
[336] Poppe, *Arbeit*.
[337] http://www.tgevents.co.uk/

The setting up on the concert day went very smoothly and was most professional. However, while setting up it was found that the overall volume for the piece by Enno Poppe was too low. Since the personnel in the hall, the seasoned team hired by the festival itself and two professors for computer composition of the University, did not own and work regularly with this specific soundcard, a hectic search for errors in the patch, the soundboard, the loudspeakers and the computer commenced. The solution was found by accident when taking a very close look at the audio interface where it says in small print that the volume button of the interface has to be pushed in to control the overall volume level.

Figure 33: A MOTU Traveler Audio Interface

The front face design of the MOTU Traveler is described as 'a little non-intuitive'[338] by reviewer Robin Bigwood although he calls the double feature of the volume button 'a great feature'.[339] However, the decision to write this information under the volume button – a place hard to see when not looking at the soundcard from an underneath angle – could probably be seen as non-optimal and was scrapped on the newer MOTU Traveler mk3, where headphone and master volume are now controlled by two separate buttons.

Figure 34: The MOTU Traveler-mk3 with changed front panel[340]

4.3.2 Summary and Conclusion

Five audio technology experts needed 15 minutes to find the master volume level on a quite well-known interface – an interface whose functionality was tested for two days – just to find out that all

[338] Robin Bigwood, "MOTU Traveler," *Sound on Sound*, June 2005, accessed 18 June 2012, http://www.soundonsound.com/sos/jun05/articles/motutraveler.htm.
[339] Ibid.
[340] Figures 33 and 34: Image © MOTU, Inc. Used with permission. The red circles were added by the author.

they had to do was to push a button. A feature, not a bug, as the professional reviewer of *Sound on Sound* sees it. What this incident makes clear is that there is no standard for what an audio interface has to look like and even the successor of the very same interface has again a different layout. I have already given the argument of complexity in digital devices using the Yamaha SY-77 workstation and the MIDI capabilities of the Kurzweil K1000 synthesizer in chapter 4.1 and the unlikeliness of finding the right settings by chance. The relative complexity of the MIDI protocol can easily be underestimated by people not dealing with the matter on a daily basis but audio interfaces are the bread and butter of digital musicians and it seems that these devices are expected to be understood just like a piano or a direction indicator in a car. What is then probably underestimated just as well are the huge efforts that go into the harmonization of vehicles[341] – something manufacturers of audio equipment actively undermine by using all kinds of neologisms to support the unique selling point of their devices. What this discussion then once more proves is the fact that technical equipment, in order to be handled in an utmost secure manner, needs to be just as known as interpreters need to know their instruments. The signal flow

- from keyboard and fader box into the MIDI interface

- from there into the computer with its respective MIDI settings

- from there into the Max patch

- which triggers the audio in the virtual instrument

- which then gets routed using the audio settings of the computer and into the audio interface

- from where it goes into the loudspeakers

is not only very long but also very complicated with dozens of settings in menus and submenus. What is worse is that there are hardly any error messages since the whole set-up is modular and there is no possibility to know when all the connections work correctly other than by trial and error.[342] What therefore follows is that the search routine for errors is extremely tedious because the mistake could be anywhere in that signal flow, from programming errors to altered settings in the computer to a mechanical failure in a cable or even the loudspeaker.

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[341] These harmonization efforts are actually a worldwide effort partially led by the United Nations and the World Forum for Harmonization of Vehicle Regulations, which went 2011 in its 153th session. The German regulations for the design and marking of in-car switches, one of 126 regulations, spans over 300 pages (http://www.bmvbs.de/SharedDocs/DE/Artikel/StB-LA/ece-regelungen.html).

[342] Turning on a blinker on the other hand gives a threefold feedback: visually in form of a blinking signal, audibly in form of a clicking noise and haptically because the hand lever to turn on the signal has to offer a certain resistance (cp. also chapter 3.8.2.1).

Although this incident was solved well in the buffer time allocated to the set-up it proves that even seasoned technical personnel and experts cannot handle any device they meet with the required confidence necessary for setting up a concert and that all the devices used in a concert must be known with all their functions, quirks and peculiarities by the people setting up. From which follows that the only persons who can know the interaction of all the devices brought up on stage and who can guarantee a seamless signal flow right until the digital-analogue converters are actually the performers themselves who have to build up a core audio set-up consisting of controllers, computer and interfaces that are being tested extensively in rehearsals. This way they can actually practise with the electronics and can practise not only the music the way it should be rehearsed but also the set-up process, which should result in a more or less effortless workflow on the concert day.

4.4 Staatliche Hochschule für Musik und Theater Hannover, 09.12.2009

4.4.1 Organization

In an effort to promote contemporary music at the University of Music and Theatre in Hannover, Joachim Heintz, the head of the electronic studio at the university, asked me to play a concert with music for piano and live-electronics. Having taught at the university for three semesters and having organized concerts with electronics in collaboration with the studio in that time it was assumed that I would know the facilities of the university and could organize the concert myself with the help of the studio assistant Kostia Rapoport and Vladimir Gorup as technical assistant.

To get the most attention it was decided to play the concert in the foyer of the university and the following compositions were decided upon:

Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics[343]

Terry Riley: *Keyboard Study #2* (1966) for keyboard[344]

Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano[345]

Maximilian Marcoll: *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch* (2007) for piano and recordings[346]

Enno Poppe: *Arbeit* (2007) for virtual hammond organ[347]

I had played all of the compositions before and considered them easy to set up with the exception of the composition by Scelsi. *Aitsi* by Giacinto Scelsi (cp. chapter 3.1) requires the amplification of the piano to such a level that distortion starts, which elevates the risk of feedback. Moreover, the previous bad experiences with microphones (cp. chapter 4.2) and my general inexperience with setting up microphones led to the decision to allow for some extra time setting up this piece and to try out several microphones including a contact microphone I had brought with me.

The set-up was discussed extensively with Kostia Rapoport on the telephone, with special regard to which computer we would use in the concert. Unfortunately, the software required for the composition by Enno Poppe – a B4 II by Native Instruments – was not installed on the university's computer. Since the installation process of the software instrument is very cumbersome (cp. chapter

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[343] Tutschku, *Zellen-Linien*.
[344] Riley, *Keyboard Study #2*.
[345] Scelsi, *Aitsi*.
[346] Marcoll, *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.*
[347] Poppe, *Arbeit*.

3.5) and since the university and I had the same computer,[348] it was deemed safe that I would bring my computer and we would connect it to the audio interface of the university.

Once the amplification system and all the instruments were in place I calculated a set-up time of 15 minutes for each of the pieces with the exception of Scelsi, where 30 minutes seemed to be sufficient. If this seems little time it must be mentioned that the set-up for the pieces was timed and e.g. the piece by Terry Riley needs only to power up the synthesizer and selecting and loading the program. All in all a set-up time of three and a half hours (one hour to bring everything in the atrium, one hour for the set-up of the amplification and cabling, one and a half hours for the set-up of the single pieces) was planned. To leave room for error it was decided to set up from 2:30 – 7:00 pm. The concert was set to begin at 7:30 pm.

Apart from the numerous telephone conversations, the technical information was sent in an e-mail to the sound engineer Kostia Rapoport as a list and a drawing (cp. Figure 35):

Tutschku:
Grand Piano, Max/MSP
Mic 1+2, MIDI -> Interface/Computer -> Speaker 1-4

Riley:
Synthesizer
Synthesizer -> Interface -> Speaker 1-4

Scelsi:
Grand Piano, Max/MSP
Mic 1+2 -> Interface/Computer -> Speaker 5
Output: Speaker 5

Marcoll:
Grand Piano, Max/MSP
MIDI -> Interface/Computer -> Speaker 1-4

Poppe:
Max/MSP, NI B4 II
MIDI -> Interface/Computer -> Speaker 4+5

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[348] Apple MacBook Pro with OS X.

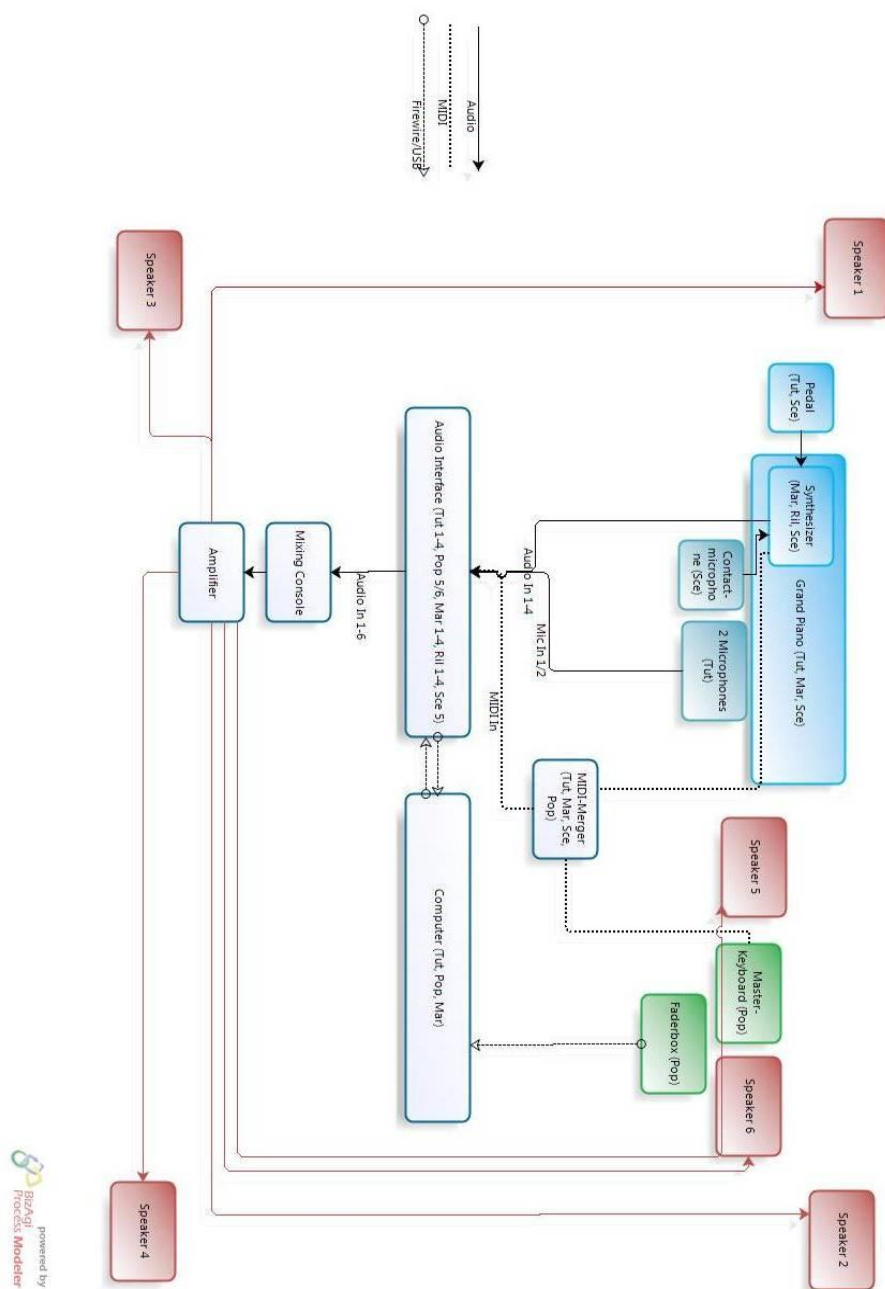**Figure 35: Set-up for the concert on December 9, 2009**

The patches were all tested on the computer I brought with me and I had set up all the pieces numerous times. Kostia Rapoport, the sound engineer, plays electronic music himself and sets up electronic equipment on a regular basis. Therefore, a trouble free concert was expected on my part. Nonetheless, the setting up of the concert can only be called catastrophic.

4.4.2 Timeline

Several incidents led to an utterly chaotic situation: a day before the concert the helping hand called to say he had a concert and would have to leave at 5 pm. On the day of the concert, the sound engineer Kostia Rapoport missed a train and set-up started only at 4 pm instead of 2:30 pm. Moreover, no programmes had been printed, two monitor speakers and the master keyboard were missing from the material I had ordered from the university and only at 4:40 pm was everything we needed in the hall. Setting up went smoothly, however, and at 5 pm, when the helping hand Vladimir had to leave the speakers and the cabling for the amplification were all set up.

In order to have some flexibility with the Scelsi set-up we decided to bring a few microphones to the venue. Unfortunately, the microphones of the university did not work with the synthesizer I brought with me for distorting the piano sound for the piece by Giacinto Scelsi because the latter could not provide phantom power. However, this problem got solved quickly and at 5:30 pm the set-ups for Scelsi and Riley were done. Setting up for Tutschku went seamless but more general problems persisted: the studio assistant did not know the digital console the university provided well enough for a quick set-up and had to step through multiple submenus to find the signals. Additionally, we found that Apple changed the FireWire connectors of the MacBook Pro from FireWire 400 to FireWire 800. This meant that the new MacBook Pro I brought with me did not connect to the RME Fireface 400 soundcard of the university and I had to walk to the centre of the town to buy an adapter.

When I came back at 6:10 pm all the audio signals were routed properly. Unfortunately, at this point we found that the computer did not receive any MIDI signals and a lengthy investigation started into whether the master keyboard did not send any MIDI signals or if the interface did not receive them. The RME Fireface 400 is a very versatile audio/MIDI interface and, like the soundboard, features dozens of settings. This proved to be a problem for the whole set-up because digital machines are generally more complex than their analogue counterparts where one can 'see' the signal flow to control the routing. Since neither Kostia nor I knew the RME Fireface very well we did not find out if the Fireface was broken or if we made a mistake in the settings. However, we could not make the two MIDI channels – and I needed both of them for the concert – work and had to replace it with MIDI input from the fader box I brought with me for the piece by Enno Poppe.

The MIDI problem stayed with us, though, and after finishing the set-up for Tutschku at around 6:50 pm, we started the set-up for Marcoll. There we found that our makeshift solution using the fader box as MIDI interface did not work and that we indeed needed a second MIDI channel. We found a solution with the help of yet another USB keyboard, into which we plugged the MIDI out from the

synthesizer and subsequently routed it to a USB input of the computer. This worked and the sound check was finished at 7:20 pm. Ten minutes before the concert, we tried to set up the piece by Enno Poppe, which had yet another surprise for us: the work around we found for the Marcoll piece did not work with the Yamaha master keyboard, which apparently did not send out any MIDI data at all. Changing of cables and multiple different set-ups in different variations did not result in any MIDI data arriving at the computer or the sound card. We thus decided to cancel the piece since it now was 7:35 pm, five minutes past the scheduled time for the concert.

After this nightmare of a set-up, it almost does not need mentioning that something went wrong in the concert as well. Although all the settings from the sound check were stored in the digital console the first piece of the evening sounded awfully distorted. Since the concert already started late we decided to play the piece as it was, although it was not what the composer intended.

Summing up it must be conceded that

- due to the stress in the hours before I did not play a relaxed concert.

- the composition by Enno Poppe was not played at all.

- *Zellen-Linien* by Hans Tutschku sounded distorted.

As in case study 4.2 the description of the events that happened that day could easily lead to a résumé that squarely puts the responsibility on the actors: people came late or left early, the keyboard was not ready, an adapter was missing – this can surely only happen when trying to run a concert with electronics without preparation. However, such a judgement does not answer why this concert that was well planned, with all the pieces already played in a concert and with experienced people setting up can go so wrong. Therefore, the Why-Because Analysis is being employed again to find the ultimate reasons why the set-up became this chaotic.

4.4.3 Analysis

The Why-Because Graph depicts the negative results of the concert: *Arbeit* by Enno Poppe was not played at all; *Zellen-Linien* was played with heavy distortion; and performer and sound engineer experienced much stress. This third factor is already analysed in a separate graph in chapter 4.2 and the following analysis thus concentrates on the technical faults of the concert.
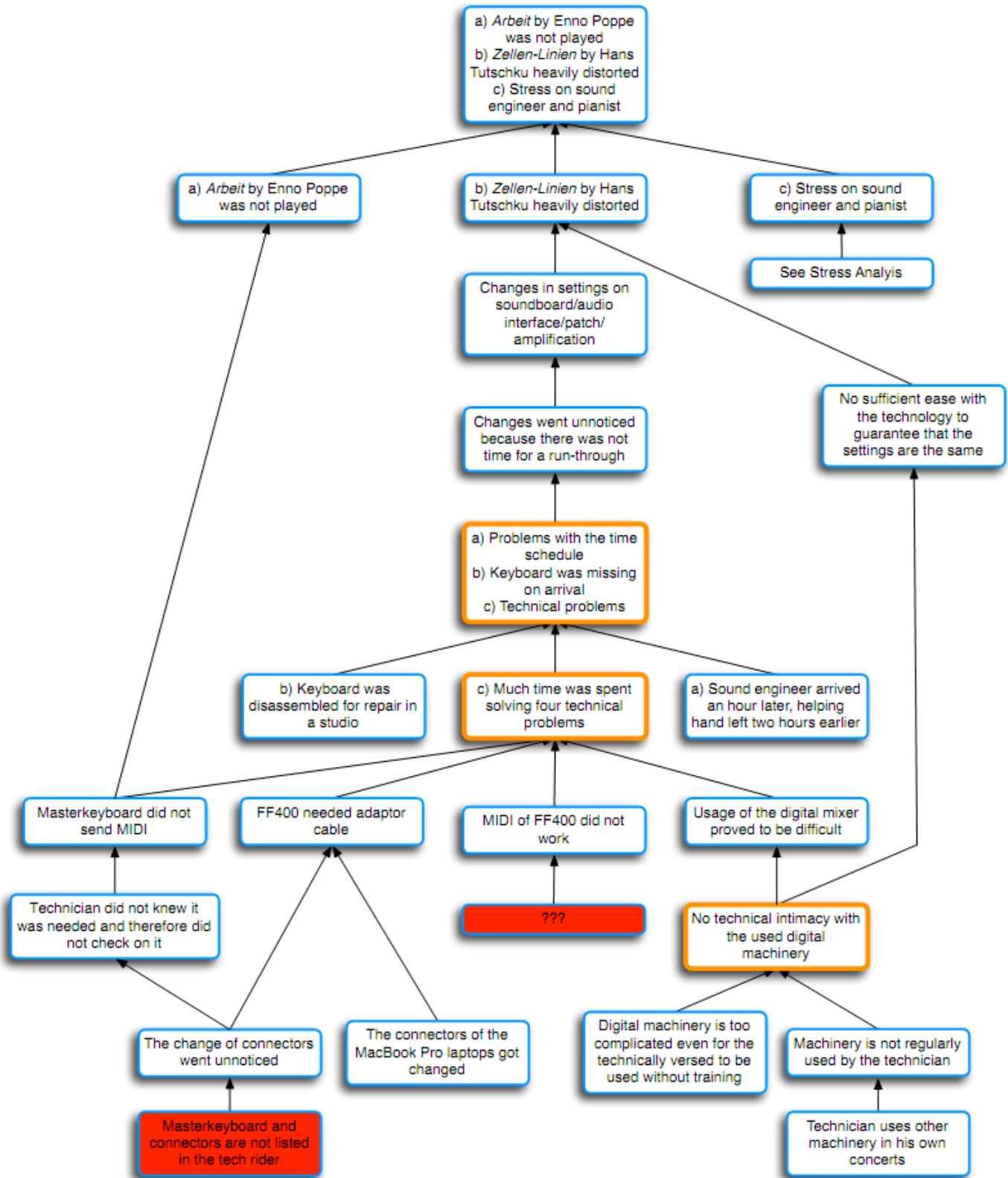
Figure 36: Why-Because Graph of the concert on December 9, 2009

The Why-Because Graph shows three nodes with three or more connections. These are coloured red:

> 1a: people coming late, leaving early,
>
> 1b: keyboard was missing on arrival
>
> 1c: technical problems
>
> 2: much time was spent solving four technical problems
>
> 3: no technical intimacy with used machinery

Although undesirable, the late coming of the sound engineer and the early departure of the helping hand did not risk the concert per se since at 5pm the basic amplification set-up was finished. These two events are outside the scope of this research and even if the basic set-up would have been ready at 4pm we would have run into the same problems but earlier. Therefore, these two incidents are not primary causes for the failure of the set-up process and the concert.

This shifts the focus to the technical problems:

1) the Master keyboard did not send MIDI.

2) the audio interface (FF400) did not work with the computer.

3) the MIDI functionality of FF400 did not work.

4) the usage of the digital mixer proved to be difficult.

1) The master keyboard not sending any MIDI data shares its causal factor with a node which is the ultimate reason why *Arbeit* by Enno Poppe was not played: the tech rider did not have a list which expressly stated which material would be brought into the hall by the performer and which material would have to come from the university. It is of no relevance if the studio assistant and the performer in the many telephone calls forgot to talk about the master keyboard or if I just assumed that I would not have to bring an 88-key keyboard, knowing the university had one: a proper preparation for concerts means trying to reduce possible mistakes and misunderstandings as much as possible and therefore the splitting up of the material in the tech rider is the primary cause for this event.

2+3) The mobile set-up of the studio for electronic music consists of a MacBook Pro and an RME Fireface 400. After it was decided to use the pianist's computer for the concert a certain belief in the interchangeability of Apple computers yielded no further questions about the connection between the two. However, in spring 2009 Apple changed the connection on their MacBook Pros from

FireWire 400 to FireWire 800 and the computer of the pianist happened to be the first one to feature this then relatively new connection. Although compatible the two types of FireWire cables feature different connectors which had to be bought. It would be a shortcoming to say that this was simply a mistake or a lack of knowledge, although it certainly was both. What this incident essentially reveals though is yet another shortcoming in the preparation for the set-up: the cable connections were not clearly marked in the tech rider. Although the different types of cables were visible in the drawing (Audio, MIDI, USB/FireWire) it was not made clear what kind of connectors would have to be used: only the MIDI cable uses one standard 5-pin connector. Audio cables can come in many different variants with jack and XLR the most commonly used in these types of settings, USB comes in a multitude of different connectors[349] and FireWire connectors exist in 4-, 6- or 9-conductor variants.

It is nonetheless not safe to assume that with a proper connection the audio/MIDI interface and the computer would work together, even if they are similar machines. In this very case it is unclear if the MIDI connection between controller, instrument and computer did not work because of a user error, a technical error or a communication problem between the devices. It is an often-overlooked fact that devices of the same maker and the same model can be quite different devices indeed. This not only refers to the software that can get updated on the device's and the computer's side (firmware and driver) but also to the hardware. Two examples are given: the RME Fireface 800 and the DSI Mono Evolver (a synthesizer by Dave Smith Instruments) use different hardware in their machines expanding their capabilities dramatically and thereby altering the devices in such a way that a user expecting some of the newer capabilities will search for them in vain. Another example would be the switch from Texas Instruments to Agere FireWire chips by Apple in 2007, which caused numerous problems with audio interfaces.[350] Moreover, the updating of a computer system triggers the updating of the driver architecture: for an RME Fireface to work with the current Apple 10.7 system a new driver must be installed which in turn only works with a relatively new firmware, which in turn demands that the device has not been altered on the hardware side. The two most current drivers from the RME website's for Windows XP/Vista/7 drivers state that version 2.9991 removes MME support, and that version 2.998 requires firmware 2.77. In summary, this means that electronic devices of the same brand and type might differ fundamentally in their characteristics without any visible difference whatsoever.

Concerning the concert on December 9, 2009 it is therefore irrelevant what the cause of the catastrophic failure of both MIDI channels in the MIDI interface were: the computer and the

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[349] Type A, Type B, Mini-B, Micro-A, Micro-B and USB 3.0 B with different plugs and receptacles. Additionally there are many proprietary connectors and formats as well as several different pin formats.
[350] "New Macbook Pro with Lucent/Agere FW Chipset! - Gearslutz.com," n.d., accessed 4 June 2012, http://www.gearslutz.com/board/music-computers/335773-new-macbook-pro-lucent-agere-fw-chipset.html.

interface should never have come from different sources in the first place but form an ensemble that must be tested and taken to performances together.

4) Seasoned audio engineers will be able to acquaint themselves with an analogue mixing console in a relatively short time because of their similarity in design. Digital models on the other hand feature a wealth of features and come in many different formats from being merely controllers for digital audio workstations to full blown computers. The enhanced possibilities and the turning away from the one-button per function paradigm often found in analogue mixers towards a design with an LCD-screen and nested menus make the models of different makers harder to understand at first glance and require a longer familiarisation time with the machine. This generalization can be challenged depending on the application and complexity of the task, but in terms of usability analogue models could be compared to pianos and digital ones to synthesizers.

The difficulty in using a digital mixing console is often observed by the author, especially in stressful situations, as is often the case in setting up concerts with live-electronics. It is also confirmed by Hannes Seidl, curator of Acousmain,[351] saying: 'Analogue ones are much more similar (in design)'[352] and Cort Lippe, who even regards digital mixing consoles as the device most prone to give a troublesome set-up experience because people are not familiar with them.[353] However, it cannot only be observed with mixers but with all kinds of digital devices, where the analogy from one device to the other seems to be more pronounced than generally expected. Examples for this are difficult to state, since it could be read as belittling seasoned personnel. Only three examples are therefore given:

- the usage of a Midisport 4x1 in a concert on November 26, 2011 caused a delay of almost an hour because the device required some renaming in the MIDI settings of the computer.

- the unanticipated change of MIDI channels in a master keyboard after powering up caused havoc right before a concert in 2002 and during a production in 2009.

- the complexity of digital devices being computers is also illustrated by the fact that mechanical failure of digital machinery inevitably results into sending the device back to the manufacturer, whereas analogue equipment can often be repaired at the institutions repair shops.

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[351] Acousmain is a concert series promoting electronic music in Frankfurt/Main (http://www.acousmain.de/).
[352] Personal communication by SMS, January 13, 2012.
[353] Cort Lippe, "Interview with Cort Lippe" interview by Sebastian Berweck, Digital Recording, January 26, 2010.

Yet another incident has been described in chapter 4.3, where it took several experts to find the button for the master volume control on an unknown audio interface.

4.4.4 Conclusion

Results from the overall concert and the Why-Because Analysis are:

- the tech rider did not feature an explicit list of what machinery would have to be provided by the venue

- the tech rider did not feature the exact connectors

- the usage of an untested audio/MIDI interface – computer combination proved to be fatal

- microphones should be part of the core audio set-up of a performer

Changes to concert organization on behalf of the pianist are thus the establishment of a *core audio set-up* consisting of all the digital machinery used in a concert: computer, audio interfaces, and controllers. Since setting up the microphones seems often to be delicate, they should be part of it as well. Only a tested core audio set-up can guarantee a seamless set-up process where the performer on stage takes on responsibility for a working audio line until the analogue audio out. It is this set-up that has been practised with and has been tested numerous times in rehearsals and can be considered safe for a stage performance.

It must therefore be understood that the performer of music with electronics must be ready to make a financial commitment in order to own the devices with which to play electronic music, even if they at first seem to be just add-ons to the original instrument.

Another result of this case study are enhanced tech riders which do not only feature the type of signal being transferred but also the cable connectors and the splitting up of the material list into as many parts as there are people involved in the concert.

4.5 Tour Huddersfield, Frankfurt, Karlsruhe, Reutlingen, March 2011

In March 2011, I was asked to play four demanding concerts with and without electronics in four different cities in a very short time. Some of the pieces posed problems in earlier concerts and are described in chapters 3.1, 3.5, 4.1 and 4.4. This series of concerts therefore put the experiences and findings on how to run concerts with electronics – namely the core audio set-up (cp. chapters 4.1 and 4.3) and the technical riders (cp. chapter 4.4) – to a test. The concerts, the programmes and the required soft- and hardware without the core audio set-up were as such:

Solo concert, March 14, 2011, Huddersfield

> György Ligeti: *Études pour piano, premier livre* (1985)[354]
>
> Johannes Kreidler: *Slot machine* (2009) for piano and mp3-player[355]
> (mp3-player, portable speaker, Y-connector, in-ear earphone, iron rod)
>
> Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano[356]
> (contact microphone, small keyboard, foot pedal, Max/MSP)
>
> Martin Schüttler: *schöner leben 2* (2006) for prepared, amplified and distorted piano[357]
> (contact microphone, small keyboard, foot pedal, Max/MSP, preparations)
>
> Terry Riley: *Keyboard Study #1* (1966)[358]
> (Pianoteq, MidiPipe, 5-octave keyboard, stopwatch)

Trio Nexus, March 16, 2011, Frankfurt

> Christoph Ogiermann: *lebend durchführung 19* (2007) for flute, percussion and keyboard/prepared piano[359]
> (stopwatch, small USB-keyboard, PAAX sampler, megaphone, preparations)
>
> Dror Feiler: *Stormo V* (2005) for flute, percussion and piano[360]

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[354] György Ligeti, *Études pour piano: Premier livre* (Mainz: Schott, 1998).
[355] Johannes Kreidler, *Slot machine* (Manuscript, 2009).
[356] Scelsi, *Aitsi*.
[357] Martin Schüttler, *schöner leben 2 (Monument für T.H.)* (Manuscript, 2006).
[358] Riley, *Keyboard Study #1*.
[359] Christoph Ogiermann, *lebend durchführung 19* (Manuscript, 2007).
[360] Dror Feiler, *Stormo V* (Manuscript, 2005).

Solo concert, March 17, 2011, Karlsruhe

Terry Riley: *Keyboard Study #1* (see above)

Giacinto Scelsi: *Aitsi* (see above)

Enno Poppe: *Arbeit* (2007) for virtual Hammond organ[361]
(small USB-keyboard, B4 II virtual organ, Max/MSP)

Johannes Kreidler: *Slot machine* (see above)

Ludger Brümmer: *move* (2006) for piano, tape, live-electronics and live video[362]
(since the electronics were provided by the ZKM, I only had to provide in-ear earphones)

With Erik Drescher, March 18, 2011, Reutlingen

György Ligeti: *Études pour piano, premier livre* (see above)

John Cage: *Two* (1987) for flute and piano[363]

Although the fourth concert did not feature any electronics, it is nonetheless included, because it had to be prepared as part of the tour and was part of the stress burden. In other words, the three concerts before had to go well enough in order to play a satisfactory fourth concert.

4.5.1 Requirements for a successful tour

As opposed to touring with one set-up and getting used to setting it up, the four concerts required different set-ups in four cities without technical support and using public transportation. In order to make the tour as stress-free as possible and not to detract me from my original task – which is not to care for the instruments but to play them – three things were paramount:

- the set-ups must work quickly and without much thinking.

- additional tasks that have to be done in the concert – for example additional preparation or starting a computer program – have to be as easy as possible.

- everything that can break has to be quickly replaceable.

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[361] Poppe, *Arbeit*.
[362] Ludger Brümmer, *move* (Manuscript, 2006).
[363] John Cage, *Two* (Frankfurt: C.F.Peters, 1987).

4.5.1.1 Set-ups working quickly and without much thinking

To prepare for the set-ups before the concert the venue had to be informed of the requirements and I had to prepare myself in order to avoid getting tired while setting up. I therefore

- prepared detailed tech riders including any possible information were provided for the venue. The experiences described in earlier chapters went into vastly improved tech riders, which included drawings of the set-ups, timelines and lists of the devices that had to be provided by the venue. Great care was taken to include as much information as possible in order not to receive a phone call about a concert happening in two days time while concentrating on the concert happening that very day.

- called or mailed the sound engineer two weeks before the tour to make sure everything was understood and to provide any other information that was needed.

- made simple to read, numbered instructions on how to set-up my own machinery. These numbered lists then would make setting up my devices as difficult as painting by numbers.

4.5.1.2 Additional tasks in the concert

Additional tasks in the concert include individual set-ups for single pieces (like the preparation of a piano which had to be played unprepared before), using devices that were prepared before the concert but needed extra attention before playing the piece (like setting up mp3-player and loudspeaker and turning them on), and finally using the computer to start programs and loading the patches. Again not to get distracted from the actual playing by having to think about and remembering what I had to do,

- additional lists for the set-ups of pieces that needed additional preparation in the concert were made, listing the order in which things have to be set-up and what settings needed to be set to start the piece

- a new user account was set up on the computer for the concerts to provide for an uncluttered desktop with only a few icons and folders. Clearly named aliases were used to start programs and if any additional settings had to be set, a numbered list would provide that information (an example for this is given in Figure 59)

- the audio interface was programmed in order to have the right setting by clicking on numbered buttons.

A list for setting up a piece to be played would then look somewhat like this:

1. prepare score and preparation (see list in score on back page 1).

2. click "1" in mixer window *(to mute audio output).*

3. double-click "schöner leben" *(to start Max/MSP and the patch).*

4. click "Folder" and choose folder location desktop -> schüttler -> samples *(to load the samples into the program).*

5. click "5" in mixer window *(to load audio settings for this piece and turn off muting).*

6. check audio/MIDI connection.

7. go!

Playing the same programme several times would have made this list obsolete because the set-up would become a routine. However, when playing multiple set-ups it is not possible to remember effortlessly every set-up and easiness in setting up had to be achieved.

4.5.1.3 Replacing potentially breaking devices

In order to make everything replaceable except the provided grand pianos[364] two things had to be considered: the hardware must be widely used in order to find a replacement with a few telephone calls and any information that might be used must to be immediately accessible.

The decision as to what hard- and software I take with me on a tour is only partly in my hands – in some cases like Enno Poppe's *Arbeit* the B4 II software instrument by Native Instruments has to be used, as well as a patch for Max/MSP. Additionally the hardware has to fulfil certain tasks, like being an audio interface and a MIDI interface with two separate MIDI inputs. This would also be possible with separate audio and MIDI interfaces using a MIDI merger but three devices with the necessary cabling are more prone to breaking than one machine is. Finally, the instruments that have to be used at the venue have to be factored in and that these machines, although unknown, have to immediately work in the chosen set-up.

After making extensive lists of what was needed on the tour and comparing it with widely distributed machinery – and with reference to the experiences previously made – it was decided to take as many devices as possible with me. This included the core audio-set-up (in this case an RME Fireface 400, a mid-2009 Apple MacBook Pro, the necessary cables, backup cables, a plug strip and an adapter for English plugs) and the necessary small devices like mp3-players, portable speakers, stopwatch etc.

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[364] I have played concerts on many gruesome pianos but I have never had to cancel a concert because of a mechanical failure of these long tested devices.

The last three things might be considered unnecessary ballast while travelling, but the focus, again, has to lie on using the machinery with as much ease as playing the instrument. It is detracting if a performer has to remember how to use an mp3-player in a concert, whereas the mp3-player, with which the piece has been practised with, can be used almost without thinking. The same goes for such seemingly easy devices as a portable speaker (which has to be switched on and off and whose characteristics will likely be different) and stopwatches (which are also not standardized and will react differently, which consequently leads to errors like taking a split time when the intention was actually to stop the watch). The bill of materials concerning the electronics eventually comprised 25 items, but they were chosen to be lightweight enough for travelling easily.

Information in a conventional concert would consist of the score and information on preparations if necessary. Playing with electronics, the amount of information that needs to be collected is many times higher. In case a piece of hardware fails and has to be replaced, the program, its information on copy protection and the patch used have to be provided.

Taking for example the audio interface: the audio interface was programmed in order for a seamless change of the settings in different concerts by recalling saved settings. If my own device would break, this information – along with all the settings guaranteeing a working connection between the device and the computer – would have to be copied onto the machine. This includes then not only the patch but also the firmware in case the machine was not up-to-date and would not work with the drivers on my computer. Additionally any program that must be used to port the settings from one machine to the other must be readily available as well as the tool to flash the device, both of which in some cases require a licence.

Therefore a complete set of information concerning hardware consists of:

- the firmware

- the firmware flashing software

- the drivers

- the patch

- the program to write the patch on the machine

- the licences

It is certainly useful to provide a manual for the machine and the program as well.

Most of what is being said about the hardware is of concern for the software as well. If the computer fails, a version not only similar but actually mirroring the software the composition was being tested on is needed. Therefore, the installation file for the software as well as the licence (or whatever copy protection is being used) must be available along with the patch. Again, it is advisable to have a manual ready instead of relying on the internet because of the time that is needed to hunt down the document, which could include registering processes on the firm's website and other time consuming efforts (cp. chapter 4.1) which should be avoided. Finally, any additional material that the software might use, such as samples, has to be made available as well. Overall, the information that must immediately be accessible comprises:

1. scores

2. hardware:

    a. manual for the hardware

    b. drivers

    c. firmware

    d. firmware flashing program

    e. programs

    f. manual for the program

    g. licence for the program

3. patches

    a. software

    b. manuals for the software

    c. serial numbers for the software

    d. patches for the software

4. samples and other information needed by software

This information, which was stored on the computer and the other hardware, was copied onto a USB stick and on the internet using cloud storage. The internet storage was then shared with the sound engineers at the venue in case they needed some information from it.[365]

Another way to provide replacements in case hardware breaks down would of course be to take another set of hardware devices on the road. This solution is prohibitive not only financially but also because the amount of suitcases one person can carry is limited. Finding another set of the exact same hard- and software on the other hand is unlikely and asking several people to download and install software and testing out patches for the rare case that my own hardware breaks is impractical.

4.5.2 Conclusion

The preparation and running of the tour implementing strategies learned from the previous events was successful with the exception of the malfunction of the master keyboard in the performance of Poppe (cp. chapter 3.5). The conditions of running four demanding concerts with different set-ups, no technical team and including hefty virtuoso piano music like the Ligeti *Études*, which required my full attention, were difficult. However, the tour was not only failure-proof but more importantly stress-free, as far as dealing with set-ups went. The tools that were instrumental to running the tour were:

- complete tech riders with an abundance of information

- contacting the sound engineers two weeks before the concerts to make sure the tech riders have been read and everything is understood and available

- an extensive backup scheme if a device breaks

- an easy to follow list for my own set-ups so that I did not have to think the set-up of the night through but just follow orders

- another list to follow in the concerts for setting up additional pieces including reminders on specific hardware

- providing an uncluttered and pre-programmed interface on the computer

The preparation process has the one goal of not distracting the performer from the performance itself by focussing concentration too much upon the set-up process. The lists for the performer and the preparation of the computer proved to be of special importance to achieve that goal, since no

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[365] This proved later to be problematic because one of the sound engineers accidentally deleted all the content in the *dropbox* cloud folder. An ftp server seems to be a better solution at this point.

thinking was required to set up my own machinery. This resulted in a hassle free and extremely quick set-up without tiring the performer and using up brainpower required for the performance.

4.6 piano+ festival, ZKM Karlsruhe, 25.11.2011

For a concert at the piano+ festival at the Zentrum für Kunst und Medientechnologie (ZKM) in Karlsruhe the following programme was chosen:

Terry Riley: *Keyboard Study #2* (1966), version for synthesizer and Klangdom[366,367]

Orm Finnendahl: *Wheel of Fortune* (1994-96/2011) for MIDI grand piano, live-video, live-electronics and recordings[368]

Enno Poppe: *Arbeit* (2007) for virtual Hammond organ[369]

Maximilian Marcoll: *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.* (2007) for piano and recordings[370]

Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics[371]

The programme consisted of pieces previously played and described, with the exception of *Wheel of Fortune* by Orm Finnendahl, which is described in chapter 3.4 and the new version of which was to be premiered in this concert. Although the programme does not look any different from previous electroacoustic programmes, for example the one played at the Huddersfield Contemporary Music Festival (cp. chapter 4.3) or the concert played at the ZKM (cp. chapter 4.5) earlier the same year, it does show the limits of the hitherto described approach of a core audio set-up which is being tested by the performer and brought to the venue.

The material list for the concert, giving the date, name, and an 'easy to remember' version of the programme and two separate listings consisting of a list dividing the material between the people and between the compositions, looked like this:

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[366] Riley, *Keyboard Study #2*.
[367] The Klangdom (Sound Dome) is a 'hightech instrument for spatialization at the ZKM' ("ZKM | Music & Acoustics :: Klangdom/Zirkonium," n.d., accessed 30 April 2012, http://www.zkm.de/zirkonium.)
[368] Orm Finnendahl, *Wheel of Fortune (rev. 2011)* (Manuscript, 2011).
[369] Poppe, *Arbeit*.
[370] Marcoll, *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.*
[371] Tutschku, *Zellen-Linien*.

Figure 37: Material list ZKM November 25, 2011

This material list did not change except for a second grand piano and another monitor screen, which were not necessary but were used because they would make for a better concert flow. With the program and this material list a first version of the tech rider was made (see Figure 57): a video screen can be seen at the back of the room, two positions on stage (one on the left with the grand piano for the works by Marcoll, Tutschku and Finnendahl and one on the right with a keyboard for the composition by Poppe), the loudspeakers (a monitor speaker on stage left, two speakers on stage right and 8-speaker system on the sides symbolizing the Klangdom) and the mixing console with a video projector and the Clavia Nord G2 Synthesizer for the composition by Riley. The pieces by Riley, Tutschku and Finnendahl are played through the Klangdom, which requires another computer attached to the console. This is a special feature of the Kubus, the concert hall dedicated to the performance of electronic music at the ZKM, and therefore not depicted in my tech rider. The

colouring is pink for audio going to speakers, yellow for audio going to/from the console for further treatment and blue for digital signals (MIDI, USB, FireWire, video).
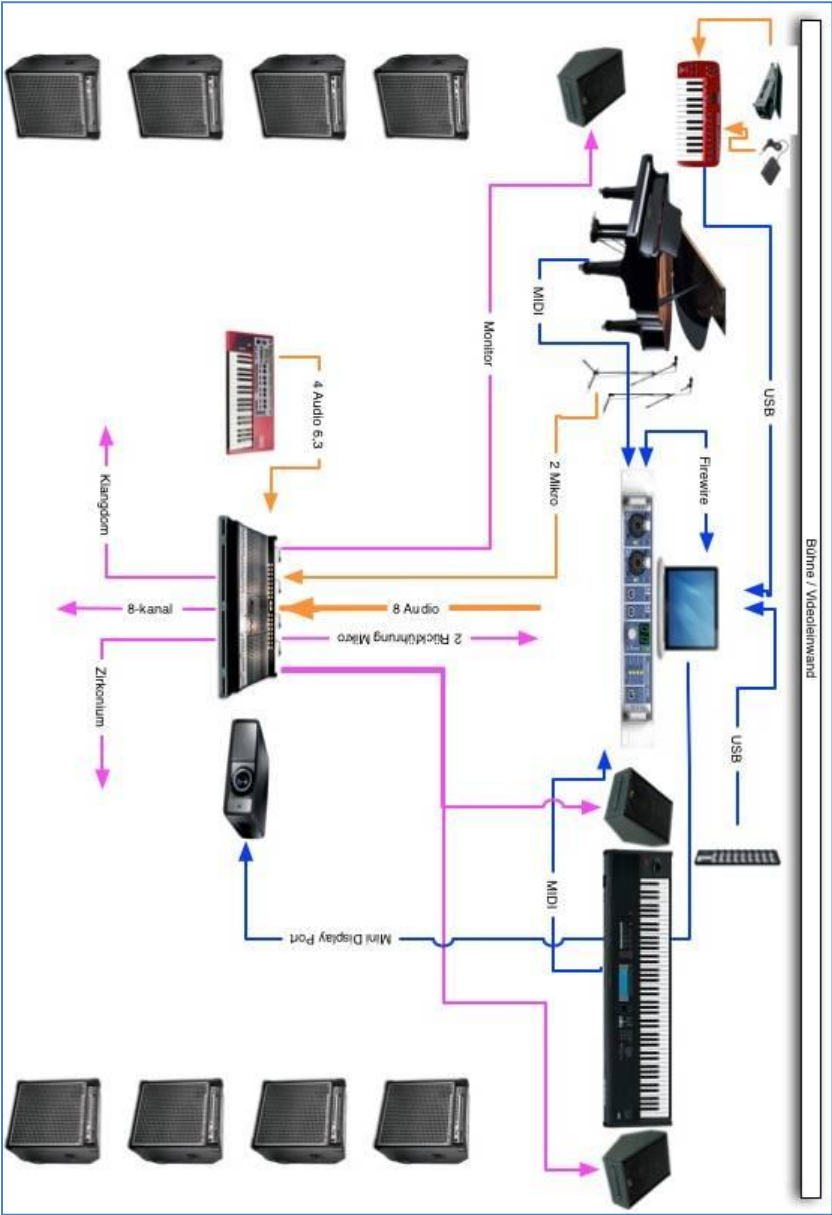

Figure 38: First tech rider ZKM November 25, 2011

This set-up would result in four 'stations' where music was being generated:

- stage left: electronic core audio set-up with a USB keyboard with two pedals attached, MIDI grand piano, two microphones and a monitor speaker, monitor screen (for the piece by Finnendahl) and monitor signal going to the video projector

- stage centre: electronic core audio set-up with a USB keyboard with one pedal attached, Steinway grand piano, two microphones and a monitor speaker, monitor screen (for the piece by Tutschku)

- stage right: electronic core audio set-up with 88 key master keyboard and fader box attached, two speakers, monitor screen (for the piece by Poppe)

- soundboard: synthesizer connected to the house computer via D/A boxes

Within this, the electronic core audio set-up consisting of a computer and an audio/MIDI interface is clearly the centre piece with every non-analogue sound produced on stage going through it: two MIDI controllers, the MIDI grand piano, a MIDI master keyboard and the signal from two microphones all go into the computer and the interface, and eight audio channels and video are coming out of them.

4.6.1 Limits of the developed system

Although this set-up looks at first glance as feasible as the set-ups previously discussed, it bears a multitude of difficulties.

4.6.1.1 *The core audio set-up is needed at different stations*

When the core audio set-up is needed at different stations it must be easily portable, like standing on a rolling table. Since the core audio set-up needs electricity and is connected to the audio console it will drag a bunch of cables behind it. This rolling table needs a flat surface to roll on which means that all the cabling has to go around the stage. This is not only burdensome but also results in a more complex set-up.

4.6.1.2 *Connections have to be made on the fly*

Electric cables can only have a limited length and on a big stage it is probably not possible to connect a MIDI cable directly from the controller on the one side of the stage to a computer on the other side of the stage (this can be bypassed by soldering adapters to use solid audio cable or MIDI amplifiers, but these are rather rare and would lead to even more connections that could break). But even if it was possible one would have a core audio set-up with almost a dozen cables coming to and from it which would require a cable guy and constant monitoring if the connections are still working.

4.6.1.3 *More connectors than provided by the computer are needed*

Connecting four MIDI controllers to a computer is possible but requires additional programming inside the patches. Since the patches are originally programmed by another person it is not clear if this additional patching would keep the patch functional and it cannot be the goal to recode patches for every concert. Using a MIDI merger on the other hand would require changing the settings in the program for each piece, which would mean working on the computer on stage and thus interrupting the flow of the concert and the concentration of the player.

4.6.1.4 *No reliable recall function*

Of the four Max/MSP patches used in the computer, only one had – at the time of the concert – a saving function to easily recall the parameter data chosen in the rehearsal. Even if they all feature this function it is uncertain if the recalling of data seamlessly works after USB controllers or other devices have been plugged and unplugged into the computer. This means that, although a saving function is urgently needed in all the patches (cp. chapter 3.5.3) a line check with the computer is required, which would again turn the performers' attention to programming the computer instead of concentrating on the performance.

4.6.2 Conclusion

The findings of this set-up are that the solution of a tested core audio set-up being brought into the venue by the performer finds its limits where multiple set-ups at different places (stations) are needed and/or more connectors that the computer provides are needed. Additional tasks like using the video outlet of the computer add a substantial amount of work because the screens have to be adjusted. All this not only interrupts the flow of the concert by having people work on computers but also takes the concentration of the performer away from the compositions that are going to be played.

A set-up of this type therefore requires the support of a professional team with enough technical and time resources to be successfully run.[372] Knowing that the setting up would be a team work between the studio and the performer the tech rider changed as well, giving more general information about the pieces and letting the sound engineer decide on how to use the machinery and the personnel of the house best (cp. Figure 58).

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[372] This specific concert was set-up over the period of seven hours using five monitor screens, six different kinds of software and with a technical team of four.

Position links: Tutschku, Marcoll

Haus:
- Steinway
- Klavierbank
- Monitorbox
- kleiner Tisch für Noten
- Stütze/Audio (2 Mikrofone)

Sebastian:
- MIDI-Keyboard + Pedal
- Präparierung
- Plektron etc.
- patches auf dropbox

Verbindung:
- Mikrofone -> Mischpult/Computer ZKM
- Mischpult -> Monitorbox
- MIDI Keyboard -> Computer ZKM

Position Mitte: Finnendahl

Haus:
- MIDI-Flügel
- Klavierbank
- Bildschirm
- Stütze (2 Mikrofone)
- Controllerpedal -> MIDI Übersetzung (z.B. kleiner Synth, Keyboard)

Sebastian:
- Controllerpedal (Earnie Ball Jr.)(TRS Klinke)
- Präparation

Orm:
- patch

Verbindung:
- MIDI Pedal -> Computer ZKM
- MIDI Flügel -> Computer ZKM
- Stütze -> Mischpult
- Screen Computer ZKM -> Bildschirm
- Video "WoF" -> Beamer

Position rechts: Poppe

Haus:
- 88 MIDI Keyboard mit Sustainpedal
- Keyboardständer (sitzend)
- Klavierbank
- 2 Notenständer (solider Rücken)
- 2 Lautsprecher, quasi als Lautsprecher des Keyboards
- 3 Steckdosen
- kleiner Tisch für Laptop

Sebastian:
- Laptop (MacBook Pro mid-09)
- Fireface 400
- Faderbox (NanoKontrol 2)
- Instrumente & Patch auf Dropbox

Verbindung:
- 2x Großklinke aus Fireface zum Mischpult
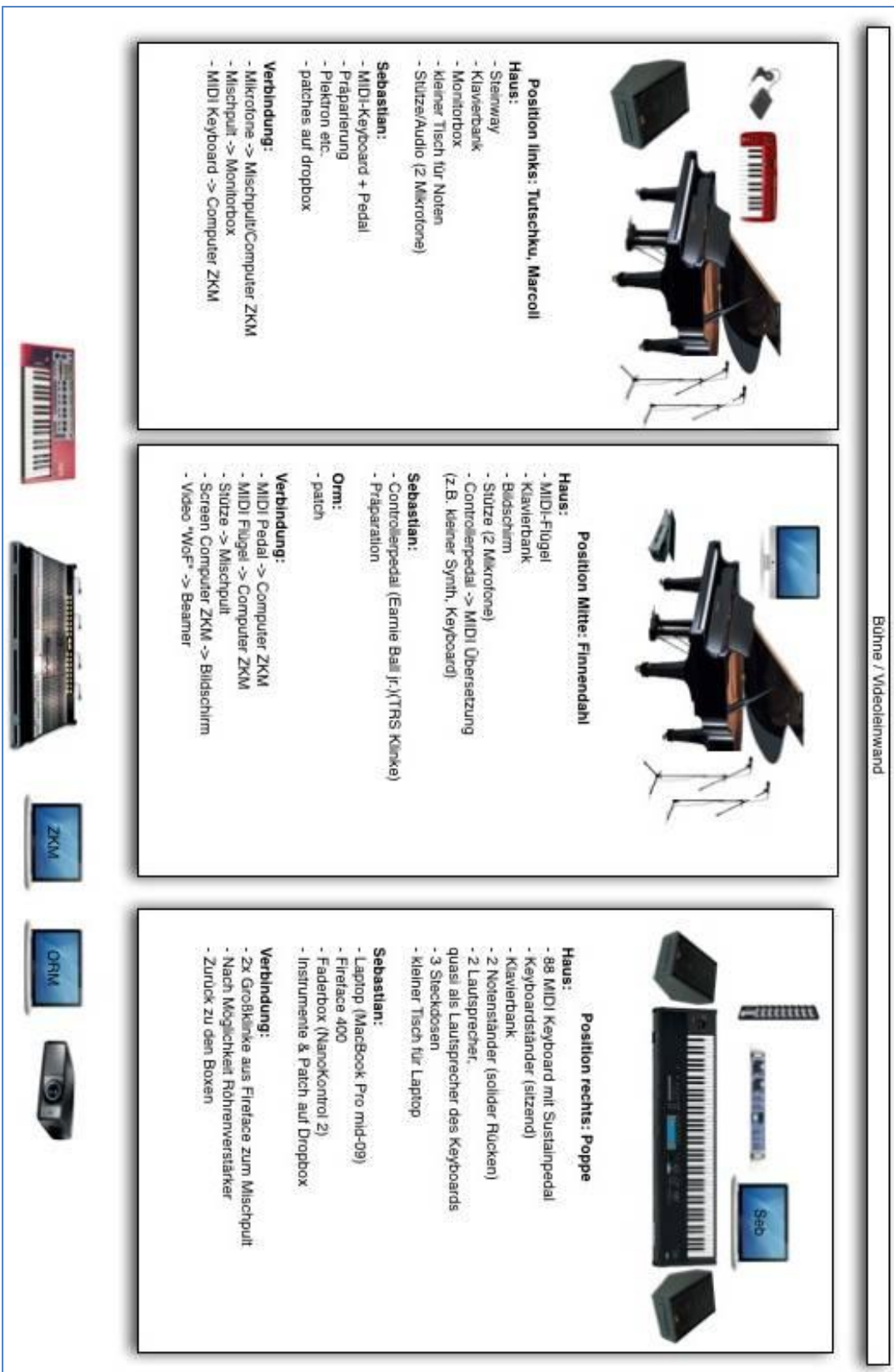- Nach Möglichkeit Röhrenverstärker
- Zurück zu den Boxen

Figure 39: Second tech rider ZKM November 25, 2011

From the performer's perspective this concert, as well as the previously described tour (cp. chapter 4.5), ran as smoothly as can be wished for. The defaulting of the patch by Orm Finnendahl (cp. chapter 3.4.4) described earlier and the sound engineer drastically lowering the volume in the piece by Poppe (although promising not to do so) make clear though that the production of music with live-electronics is teamwork and that, unlike in purely acoustic concerts, the course of the performance is not solely in the instrumentalists hands. But with the lessons learned from earlier concerts the setting up and performing of the last concerts differed starkly from the concerts described in 4.2 and 4.4 and can probably be considered the optimum of what is possible at this time.

5 Summary

The discussion of the nine very different compositions and the course of the concerts over three years revealed many different problems as well as several remedies to the most common problems in the production of music with electronics.

The intention of the discussion is to outline the roots of those problems as well as propose solutions as to how to share the elevated workload when producing music with electronics. It is not being stipulated that the outlined solutions (nor the problems) cover everything that might be experienced when performing music with electronics. There are just too many fields of expertise that need to be discussed – from data archaeology and project management to copyright issues and personal issues – that it would be absurd to claim that everything can be covered in one study alone.

The findings outlined below under the headers of the five stakeholder groups nonetheless give a detailed overview of where the conventional production of music must adapt to the new challenges when producing electroacoustic music.

5.1 Publishers

With the advent of music with electronics, the chores of the publishers have dramatically changed. Historically, the main task of a music publisher was to produce and distribute printed editions of music. With electronics, not only has the storage of the information changed, but also a meta-instrument was invented that is not being played by a specific instrumentalist. Furthermore, the legal situation has become much more complex with the inclusion of other parties like technicians and programmers who need not only be included in the business chain but in the upkeep of the material, too. Since the legal situation is unclear as to who can claim authorship on patches and to what extent, the financial situation remains unstable. Michael Zwenzner of Ricordi München reports that the financial demands of technicians and studios have at times been such that the performance of pieces has become impracticable (cp. chapter 5.4.2). He mentions that the situation where technicians and studios 'suddenly are no longer available'[373] sometimes results in an outright 'blockade'[374] of performances which keeps being 'a very unpleasant problem'.[375] To summarise, it can be observed that the business model has changed dramatically and scores which historically were bought once and for all now carry an unforeseeable financial burden in their upkeep.

However, it must be said that it seems that both composers and performers are sometimes unhappy with publishers. This view is reflected in several publications on the web, like the blog of Tim

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[373] '*plötzlich nicht mehr zur Verfügung stehen*', personal communication by e-mail on February 24, 2012.
[374] '*Blockade*', ibid.
[375] '*eine sehr unangenehme Problematik*', ibid.

Rutherford-Johnson with entries by Pedro Alvarez ('I wanted to buy a couple of scores by a quite famous German composer [...] I was so surprised to find out that they just weren't interested in selling them'), Will Mego ('They seem to do little or nothing to promote'), Dave MacDonald ('If publishers really provided the best and most useful information in a clear and engaging way'), N F Chase ('I know many composers who have played the major leagues in publishing for years and are refusing to continue with the old stand-bys – BooseyHawkes, Peters, et al, because those consistently fail to extend their catalogues to customers. [...] What's more, as pointed out above, publishers frequently don't have any idea what is in their catalogue'), and Henry Holland ('I can't tell you how many times I've seen an announcement of a production on an opera company's website and it will take 3 months to show up at the UE site, *if it shows up at all*').[376] Eminent composers Johannes Schöllhorn and Mathias Spahlinger readily provide many stories of neglect of works on behalf of the publishers,[377] and case studies in chapters 3.1, 3.2, and 3.5 deliver some more material. It is therefore well worth looking at the role of publishers in the production of music with electronics.

5.1.1 The material is lost

Publishing houses play an eminent role in the upkeep of our musical heritage, as for example *L'Archivio Storico Ricordi* with 5,000 scores and 9,000 libretti at the Braidense National Library shows.[378] However, in this study, two instances where material and with it the compositions are lost have been found. In the interview with Alcides Lanza, he refers to some compositions of his from the 1960s where his publisher simply cannot find the tapes.[379] And although a much better tape has been found and is waiting for restoration (cp. chapter 3.2) it must be said that the tape for *...sofferte onde serene... by Luigi Nono* is still not the original tape.

5.1.2 The material is not stored properly

Magnetic tapes have, for a long time, often not been stored properly and the quest for saving them has been written about extensively. James Eggleston of Boosey & Hawkes London recalls tapes being stretched by inadequate storage, which results in the tape sounding a semitone lower than the instruments.[380] This problem has since been tackled on a major scale and already in 2006, Simon Emmerson stated that 'transcription standards have become (pretty well) established and substantial

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[376] All comments in Tim Rutherford-Johnson, "Music Publishers Losing Ground to the Unauthorised Web," The Rambler (blog), July 12, 2011, http://johnsonsrambler.wordpress.com/2011/07/12/music-publishers-losing-ground-to-the-unauthorised-web/. The orthography has been left untouched.

[377] In private conversations by e-mail (Johannes Schöllhorn on September 27, 2011) and in person.

[378] "Ricordi & C. - Historical Archive," n.d., accessed 14 June 2012, http://www.ricordicompany.com/archivio_index.php?lang=eng.

[379] Alcides Lanza, "Interview with Alcides Lanza" interview by Sebastian Berweck, Digital Recording, January 30, 2010.

[380] James Eggleston, "Interview with James Eggleston" interview by Sebastian Berweck, Digital Recording, June 28, 2011.

progress made in creating digital archives of analogue works.'[381] Proof of this could be the Concordia Archival Project (CAP), where a major collection of electroacoustic works from the 1960s–1990s held at Montréal's Concordia University has been recovered and digitally archived.[382] In fact, the archiving of data has grown into a major business, as for example over 750,000 carriers containing music (analogue tapes, digital tapes, CDs) of the Universal Music Group International are currently being digitized by a firm in Bremen.[383] Whether all archives will be able to restore their tapes is questionable though, as the experiences with the Yvar Mikhashoff Archive at the University of Buffalo show (cp. footnote 95).

Unfortunately, the same cannot be said about obsolete computer programs and electronic hardware, an issue currently being discussed even in the wider public, as shown by articles in *The Atlantic*[384] and *Lettre International*[385] as well as the exhibition *Digital Art Works – The Challenges of Conservation* at the ZKM Karlsruhe.[386] It is also being debated in the scientific community (cp. chapter 5.2.1 for further discussion) and is heavily invested in by state organizations like the CASPAR project for preservation of digitally encoded information of the European Union,[387] its US-American counterpart, the National Digital Information Infrastructure and Preservation Program (NDIIPP),[388] and the mainly Canadian project International Research on Permanent Authentic Records in Electronic Systems (InterPARES).[389] Examples for projects specifically aimed at media art and music would be mediaartbase.de, a project aimed at building a database for several major German art institutions,[390] and the Birmingham Conservatoire's Integra project, whose tools are used, amongst other things, to modernise works that use old technology.[391] However, it seems that publishers lag behind on these issues and Polfreman, Sheppard and Dearden find that 'publishers and composers are not generally organised to update their archives systematically and transfer material to new media as these become outdated. Their approach has been generally reactive, with the demand for a performance

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[381] Simon Emmerson, "In What Form Can 'Live Electronic Music' Live On?," *Organised Sound* 11, no. 03 (2006): 209.

[382] Jef Chippewa and Yves Gigon, "CEC - The Concordia Archival Project (CAP)," *eContact!* 10, no. x (December 2008), accessed 11 May 2012, http://cec.sonus.ca/education/archive/10_x/cap.html.

[383] Cube-Tech International, "Virtual Crown Jewels" (Cube-Tech International, n.d.), accessed 11 May 2012, http://www.cube-tec.com/downloads/maas_VirtualCrownJewels2010_07.pdf.

[384] Clay Risen, "Inside the Pac-Man Archives," *The Atlantic*, March 2010.

[385] John Adams, "Die Maschine im Garten," trans. Jens Hagestedt, *Lettre International*, December 2009.

[386] Chiara Marchini Camia, *Digital Art Works - The Challenges of Conservation* (Karlsruhe: ZKM, 2012).

[387] "CASPAR Digital Preservation User Community," n.d., accessed 11 May 2012, http://www.casparpreserves.eu/.

[388] "Digital Preservation (Library of Congress)," n.d., accessed 11 May 2012, http://www.digitalpreservation.gov/.

[389] "The InterPARES Project:," n.d., accessed 20 May 2012, http://www.interpares.org/.

[390] "Community List," n.d., accessed 11 May 2012, http://www.mediaartbase.de/?locale-attribute=en.

[391] "Integra Project – Fusing Music and Technology," n.d., accessed 11 May 2012, http://www.integralive.org/.

leading to required updates. This leaves works that have not been performed for a number of years in real danger of becoming too difficult to stage.'[392]

5.1.3 The patch is not updated

Since computer systems are being constantly renewed and demand updated software, it is unlikely that one will indeed get an up-to-date patch: it is simply unworkable for a publisher to revise every patch for every composition after each software update. Since publishers do not have electronic studios, all the work concerning the electronics is being outsourced. The approach and the cost distribution is different with every publisher: Breitkopf & Härtel generally work together with large studios and pay for the upkeep of the electronics[393] and Ricordi tries to establish the same connections in the long term but faces problems since the staff resources of those institutions are limited.[394] Both publishers take on responsibility for the ensuing financial obligations. Boosey & Hawkes on the other hand will try to establish a connection between the customer and the programmer/technician who realized the piece but does not want to be involved in the separate financial discussion that will ensue.[395] The young publishing house Edition Juliane Klein finally sends updated patches on CD to the customer and their composers see it as their duty to update their patches.[396]

It is obvious that some publishers will only work as far as their economic interests go and that they will probably not re-finance a whole revision of a composition that is not often being played. The expectation of the buyer or leaser though would be to get fully functioning material at the price given in the catalogue. However, it is often the case that the consumer only gets some hints about the whereabouts of the electronics from the publisher and has to finance the re-working of the software. This is indeed a change of the business model, which is passed over in silence by the publishers.

5.1.4 The information is incomplete

If a publishing house agrees to be the distributor of a composition, the buyer or leaser expects edited material. Prominent examples where this does not apply to the score could be the many scores where the handwriting of the composer is simply hectographed, like the score of Nono's *...sofferte onde serene...* (Ricordi München) or the works by John Cage (C.F.Peters Frankfurt) and Milton Babbitt

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[392] Richard Polfreman, David Sheppard, and Ian Dearden, "Time to Re-wire? Problems and Strategies for the Maintenance of Live Electronics," *Organised Sound* 11, no. 3 (2006): 229f.

[393] Thomas Trapp, "Interview with Thomas Trapp" interview by Sebastian Berweck, Digital Recording, June 18, 2010.

[394] Personal communication with Michael Zwenzner by e-mail on February 24, 2012.

[395] Eggleston, "Interview with James Eggleston."

[396] Cp. Lippe, "Interview with Cort Lippe." as well as the cited compositions by Hans Tutschku, Scott McLaughlin and Richard Festinger.

(C.F.Peters New York).[397] The above examples are chosen because of the importance of the composers and the publishers.

For programming purposes, it is vital that all the information pertaining to the condition of the composition is readily available. If Giacinto Scelsi's *Aitsi* is taken as an example (cp. chapter 3.1), it can be seen that Salabert simply lists it as '*pour piano'* (cp. Figure 40), although it should at least say '*pour piano amplifié*' as Scelsi wrote it.
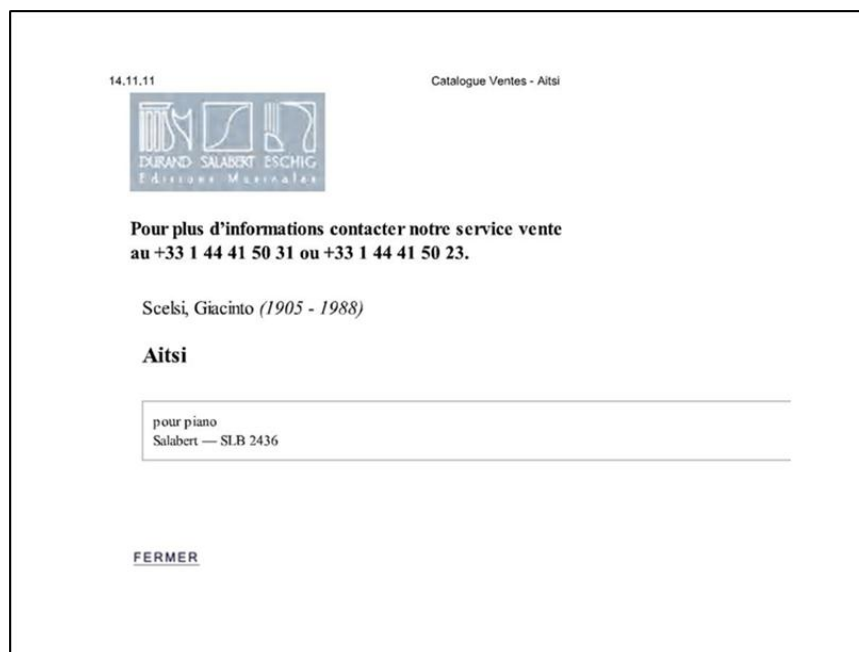

Figure 40: Catalogue reprint of *Aitsi* by Giacinto Scelsi at Salabert[398]

NoaNoa by Kaija Saariaho[399] can be obtained by Chester Novello and Hal Leonard. Hal Leonard sells the score for $ 17.95 and lists the piece as 'for Flute and Electronics' but does not give any hint as to where to obtain the electronics (cp. Figure 41).

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[397] The fee for the score and the (reel) tape of Babbitt's *Reflections* amount to $ 116 plus handling and shipping.
[398] http://www.durand-salabert-eschig.com/fiche_vente.php?id=13410&lang=fr (Acc. May 12, 2012)
[399] Kaija Saariaho, *NoaNoa* (London: Chester Music, 1992).

Figure 41: *NoaNoa* **by Kaija Saariaho at Hal Leonard**[400]

Chester Novello lists the piece in the category 'Solo Works (excluding keyboard)' and provides two links for the score: the *Full Score* with the order number CH60955 and a *Set of Parts* with the number OM24564 (cp. Figure 42).

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[400] http://www.halleonard.com/product/viewproduct.do?itemid=14028535 (Acc. May 12, 2012)

Figure 42: *NoaNoa* at Chester Novello[401]

Following the link to the 'Full Score' one may buy the 'Sheet Music' for £ 9.95 and following the 'Set of Parts' it is possible to buy a CD-ROM with the 'Software for this piece' for £ 14.95 (cp. Figure 43).

[401] http://www.chesternovello.com/default.aspx?TabId=2432&State_3041=2&workId_3041=11105# (Acc. November 14, 2011)

Figure 43: Software for *NoaNoa* for sale[402]

Surprisingly though, at Chester Novello the software can be downloaded for free by following the link 'For full information on the electronics' (cp. Figure 42).

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[402] http://www.musicroom.com/se/ID_No/00009903/details.html?kbid=1296 (Acc. May 12, 2012)

Figure 44: Download of software for _NoaNoa_[403]

The description of the software and the requirements that then show up in a new window (cp. Figure 44) as well as the possibility to download the latest patch version as a .zip-file are exemplary. However, for the buyer of the score the situation is confusing: Hal Leonard ignores the existence of the computer patch and Chester Novello tries to sell it (thus more than doubling the price for the score) but on the other hand provides up-to-date information for free and a download link.

In any case, what is still unknown at this moment is the instrumentation of the piece: is it a duo for flute and sound engineer or can it be played by the flutist alone? Another example would be a composition for piano and live-electronics, which could in fact very well be a duo for pianist and the player of the electronics. The two examples make clear that music with electronics does not fit within the pre-defined categories and it might be better to list them following the example of works for orchestra: they are listed under the orchestra header but detail how many players on what instruments are needed.

However, more information is needed: a composition 'for synthesizer' could mean anything from a hardware synthesizer to a Max/MSP patch to a free choice of an electronic music instrument. Therefore, hardware model, software used, programming tasks, operating system, data carrier

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[403] http://www.chesternovello.com/documents/additional/noanoa.htm (Acc. November 14, 2011)

(download, CD-ROM, floppy disc) and not last the program version on which any pre-programmed data was tested on are all vital information without which no informed evaluation on the actual condition of the composition and the amount of work that has to go into it can be made.

5.1.5 Technical information is incomplete or false

In regards to the technical information, 'there is significant variability in the quality of information publishers keep readily available regarding both the technical requirements for a work and the materials available [...] In order to get the precise specification it is typically necessary to go to the score itself, although even here the information might not be sufficient in some cases.'[404] Examples for the latter are all the case studies on the pieces that are being published by publishers, which are the compositions by Nono, Scelsi and Poppe. Kerry Yong gives other examples where the information is not updated. He mentions the seminal *Synchronisms No. 6* by Mario Davidovsky:[405] 'The introductory page [...] appears not to have been updated' and 'provides no explanatory or systematic information in the performance notes',[406] as well as Milton Babbitt's *Reflections*,[407] where the tape was provided on a ¼ inch reel-to-reel tape and where 'no directions [are] given on an ideal balance, the placement of speakers or the relation between the tape sound source and the acoustic piano'.[408] This problem obviously overlaps with the responsibility of the composers to write down all the information needed and as we will see below it is an often-neglected deed. Nevertheless, it is the responsibility of the publisher to make sure that their products have the correct information and that they do not deliver a text that leaves so much room for interpretation as has been demonstrated in the case studies of Scelsi and Nono.

Thomas Trapp of Breitkopf & Härtel mentions that oftentimes the technical set-up of a work changes between the preparation of the material for a premiere and the actual premiere simply because the first realisation of the piece commands them. These changes are often not communicated back to the publisher, which results in the notes for the technical set-up being outdated even before the composition is set for the stage the very first time. Although the course of this process is comprehensible, it leads to scores with faulty technical directions and a more pro-active attitude could remedy this for example by demanding an update from the technical team of the premiere and including it in the score in form of an errata sheet.

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[404] Polfreman, Sheppard, and Dearden, "Time to Re-wire? Problems and Strategies for the Maintenance of Live Electronics," 230.
[405] Mario Davidovsky, *Synchronisms No. 6* (New York City: E. B. Marks, print on demand).
[406] Yong, "Performance Practices in Music for Piano with Electroacoustics," 172, 175.
[407] Milton Babbitt, *Reflections* (New York City: C.F.Peters, 1976).
[408] Yong, "Performance Practices in Music for Piano with Electroacoustics," 208.

5.1.6 Location of the material is not obvious

If it is agreed that the publisher cannot uphold working patches at any time, information on where to obtain a working patch or at least the relevant information on where to start the work must be readily available. The above-cited example of *NoaNoa* by Kaija Saariaho as well as the case study on *Arbeit* by Enno Poppe show that the information on the whereabouts is not given and the customer might have to call in to get full information on the electronics. James Eggleston, head of publishing of Boosey & Hawkes in London, encourages everybody to see the publishers as partners in the production of music but the (paying) consumer obviously expects a finished product and not a product they have to call in to find out more information on how to make it work. From the performer's standpoint, however, it would be desirable if this information could be as easily found as the information for purely acoustic music.

5.1.7 Conclusion

As mentioned earlier it is understandable that publishers do not update compositions with live-electronics when the compositions are not played very often, if at all. It is also difficult for the publisher to get the technical requirements correct and complete when the composers do not provide them and the publisher can only ask for them.[409] Nonetheless, the publishers do have a responsibility to the buyer/leaser and the musical heritage and while a 'performance-driven updating of works ensures the survival of some works, others that are being neglected at present may become so difficult to perform as to be effectively lost forever.'[410]

Behind closed doors, publishers admit that things are not as they should be. In conversations with publishing houses Boosey & Hawkes, Ricordi, Breitkopf & Härtel as well as in a telephone conversation with Rolf Stoll of Schott Music[411] financial issues and too little revenue from chamber music works are being cited. However, this is not the place to discuss whether the publishing of contemporary classical works for chamber works provides enough revenue from leasing, selling and collecting royalties; it would lead away from the main argument. If a publishing company takes on the work of a composer, they have the ultimate responsibility to archive the work, even more so when they are often the only source of information after the death of the composer.

From the standpoint of a performer, publishers fall short on these issues:

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[409] In a personal communication with Julia Haecker, former research associate at mediaartbase.de (cp. footnote 390), she reveals that the hardest part in setting up an archive for media art was to get the information from the artists themselves.

[410] Polfreman, Sheppard, and Dearden, "Time to Re-wire? Problems and Strategies for the Maintenance of Live Electronics," 242.

[411] A publishing house that refrains from publishing electroacoustic music.

- the old business model of obtaining reliable and complete material from the publisher has been unilaterally changed and holds true only for the printed score.
- printed information in the score on technical requirements can be incomplete or false.
- information on the location of the technical requirement has to be searched for.
- the cost for updating the software, whether this is being done by a studio contracted to the publisher or by the interpreter, has often to be carried by the interpreter or the promoter.
- information on the websites and the catalogues are incomplete and it takes research to find out how much work must be put into a composition. Unfortunately, this research needs expertise, which an instrumentalist is likely not to have.

Proposed changes in practices by publishers are therefore to

- secure the longevity of the remaining analogue tapes and the digital data; probably by working together with the above mentioned state-funded organizations (CASPAR, NDIIPP, mediaartbase)
- develop a formalized tech sheet that composers will have to fill in the information concerning the hardware set-up (this could be done in ways analogous to the formalized tech riders of promoters like the ZKM, the Ensemble Modern or the Huddersfield Contemporary Music Festival)
- develop a formalized tech sheet upon which composers will have to fill in the information concerning the software set-up
- develop a database where the current state of the software is documented (cp. Figure 44)
- develop a consistent instrumentation of electronics instruments analogous to acoustic instrument ensembles
- work together with a specialist to develop the requirements and implement them in a way that is easy for both the publishers and the customers to use
- work together with copyright agencies to establish a solid legal basis on which the works can be sold/hired[412]
- establish a pro-active attitude in preserving the works, as opposed to a reactive one.

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[412] An example on how to deal with this issue can be taken from Daniel Teruggi, "Is There a Right Way to Deal with Rights?," *Organised Sound* 11, no. 3 (2006): 205–207.

5.2 Composers

Many of the things that have been said about the publishers can be said about the composers as well, since the publishers are often dependent upon the information the composers convey to them. Moreover, since composers have begun to self-publish the findings in 5.1 applies to them as well, if they take on that role. After a brief discussion on record keeping and archiving of electronics, this section will deal mainly with computer patches coded by the composers themselves. It will end with a proposal about what information should be listed in a tech rider.

5.2.1 Material is lost or deteriorated

In a survey of record keeping practices of composers on behalf of the InterPARES 2 project[413] in 2004 Michael Longton found that:

- 97% attempt to keep the digital files

- almost half (47 %) of the respondents have lost files they considered valuable through hardware or software obsolescence

- 40% do not keep a record of the digital records they produce

- lack of time, knowledge and especially money was evidenced by respondents as the reason for not doing more in the way of record keeping[414]

- some composers appear to be overwhelmed by the amount of work that seems to be needed: 'In order to preserve a work, one needs to not only keep the media, but also the machines that read it! It seems insurmountable'[415]

These findings seem to hint at some confusion on how and what to archive as well as a certain attitude that is best expressed in the words of one composer: 'Though we might do the backups, keeping them organized is not exactly in the nature of most composers.'[416]

The interviews conducted with the about two dozen composers in the course of this study indicate that not much has changed since the survey in 2004, despite the issue being widely discussed, as for example the December 2006 issue on sustainability by *Organised Sound* shows. Since it is not in the scope of this study to go into detail how composers could build up reliable archiving schemes only an overview of the most important articles is given here:

- Polfreman, Sheppard, Dearden: Time to re-wire? Problems and strategies for the maintenance of live electronics[417]

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[413] http://www.interpares.org/

[414] This information is taken from the overview of the above cited survey. Cp. Peter Gagné, *Overview: General Study 04: Survey of Recordkeeping Practices of Composers* (Université Laval: InterPARES 2 Project, 2006).

[415] Michael Longton, *Survey of Recordkeeping Practices of Composers* (InterPARES 2 Project, rev 2004).

[416] Gagné, *Overview: General Study 04: Survey of Recordkeeping Practices of Composers*.

- Wetzel: A model for the conservation of interactive electroacoustic repertoire [...][418]

- Emmerson: In what form can 'live electronic music' live on?[419]

- Bernardini, Vidolin: Sustainable live electro-acoustic music[420]

- Guercio, Barthélemy, Bonardi: Authenticity Issues in Performing Arts using Live Electronics[421]

- Bonardi, Barthelémy: The Preservation, Emulation, Migration, and Virtualization of Live Electronics for Performing Arts: An Overview of Musical and Technical Issues[422]

- Bullock, Coccioli: Modernising musical works involving Yamaha DX-based synthesis: a case study[423]

- Bullock: Modernising live electronics technology in the works of Jonathan Harvey[424]

- Puckette: New Public-Domain Realizations of Standard Pieces for Instruments and Live Electronics[425]

- Burns: Realizing Lucier and Stockhausen[426]

Finally, Andrew Gerzso found a very interesting way to notate the electronics in a way that is also most helpful for the performer. It can be found in the score of Pierre Boulez' *Anthèmes 2.*[427]

The results of these studies are varied in their complexity and their approach: Vidolin and Bernardini suggest a multi-media glossary complete with impulse responses of the single modules and Bonardi and Barthélemy see plain words (they call it virtualization) as the way for longevity of live-electronics. What the authors agree on is that non-proprietary file formats should immediately guarantee a much

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[417] Polfreman, Sheppard, and Dearden, "Time to Re-wire? Problems and Strategies for the Maintenance of Live Electronics."

[418] Wetzel, "A Model for the Conservation of Interactive Electroacoustic Repertoire: Analysis, Reconstruction, and Performance in the Face of Technological Obsolescence."

[419] Emmerson, "In What Form Can 'Live Electronic Music' Live On?".

[420] Bernardini and Vidolin, "Sustainable Live Electro-Acoustic Music."

[421] Mariella Guercio, Jerome Barthélemy, and Alain Bonardi, "Authenticity Issue in Performing Arts Using Live Electronics," in *Proceedings of the Sound and Music Computing Conference 2007* (presented at the Sound and Music Computing Conference 2007, Lefkada: Sound and Music Computing Conference, 2007).

[422] Alain Bonardi and Jerome Barthélemy, "The Preservation, Emulation, Migration, and Virtualization of Live Electronics for Performing Arts: An Overview of Musical and Technical Issues," *Journal on Computing and Cultural Heritage* 1, no. 1 (2008).

[423] Jamie Bullock and Lamberto Coccioli, "Modernising Musical Works Involving Yamaha DX-Based Synthesis: A Case Study," *Organised Sound* 11, no. 03 (2006): 221–227.

[424] Jamie Bullock, "Modernising Live Electronics Technology in the Works of Jonathan Harvey," in *Proceedings of the International Computer Music Conference 2005* (presented at the International Computer Music Conference 2005, Barcelona: International Computer Music Association, 2005).

[425] Miller Puckette, "New Public-Domain Realizations of Standard Pieces for Instruments and Live Electronics," in *Proceedings of the International Computer Music Conference 2001* (presented at the International Computer Music Conference 2001, San Francisco: International Computer Music Association, 2001).

[426] Christopher Burns, "Realizing Lucier and Stockhausen: Case Studies in the Performance Practice of Electroacoustic Music," *Journal of New Music Research* 31, no. 1 (2002): 59–68.

[427] Pierre Boulez, *Anthèmes 2* (Vienna: Universal Edition, 1994).

longer life span of the information. An example for this – and a solution that can be adapted to other problems – would be to provide wave-files and instructions on how to implement them into a sample player instead of providing a file for a specific program.

5.2.2 Computer patches

That the technology is not working on the day of the concert seems to be taken as fate and technological problems are deemed inevitable like breaking strings on a piano. That it is – apart from the cables – especially the software part of the electronic set-up that is prone to failure is confirmed by three sound engineers, who convey in the interviews that the first thing they do when they get a new Apple computer is to silence the start-up chime in order to not let the public know when they need to reboot the computer.[428] In order to shed some light on the severity and frequency of such incidents, a random list of incidents together with quotes from practitioners is presented:

- Joan Riera Robusté: *Deformacions n.2*,[429] Sant Joan de Vilatorrada 2008. The piece was composed on a laptop different from the older machine the premiere was to be played on and only a week before the concert it was found out that this computer could not take the workload. The two possible solutions at that time were to buy a newer computer or to adapt the patch to the older computer. Both ways were unsuccessfully followed. The electronics failed in the concert.
- Orm Finnendahl: *Wheel of Fortune,*[430] Freiburg 1995. Some electronics provided by the promoter did not work properly and the piece had to be recoded to adapt to the situation. This resulted in an extremely stressful situation on the day of the concert and coding right until the concert. The premiere failed because of a stressed out sound technician.
- Martin Schüttler: *schöner leben 2,*[431] Karlsruhe 2009. The performance failed because the set-up in the hall was buggy and some feedback occurred. This resulted in last minute changes to the patch, which resulted in a distorted performance.
- Hans Tutschku: *Zellen-Linien*[432]*,* Hannover 2009. The MIDI pedal sent multiple signals upon press and release, resulting in 'double triggers'.[433]
- Enno Poppe: *Arbeit,*[434] Karlsruhe 2011. The MIDI pedal, which worked perfectly well in the dress rehearsal and did not get touched until the beginning of the concert, did not send out any MIDI signals in the concert, which resulted in a failed performance.
- Richard Festinger: Head over Heels,[435] Berlin 2011. The patch could not be tested on a modern computer and to find out what needs to be updated and the search for solutions on

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[428] Cp. Todd Vos, "Interview with Todd Vos" interview by Sebastian Berweck, Digital Recording, February 1, 2010; Ean White, "Interview with Ean White" interview by Sebastian Berweck, Digital Recording, February 12, 2010; Brad Garton, "Interview with Brad Garton" interview by Sebastian Berweck, Digital Recording, February 3, 2010.

[429] Joan Riera Robusté, *Deformacions n.2* (Manuscript, 2008).

[430] Finnendahl, *Wheel of Fortune*.

[431] Schüttler, *schöner leben 2 (Monument für T.H.)*.

[432] Tutschku, *Zellen-Linien*.

[433] A 'double trigger' is the author's expression for the common pedal problem that the pedal gets pressed once but sends two or more signals to the computer.

[434] Poppe, *Arbeit*.

- the net and in talks with people from Cycling '74 took such a long time that the performance had to be cancelled.
- Scott McLaughlin: Dissolution,436 Huddersfield 2010. The patch simply never worked and the piece performed was very different from the original intention.
- Scott Hewitt: on_radio_midi,437 Huddersfield 2010. The patch would only work if the local hard drive was renamed.
- Orm Finnendahl: Wheel of Fortune,438 Berlin 2011. A six hour rehearsal was spent compiling and recoding erroneous software on another computer with another operating system.
- Alvin Lucier: Gentle Fire,439 Freiburg 2009. The computer patch was 'optimized' in the minutes before the concert resulting in a malfunction and a premature end of the rendition.
- Martin Schüttler: venus_5,440 Karlsruhe 2002. The performer got the dozens of triggers only two days before the rehearsal because the patch was not finished.

Further reports come from Rei Nakamura:

- Shortly before the concert we had difficulties with the prepared patch and, in order to perform the piece, the only option was for [the composer Alistair] Zaldua to trigger the sound manually.[441]
- Despite the lengthy development process, the very first performance in April 2008 was also the very first rehearsal with the complete audio-video set up.[442]Much rehearsal time in the concert space was spent working out details of the computer program designed for the project, or waiting nervously for the video signal to [be] recognized by the software.[443]
- It would not be unusual to have spent half a day working on the technical set up, before even beginning to play.[444]

and Sarah Nicolls:

- Setting up takes time and the frustration can easily be that you sit down for 2 hours practice and spend 3 days trying to get a sound out of the thing![445]

Finally, it must be said that the 'comedy of errors'[446] — as Elizabeth McNutt calls the following excerpt from a text by Puckette and Settel from 1993 — still holds true today:

The composer… must first assemble the combination of local and flown-in gear which will permit the piece to be played. If time remains, the piece will be rehearsed and adapted to

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[435] Festinger, *Head over Heels*.
[436] McLaughlin, *Dissolution*.
[437] Scott Hewitt, *on_radio_midi* (Computer program, 2010).
[438] Finnendahl, *Wheel of Fortune (rev. 2011)*.
[439] Alvin Lucier, *Gentle Fire* (Köln: MusikTexte, 2005).
[440] Schüttler, *venus_5*.
[441] Rei Nakamura, "My Cyber Chamber Music Partner," *eContact!* 13, no. 2 (April 2011).
[442] Ibid.
[443] Ibid.
[444] Ibid.
[445] Sarah Nicolls, "Brief Thoughts on Using Live Electronics - Preliminary Version of an Article for eContact! 13.2," April 2011.
[446] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 297.

whatever hardware changes were made. It is at this moment that the player meets her accompanist… for the first time. … Part of the rehearsal is taken up by an extraordinary sound check in which sound engineers push the outputs all the way up to listen to hisses and hums. … The computer software and hardware extend the sound check into a debugging session. The computer is rebooted again. Will it work this time?[447]

Since there is no study yet on the quality and usability of computer patches coded by composers, the author can only pass on some observations made during the study and the previous 15 years of playing with (live-)electronics. These observations are certainly personal; it is hoped however that the number of cited compositions and concerts give some credibility to the findings.

5.2.2.1 Patches are tested on the programmer's computer only

It is the author's experience that new computer patches have in general not been tested on other computers prior to delivery. There seems to be an expectation that a patch that works on one computer will seamlessly work on another one as long as it is an Apple computer. This imagined standard of machinery is contradicted by constant changes made on all levels of hard- and software:

- Hardware: the built-in hardware along with the drivers, for example the change from Texas Instruments to Agere FireWire chips by Apple between 2007 and 2009, caused numerous problems with audio interfaces.[448]

- Interfaces: in the five years of its existence, video and FireWire (none, 400 and 800) connections have changed several times on the Apple MacBook Pro laptop range. The ExpressCard slot has since been abandoned on the smaller models and the latest 17'' MacBook Pro even features a new power plug connector.

- The operating system: the updates to 10.6 and 10.7 were accompanied by major problems with audio devices and RME audio cards, a favourite amongst electronic musicians. A translator program supporting legacy software named Rosetta has implicitly been abandoned.

- Software: The programs running on the operating system are constantly being updated as well, changing the way the program works with the files (for example the changes in the MIDI implementation in Max 4 and Max 5).

Considering all these changes, it should appear unlikely that a patch should seamlessly work without changes on another computer. If the programs written by the coders would at least be tested on one other machine, a good deal of work would have been done (cp. chapters 3.3 and 3.4).

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[447] Puckette and Settel, "Nonobvious Roles for Electronics in Performance Enhancement," 136.
[448] "New Macbook Pro with Lucent/Agere FW Chipset! - Gearslutz.com."

5.2.2.2   Patches are being changed in the week before the concert

Several reasons have been found as to why patches are being (re-)coded until the last minutes before a concert:

- the patch is not ready.

- the soft-/hardware of the concert venue and the machinery brought into it do not work together.

- the patch gets 'optimized'.

- the search for an error while setting up results in changing the patch.

- the operating system or the software got updated prior to the concert and requires adaption to other soft- and hardware.

If a patch is changed prior to the concert, it does not go through an extensive try-out period, which should guarantee its quality. It must be noted that although acoustic compositions or the score of electroacoustic compositions are sometimes finished very late or might not even be finished at all, the incompleteness of a computer patch generates problems on a much larger scale. Whereas instrumentalists can make up for errors in the score or even improvise if needed, the breakdown of a computer patch cannot be evened out.

5.2.2.3   Patches are undocumented

Out of the 25 Max/MSP and Pure Data patches the author has played with and that are cited in this study, 19 do not have a description of the interface. Providing self-made software without any explanation what the buttons and sliders are supposed to do creates a feeling in the performer that might be comparable to trying to use a ticket machine in a foreign city with a different alphabet. To give an impression of the problems an interpreter faces with each undocumented patch, some earlier depicted patches as well as a few more are given:
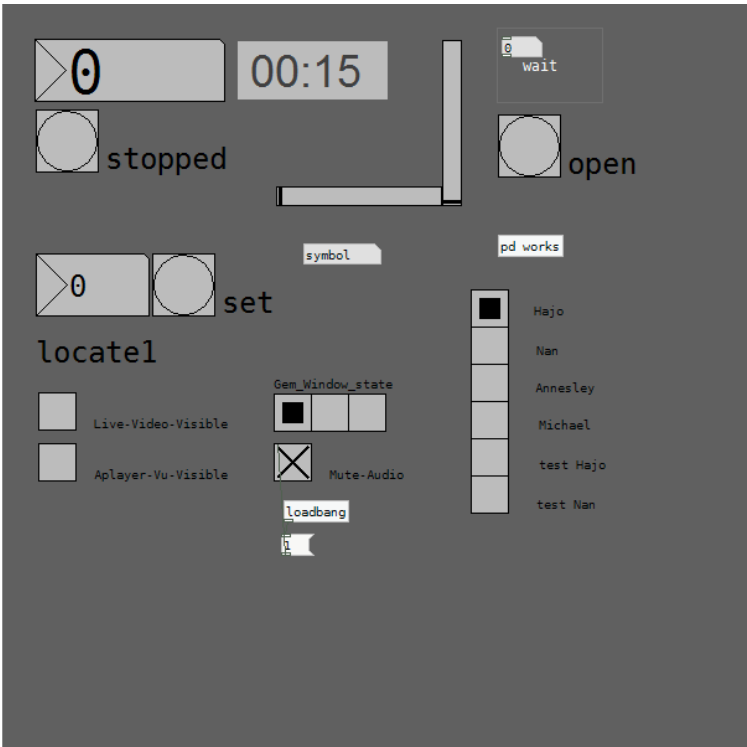
Figure 45: *4238 de Bullion* by Annesley Black[449,450]

Figure 46: *on_radio_(midi)* by Scott Hewitt[451]

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[449] Annesley Black, *4238 de Bullion* (Berlin: Edition Juliane Klein, 2007).
[450] Figures 45-52: Reproduced with kind permission of the authors.
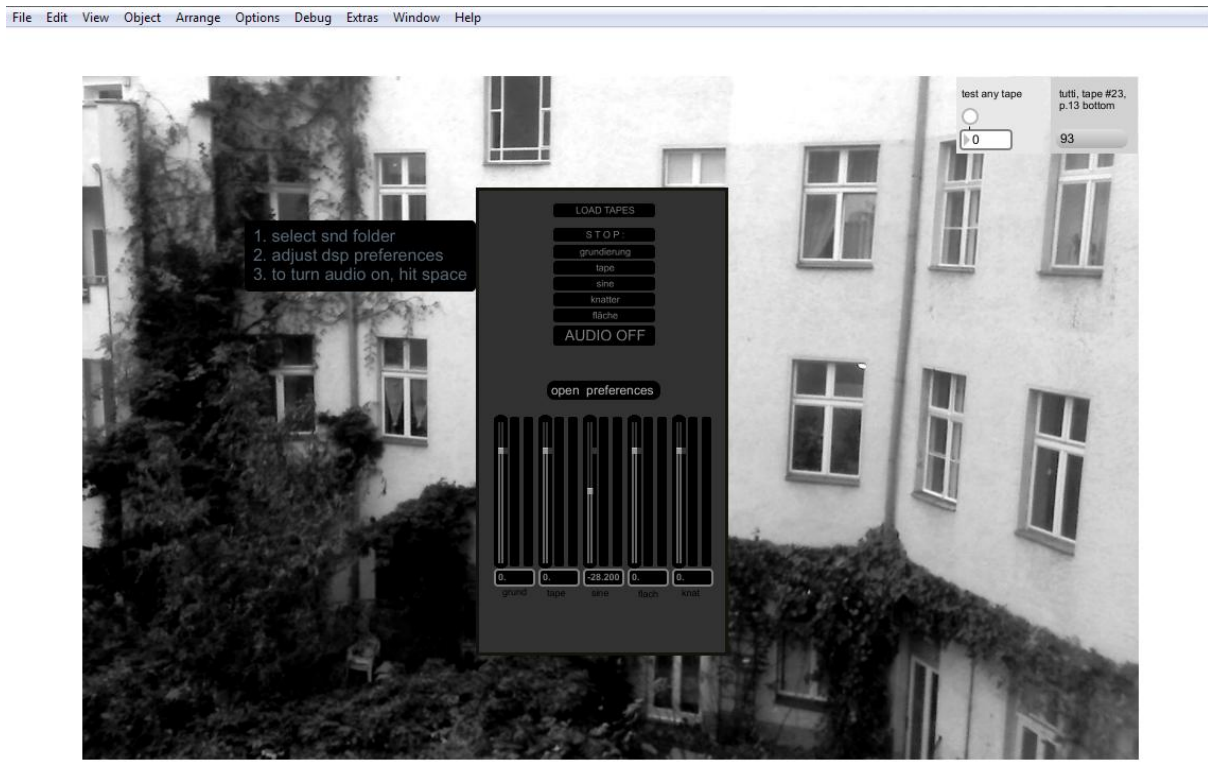
Figure 47: *Samstag Morgen [...]* by Maximilian Marcoll (original version)[452]
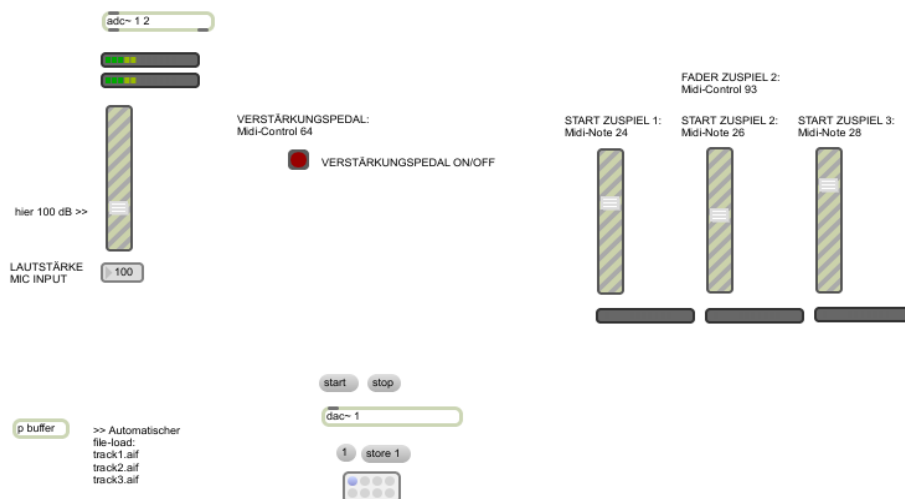
Figure 48: *schöner leben 2 (Monument für T.H.)* by Martin Schüttler[453]

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[451] Hewitt, *on_radio_midi*.

[452] Marcoll, *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.* The composer has since provided a new and better documented patch.

[453] Schüttler, *schöner leben 2 (Monument für T.H.)*.
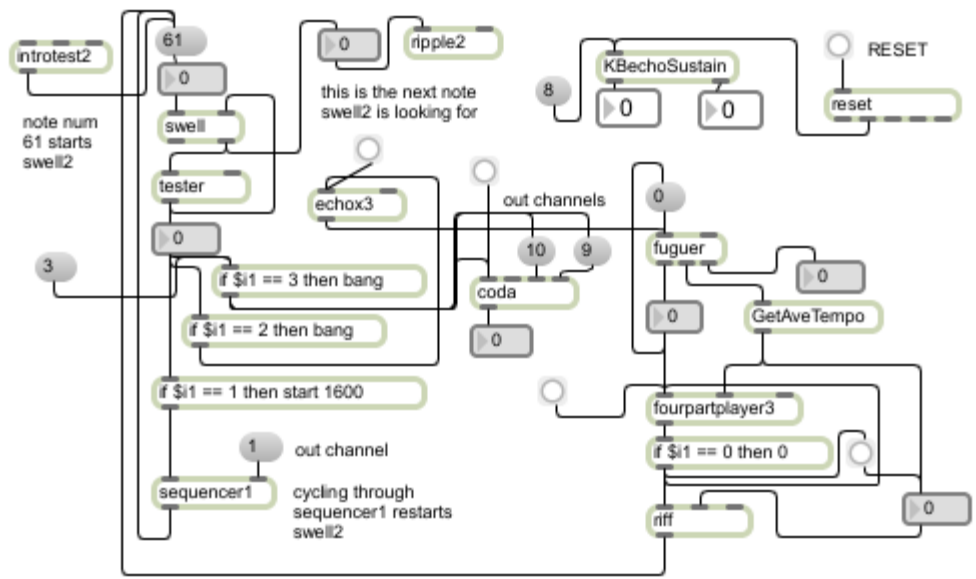
Figure 49: *Head over Heels* by Richard Festinger[454]
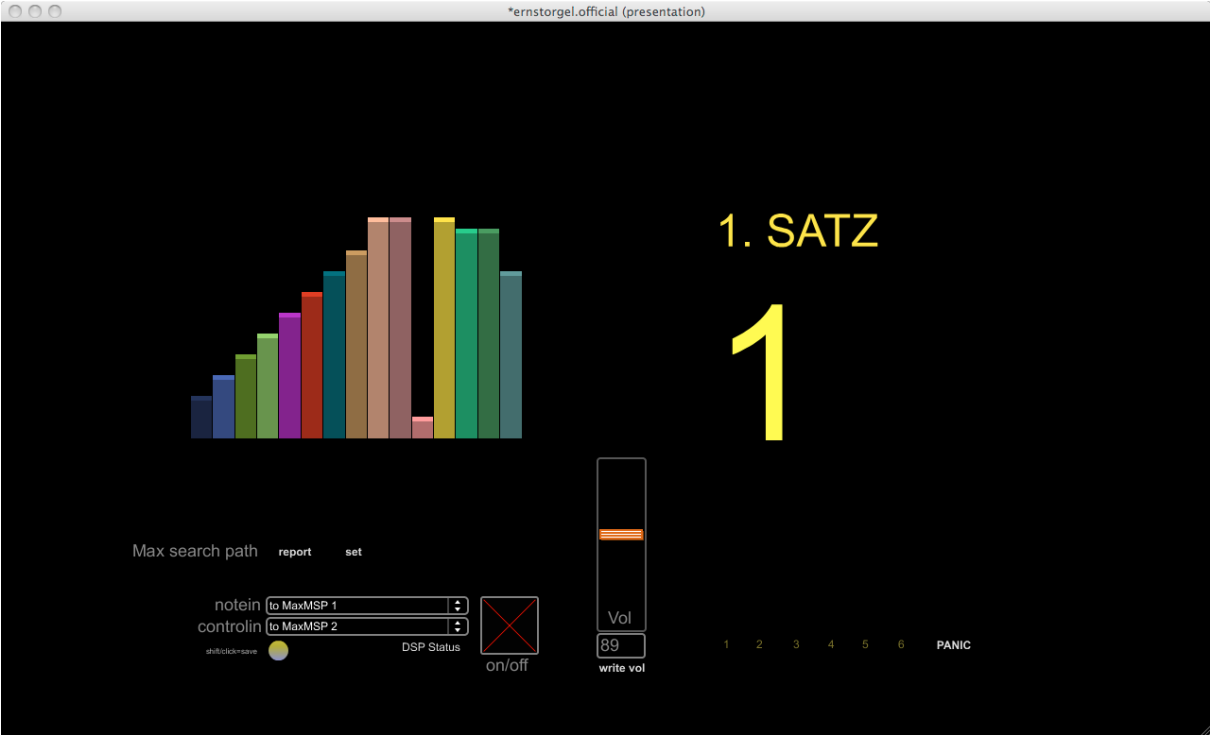
Figure 50: *Arbeit* by Enno Poppe[455]

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[454] Cp. chapter 3.3
[455] Cp. chapter 3.5
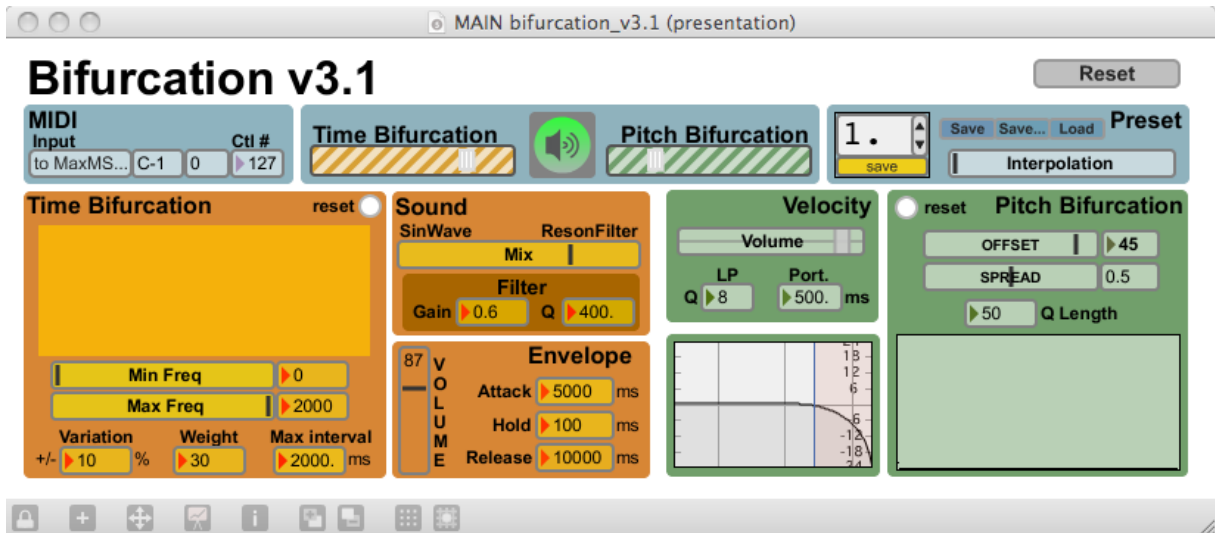
Figure 51: *Bifurcation in a Continuous System* by Scott McLaughlin (first version)[456]
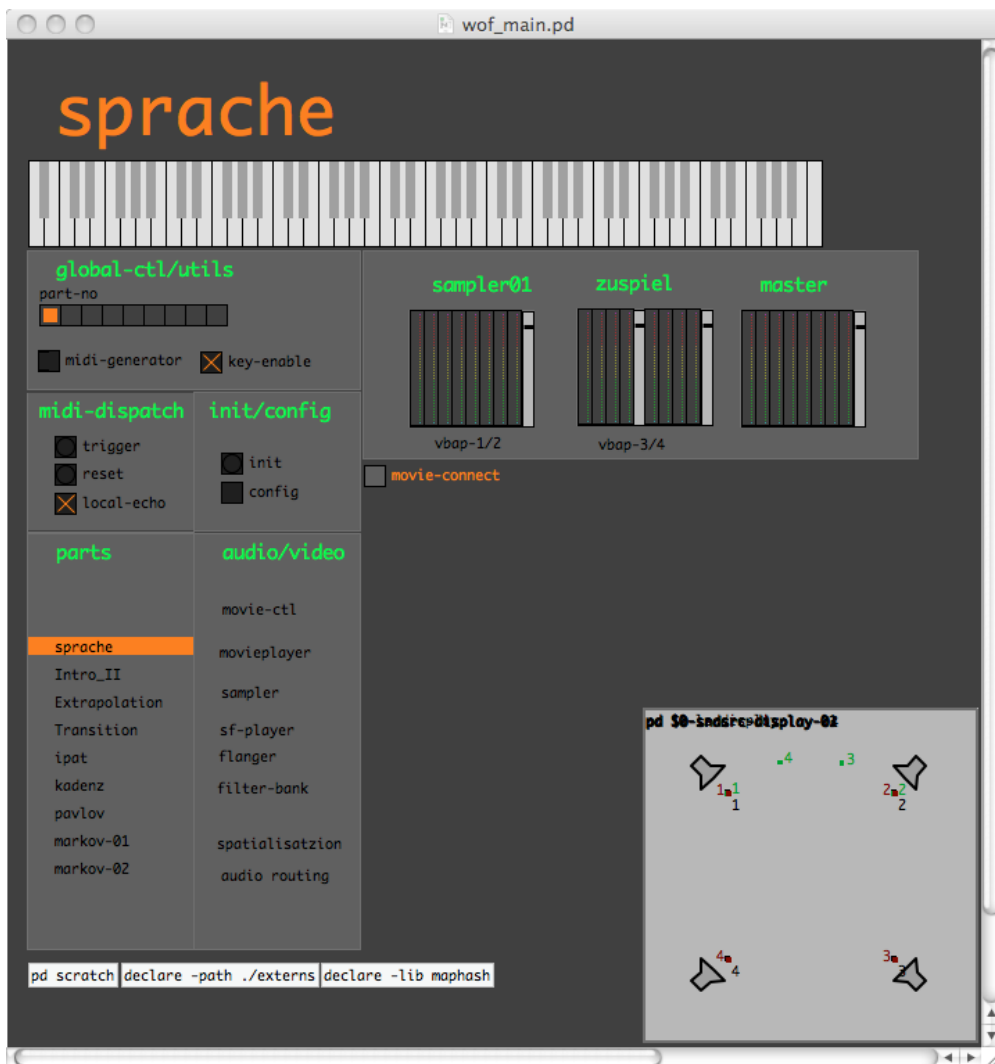
Figure 52: *Wheel of Fortune* by Orm Finnendahl[457]

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[456] Cp. chapter 3.6

Although this array of pictures is certainly very colourful and sometimes even pretty, the programs themselves are largely unintelligible for anyone else than the programmer or an expert in the field. Certainly, the patches can be approached as being black boxes and trial and error will produce results. The names give some more hints and if the patches are handed over in a format that can be opened, it could be tried to *reverse engineer* the code. However, it is questionable if this time-consuming process is indeed the duty of a performer, who is generally interested in playing the music and not in de-coding computer patches. However, even if it was the interest of the players to do exactly that, it is inconceivable that they would know each and every program the patch might have been written in. Since performers cannot be equally versed in Max/MSP, pd, Supercollider and ChucK, to name a few, the sequence of activities in order to make a patch run must be thoroughly notated.

5.2.2.4   The patches are not ready for performance

While playing concerts with electronics it has been found that some patches miss some requirements without which it is difficult to program the piece other than right at the start of the concert or after an intermission. In order to be seamlessly integrated into a concert consisting of several pieces, a patch must fulfil a few, but very important requirements:

- the patch must load more or less on double clicking. For example, there is no time on stage to step through submenus to tell the patch where to find additional sound files.
- in order to be able to load on double clicking, it must have a save-function to recall the settings from the rehearsals. This is especially important if the malfunction of a device in the signal chain makes the restart of a patch necessary.
- right before the start of the piece the functionality of the set-up, which indeed is now an instrument, must be tested. The emotional need of an instrumentalist to test the instrument can be observed before every orchestra concert where each member of the orchestra plays a few sounds on their instrument resulting in a massive cacophony. Mari Kimura gives an example on how elegantly this can be integrated into the concert flow: she simply triggers an a' played by the computer with the foot pedal (thus testing the set-up) and tunes her violin to it (thus testing the violin).[458]

Finally it must be noted, that in case the electronics use the same temperament as the acoustic instrument there must be an option to tune the electronics.

5.2.2.5   The patches are not ready for rehearsal

A rehearsal patch is a patch that is adapted to the practising situation of the performer. It is not necessarily a patch on its own but features some added functionality, which makes it suitable to be

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[457] Cp. chapter 3.4

[458] Mari Kimura, "Creative Process and Performance Practice of Interactive Computer Music: A Performer's Tale," *Organised Sound* 8, no. 03 (2003): 289–296.

integrated into the learning process at an early stage. The following three sections outline some of the features a rehearsal patch should provide.

5.2.2.5.1 Easy set-up

An instrumentalist is likely to rehearse more than one composition at a time and will thus want to set up the rehearsal space quickly. If settings that could load automatically with the patch have to be loaded every time a rehearsal starts, it will soon be felt as a nuisance, since time setting up is time taken away from rehearsing and playing the music. The calculation is simple: if a composition requires 20 minutes set-up – a time span that gets easily filled up with booting a computer, attaching the audio interface, the loudspeakers, the MIDI interfaces and the microphone, doing a quick line check and finally starting the patch, only to start a clicking frenzy to load all required sound files – and the musician wants to practise five pieces that day, almost one and a half hours will be lost by setting up. Considering that the regular rehearsal time of ensembles is about six hours a day this is a huge amount of time.

Therefore, rehearsal patches should be as easy and fast to be set up as possible. It is possible to arrange for patches to run on double-clicking, loading the required files and load saved settings for the microphone gain and loudspeaker volumes, as demonstrated in the patch for *Zellen-Linien* by Hans Tutschku (cp. chapter 3.8). If a rehearsal space would have an audio interface with a stereo speaker and a microphone or two connected to the audio in- and outputs as well as some common MIDI devices such as foot pedals or a keyboard to the MIDI port, only a computer would have to be connected to the interface and everything is ready to go.[459] A small mixing console would add comfort but is not necessary. A depiction of such a rehearsal set-up can be found in chapter 6.4.

5.2.2.5.2 Practising in sections

It is obvious that musicians do not always practise a composition from the start to the end but practise in sections, just like someone who wants to memorize a long poem does not always read the whole text but separates it in digestible bits and pieces. Rehearsal patches should likewise be able to 'jump' to certain points in a composition in order for the instrumentalist to practise the harder parts more often than the easier ones and thus not losing time. These places can be predefined but as every musician might want to start rehearsing a section at different places, it would be more flexible if the instrumentalists can set the starting point themselves.

This does not only include the possibility to start the patch at any given point but also to stop any ongoing activity easily. This should be implemented in a way that the instrumentalist can rehearse

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[459] In this setting it is assumed that most instrumentalists will not have a powerful computer reserved for audio processing only.

the same section repeatedly and concentrate on the playing without having to turn to the computer and having to focus on setting it up.

If the composition works with live-recordings of the instrument and loads these recordings into buffers for further manipulation this will not always work as intended. In this case, predefined positions will have to be used or the instrumentalist will have to do with what is left of the electronics, which will probably be good enough in most cases.

5.2.2.5.3   Practising slowly

The possibility to lower the tempo is probably the most important aspect in facilitating instrumentalists to play with the electronics as early as possible. Just as instrumentalists want to practise the instrumental part slowly, they will want to practise slowly with the electronic part, too, especially if the instrumentalist controls the system with the means of devices like a pedal or a keyboard. If the instrumentalist is forced to practise with the electronics only at full speed, the electronics will not only be integrated very late in the process; it also means that the instrumentalist is not able to rehearse the movements with which they send the commands to the computer slowly. The only other option would be to practise with non-functional devices, which could be compared to practising piano on a table with a keyboard drawn onto it.

To make a patch play a composition slower is probably the most difficult part and the sonic result might be very different from the original speed. Nevertheless, practising often means the difficult process of learning reflexes, whereas altered sonic results can easily be adapted to. Routines in the patch that hardwire a certain tempo should be made flexible and recorded material can be played back slower.[460] Only if practising the electronic part of the composition can be facilitated within the tempo the performer wants to practise it will the electronic part become as much part of the interpretation as the instrumental part is.

5.2.3   Technical specifications

The tech specifications are one of the big problems in organizing music with electronics. Of the nine case studies, eight compositions (Finnendahl, Festinger, Scelsi, Schüttler, McLaughlin, Schielein, Poppe and Nono) have either an incorrect, incomplete or no tech rider at all. Bullock and Coccioli note that 'whilst accurate score production is a requirement of instrumental performance, the composer often performs their own live electronics part. In these cases, the composer's own knowledge reciprocates the documentation, making the need for clear instructions less

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[460] For practicing compositions with fixed tape some audio players that have this function inbuilt can be used, for example current Windows Media Players or Quicktime Pro, which can also display a very handy time code. The popular iPods as well as many other handheld devices can be enhanced by installing an open source operating system called Rockbox (http://www.rockbox.org/).

immediate.'[461] However, as the list of concerts (p. 243) shows, composers are unlikely to attend every concert where their music is being played. Nonetheless, the interviews show that a large number of composers had to admit that their compositions could not be played without their presence. Since the latter deals with the question of instrumentation it will be discussed first – it is a discussion briefly raised in chapter 5.1.4 – and will then be followed by a listing of the technical specifications a performer needs to be able to perform a composition with electronics.

5.2.3.1 Instrumentation and number of players

The technical information starts with the most basic question: for whom is this piece written? Is it a solo or a duo for instrumentalist and audio engineer or composer? What instruments are being played in the piece and can the piece be performed without the composer's presence?

It is important that composers give clear and sufficient descriptions for whom the piece is written and what instruments/devices are needed, since this information ends up on the publisher's catalogue or the composer's website – the primary source of information for anyone who is planning repertoire and concerts. A few examples will try to shed some light on the issue.

Arbeit by Enno Poppe[462] is described as 'for virtual Hammond organ'. Although this description is accurate, it is not sufficient in that it implies it could be played with any virtual organ, when in fact it needs a custom Max/MSP patch for Max 5 and the B4 II organ by Native Instruments that cannot be replaced at this time. The instrumentation should therefore somehow imply that Max/MSP and the B4 II organ plugin are needed to give a first information if these instruments are available.

Evan Johnson's *Dehiscences, Lullay ('Thou nost whider it whil turne')*[463] for piano with cassette is an inaccurate description, since it is not the cassette that is being used as instrument but a cassette player playing a cassette. Thomas Wenk is more precise: *TAURUS CT-600* for 2 cassette recorders (1 player)[464] leaves no questions as to what instruments and how many players are needed.

Zellen-Linien by Hans Tutschku[465] could be played by the soloist alone, although it is arguably better sounding with an active sound engineer at the mixing console. It is therefore aptly described being 'for piano and live-electronics'. *Das bleierne Klavier*[466] by the same author and also for piano and live-electronics is not passed on to other performers anymore. Although correctly labelled 'for piano and live-electronics' it should be noted that it is not available to performers.

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[461] Bullock, "Modernising Live Electronics Technology in the Works of Jonathan Harvey."

[462] Poppe, *Arbeit*.

[463] Evan Johnson, *Dehiscences, Lullay ("Thou Nost Whider It Whil Turne")* (Manuscript, 2005).

[464] Wenk, *Taurus CT-600*.

[465] Tutschku, *Zellen-Linien*.

[466] Tutschku, *Das bleierne Klavier*.

N381 by Dodo Schielein,[467] which makes use of the sounds of the piano mechanics only and therefore needs to be amplified, should not be described as 'for piano' but 'for amplified piano'.

Elsewhere is a Negative Mirror for piano with electromagnets[468] and *Of Dust and Sand* for saxophone, piano and electromagnets[469] by Per Bloland both mention the custom-made electromagnets that are needed to play the piece. Since, at this time, the piece can only be played with those very electromagnets which only Per Bloland knows how to set up, it could be argued the pieces are actually a duo and a trio. One could even go so far to cite the composer in the instrumentation, since the instrumentalists are interchangeable but not Per Bloland.

The same holds true for many pieces where the composers do not write down the electronic parts because they are playing them themselves. An example could be the majority of works by Richard Teitelbaum, which are not documented in a way that they can be played without the composer's presence. A way in which these pieces could be described conclusively is exemplified using *Medusa* by Ludger Brümmer.[470] The composition is declared as a piece for two percussionists, 4 track audio tape and optional video, but since the diffusion of the tape part is not notated and played in a quasi improvisational way by the composer, it could be called a piece for two percussionists, 4 track audio tape (sound projection: Ludger Brümmer) and optional video.

Although this might seem bold, it is very important that the information is correct when information is being gathered about pieces since it is most tedious and unnecessary work to order compositions only to find out that the piece cannot be played at all. Since perusal scores oftentimes cannot be had and the compositions have to be ordered right away, this can even amount to financial loss.

5.2.3.2   List of technical specifications required by the performer

- **Software**
    - the program and the program version

    - the operating system and the operating system version

    - the patch including version number and a way to retrieve updated patches

    - if required, instructions on how to set up the software[471]

    - if necessary, a list of patches for both the software and hardware / virtual instruments

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[467] Schielein, *N381*.
[468] Bloland, *Elsewhere Is a Negative Mirror*.
[469] Bloland, *Of Dust and Sand*.
[470] Ludger Brümmer, *Medusa* (Manuscript, 2000).
[471] For example, if software must be installed in a specific subfolder or if files must be altered.

- a list containing all the required items, divided into items provided by the composer / publisher and items the performer / promoter have to provide

- the inputs the program is listening to (for example MIDI channels and commands), divided into sound and control data

- the data the program is sending out (for example four channel audio + one channel click track), divided into sound and control data

- **Hardware**
  - the hardware required and where necessary the sonic specification of the hardware (tube amplifier, microphone characteristics, maker) and known alternatives

  - a description of the possible set-ups (for example a variable amount of speakers) in the form of a diagram

  - a list containing all the required items, divided into items provided by the composer / publisher and items the performer / promoter have to provide

  - the minimum requirements for the computer in case of a demanding piece

- *Score*
  - an explanation of the symbols used

  - a list of all the material that is needed

  - a list of the material and the amounts needed for preparing the patch

  - a list of where (and if unusual how) to put the preparations into the instrument

  - a list containing all the required items, divided into items provided by the composer / publisher and items the performer / promoter have to provide[472]

- *Relationship between electronics and acoustic instruments*

A description of the relationship between the volume of the electronics and that of the instrument. It is useful to specify

- the loudest section of the electronics for the sound engineer to adapt to the acoustic instruments and the hall,

- a section where electronics and instruments are equally loud for the instrumentalist to adapt to the electronics,

- guidelines for the performer on how to play the piece,

- guidelines for the sound engineer on how to distribute the sound,

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[472] This list does of course not replace the usual information on the used symbols for extended techniques as well as the information if the instruments sound as written or if the accidentials are being kept for the duration of the bar.

- *A description of the intention of the piece*

Oftentimes the intention of the piece is not visible in the score and prosaic or philosophical programme notes mostly do not help either. As Elizabeth McNutt says, 'Scores of electronic music are often vague about the sounds and relationships they represent [...] Composers' comments and explanations in rehearsal are often similarly opaque to performers.'[473] Although not every piece will need such a text, it is hard to foresee when it is needed: Scelsi probably never thought that such a description would be necessary for his piece *Aitsi*. A rather obvious example would be a composition that exploits a quirk in the electronic instrument – like chaotic behaviour after pressing a sequence of panel buttons or the sound these buttons produce by themselves, since these will be difficult to reproduce later on another instrument which could, for example, be a software rendition of the same instrument or an instrument that is being considered the successor, like the piano to the harpsichord. If the information concerning the quirk is not given explicitly in the score it will be lost and with it the intention of the piece. Simon Emmerson, for example, describes a case where the intentions of a composition got lost in translation from analogue to digital.[474] In his piece *Spirit of '76*,[475] a reel tape machine is used to create an accelerating tape delay. This effect is realized by letting one of the two reel tape machines drag an empty tape spool around the performance floor. Although the sonic effect of the delay can easily be reproduced with digital means, for example a Max/MSP patch, the theatrical effect of the sliding spool gets lost. It is therefore of utmost importance to leave the dogma of 'the score tells it all'. The notion that a sound or video recording might suffice as proper documentation for the intentions (or what is more, the technology used) is being rightfully rejected by Bernardini and Vidolin since

> Live electroacoustic music is different in that we seek to preserve not only a single, memorable performance but rather the ability to perform, study and re-interpret the same work over and over again, with different performances proposing different interpretations. A recorded document of the first (or indeed, of any) performance of a live electroacoustic music work is instead completely insufficient and inadequate to the re-creation of the work itself.[476]

Composers therefore need to find a way actually to write down in plain words what the piece is about or find other ways to provide a performance tradition like the Stockhausen Kurse in Kürten or talks between composers and devoted followers like John Cage and Richard Kostelanetz.

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[473] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 298.
[474] Emmerson, "In What Form Can 'Live Electronic Music' Live On?".
[475] Simon Emmerson, *Spirit of '76* (Manuscript, 1976).
[476] Bernardini and Vidolin, "Sustainable Live Electro-Acoustic Music."

5.2.4 Conclusion

Composing with electronics incorporates many different aspects, different from composing for acoustic instruments alone: software, hardware and the dissemination of the requirements are new or different and require specific knowledge. It seems that these new requirements sometimes are not regarded as crucial to the composition as is the score. What follows are compositions that are not adequately described and it must be said that the possibility for everyone to program musical patches sometimes results in amateurish patches in the best sense of the word.

A common reaction to this problem is to claim that all compositions for instruments and electronics require the expertise of a music technology assistant who would then interpret the electronic part just like the performer of an acoustic instrument. This would certainly be desirable but the reality is that most concerts are held in a setting where the musician on stage will meet the house technician on the day of the concert.[477] This is not only cost effective but also makes artistic sense because the house technician knows the installed equipment and the mixing console. It is also clear that even the most seasoned technician will not be able to resurrect compositions if they do not have all the necessary information. In fact, it is the technicians who came forward in recent years and demanded better scores.[478]

What follows is that composers cannot be released from the responsibility to publish tested and well-documented electronic parts of their compositions. I have often heard from composers that this process is unduly time consuming and indeed unnecessary since they are mostly present in the concerts and take responsibility for the electronics. However, these arguments are objectionable since it is a work that needs to be done anyway and if composers do not do it, they unfairly delegate listing the requirements to the performer. What is more, the composers themselves will forget the computer code and set-up of a specific piece if they do not write it down. Besides, if it is the aim that the pieces should be widely disseminated, it must be possible to play them without the composer's presence. Finally, if a musical composition is written for performers, the composer must take on the responsibility that the work of the performer is not made void by rendering the piece unperformable when the only source that knows how to set up the piece – which is, the composer – cannot be present; for example by his or her inevitable demise.

From the standpoint of a performer, composers therefore fall short on these issues:

the electronic parts are not stored future proof and are sometimes lost.

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[477] Only two concerts in the course of this study had a different, better setting.
[478] Cp. footnotes 417 - 427.

- the technological requirements are not fully documented.

- it is not clear how many players are needed for the piece.

- the patches are not fully documented.

- the patches are not updated.

- the written score is unclear.

- the hardware is not tested well enough.

- the intention of the piece is not clear.

- performers cannot practise well with the patch.

As with some points in the list of shortcomings on behalf of the publishers, it is understood that not everything can be in a perfect state at any given point in time: it is understandable that composers do not recode every patch once a software update is published by the producer of that software. What is therefore even more important is that the intentions and the technical requirements are documented in a way that a third person can update or rebuild the technology. This could probably be compared to the requirements of a description of a patent; it must 'contain sufficient information to enable others to construct or perform your invention.'[479]

It would therefore be advisable if composers would adopt the following practices:

- learn about what data needs to be archived (as opposed to the notion that the full software set-up needs to be kept working).

- learn effective and time-saving archiving techniques.

- disseminate the data in ways that it can be played with other software (if at all possible).

- give a precise description of the instrumentation.

- describe the hardware set-up properly and learn time-saving methods of how to do this.

- describe the software installation process properly and give easy to follow instructions on how to do this.

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[479] Intellectual Property Office, "Patent Factsheets: Description" (Intellectual Property Office, 2007), accessed 14 May 2012, http://www.ipo.gov.uk/factdescription.pdf.

- give a description of a patch so a computer literate person can work with it.

- describe the sonic relationship between the electronics and the instrument.

- describe the intention of the piece in simple words.

- adopt simple quality management techniques for the patches (for example testing the patches on another computer than their own before releasing them).

Although this list seems long, it is only a few quintessential techniques that need to be acquired to perform these duties. It is the firm conviction of the author that these techniques need to become part of the curriculum at education institutions wherever composition with electronics is being taught.

5.3 Performers

If we take a look at classically trained instrumentalists in their entirety, we find that relatively few musicians specialize in the performance of music with electronics. Although the numbers might change it can still be assumed that the majority of graduates from music academies are well versed and interested in playing the classic-romantic repertoire with a minority 'specializing' in 20th century music and still a minority of those playing with electronics. Of those a greater number play with tape music only, as can be seen in the research by Shai-uen Ding,[480] who specializes in this matter, and Kerry Yong,[481] whose case studies are mainly pieces with tape. Ding writes that 'not enough pianists have specialised in electroacoustic music'[482] and Yong confirms that 'most classically trained performers, even those who perform substantial amounts of contemporary music, work with electroacoustics quite rarely.'[483] Elizabeth McNutt even goes so far as to saying that 'electroacoustic performance [is] uncomfortable for classically trained musicians.'[484] The interviewed performers who play classical contemporary music – Erik Drescher, Jacques Drouin, Jennifer Hymer, Margaret Lancaster, Xenia Pestova, Ernst Surberg and Mari Kimura – all confirmed that they did not receive training in playing with electronics while studying.[485] It is also supported in personal communications with the pianists Colette Broeckaert, Sarah Nicolls and Rei Nakamura.[486]The reasons for these are manifold and far beyond the realms of this study. However, even if performers have had experience playing electroacoustic music at the academy, it would have been concerts organized by a studio for electronic music. In this case, all the instrumentalists have to do is play their instrument, since they are being surrounded by apprentice sound technicians and composers who would set everything up for them. What this necessarily results in are performers who find themselves the professional market with little experience with technology – knowing neither how it works nor how to work with it.

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[480] Ding, "Developing a Rhythmic Performance Practice in Music for Piano and Tape."

[481] Yong, "Performance Practices in Music for Piano with Electroacoustics."

[482] Ding, "Developing a Rhythmic Performance Practice in Music for Piano and Tape," 255.

[483] Yong, "Performance Practices in Music for Piano with Electroacoustics," 3.

[484] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 297.

[485] Erik Drescher, "Interview with Erik Drescher" interview by Sebastian Berweck, Digital Recording, August 19, 2009; Jacques Drouin, "Interview with Jacques Drouin" interview by Sebastian Berweck, Digital Recording, January 29, 2010; Jennifer Hymer and Georg Hajdu, "Interview with Hymer/Hajdu" interview by Sebastian Berweck, Digital Recording, May 12, 2010; Mari Kimura, "Interview with Mari Kimura" interview by Sebastian Berweck, Digital Recording [corrupt], February 5, 2010; Margaret Lancaster, "Interview with Margaret Lancaster" interview by Sebastian Berweck, Digital Recording, February 7, 2010; Xenia Pestova, "Interview with Xenia Pestova" interview by Sebastian Berweck, Digital Recording, January 28, 2010; Ernst Surberg, "Interview with Ernst Surberg" interview by Sebastian Berweck, Digital Recording, January 10, 2011.

[486] Personal communication over the course of this study by e-mail, Skype or in person.

5.3.1 Performers push the responsibility on the technicians

This neglect results in a career that starts out as being dependent upon the sound engineers and the belief that an instrumentalist who performs music with electronics can ignore the electronic part and focus solely on the instrumental part, just like any classical performer would do. This attitude principally makes perfect sense, since, as Jacques Drouin, pianist of the Nouvel Ensemble Moderne in Montreal, says, 'I've got enough to do with my instrument.'[487] It is also the favoured method on how to play music with live-electronics at IRCAM, as Josh Fineberg, professor at Boston University School of Music, confirms.[488]

This method works when an institution specialized in performing music with live-electronics such as the IRCAM or the Experimentalstudio Freiburg plans and organizes the concerts. Here the instrumental performers are part of a system; they could be described as instrumental executives. This method also works when an ensemble has a full-time member responsible for all things electronic who is regarded as musician and rehearses with the ensemble just like the other musicians. This is the preferred working method of many ensembles now, for example the Ensemble Modern (Frankfurt), Nadar Ensemble (Ghent) and Ensemble Mosaik (Berlin). For soloists who play with electronics, having a constant sound technician at hand would certainly also be desirable. Unfortunately, it is not practicable for several reasons:

- the cost of a technician to practise and travel with the soloist would result in a fee at least twice as high as that of a solo concert with additional doubled cost for travelling and hospitality.

- the cost of a technician to set up for the instrumentalist in the rehearsal period would have to be calculated. A programme with *Zellen-Linien* by Hans Tutschku and *...sofferte onde serene...* by Luigi Nono, which can each take between 20-30 hours of rehearsal time for a seasoned player of contemporary classical music, would add a combined 50 hours of the sound engineers time, which would have to be paid for.

- if the technician would use the hardware of the venue, for example the digital mixing console, they would have to be fantastically versed in all machinery ever produced.

- since this is not possible, the only solution would be to bring all required machinery including loudspeakers, mixing consoles and amplification into the hall, which would require hiring a van and possibly a driver for the span of the tour.

It is not only when playing as soloist that the promoter will likely refuse to pay for a complete set-up during the whole rehearsal period. Most orchestras, ensembles or institutions would not invest in

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[487] Drouin, "Interview with Jacques Drouin."
[488] Josh Fineberg, "Interview with Josh Fineberg" interview by Sebastian Berweck, Digital Recording, February 9, 2010.

rehearsal time with a full electronic set-up[489] and regard the electronics more like a stage set in which the singers of an opera rehearse only in the dress rehearsal. One way to solve this is the common practice to seat performers behind a trigger keyboard, who then have to react to the conductor and blindly press keys on a keyboard as if it was a computer keyboard. An example of this unfortunate practice was given in chapter 3.8 for a performance of *Winter Fragments* by Tristan Murail.

For soloists it is therefore common that they will play at a venue with a sound technician with whom they will have had contact a short time before the concert and exchanged the necessary information. However, the unversed musician is not trained to send all the information that the technician needs and will thus send what they find in the score. As has been demonstrated above, this information is in most cases incomplete and results in the described problems.

5.3.2 No possibility to practise

The musician who is not versed to work with electronics is not able to set up a practise set-up and practise with it. However, 'constant listening to the electronic part by the performer during the learning process is [...] an important issue',[490] as pianist Xenia Pestova confirms.

Hiring a technician to set everything up is, as demonstrated above, of a prohibitive cost. We have therefore a musician who does not know the composition and does not know how the electronics work right until the concert. This results in a more or less unrehearsed performance, with no ability to react to eventual flaws of the electronics. Catherine Vickers, promoter of the piano+ festival for piano and electronics at the ZKM Karlsruhe, gives an example of a concert situation, where this happens: 'Since it was not the first performance of that specific performance I have heard, it became immediately obvious to me, that the two performers were forced to compensate the lacking reliability of the electronics',[491] something 'only a performer intimately acquainted with the spirit and functional expression of the interaction between his instrument and the live electronics'[492] – in other words, a performer who has practised with the electronics – will be able to do.

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[489] This set-up can sometimes double the fees for a performance, cp. Stephan Buchberger and Mariko Steeb, "Interview with Mariko Steeb and Stephan Buchberger" interview by Sebastian Berweck, Digital Recording, June 17, 2010.

[490] Xenia Pestova, "Models of Interaction in Works for Piano and Live Electronics" (Doctor of Music, McGill University, 2008), 13.

[491] Catherine Vickers, "An Innovative Opportunity," *eContact!* 13, no. 2 (April 2011), accessed 9 May 2012, http://cec.sonus.ca/econtact/13_2/vickers_innovative.html.

[492] Ibid.

An often-cited argument in favour of this arrangement is the perceived similarity with performances like concertos for solo performer and orchestra.[493] After all, a soloist playing a Beethoven concerto will hear the orchestra only in the two rehearsals before the concert, too.

However, the argument is flawed for four reasons:

1. The soloist knows the instrument he or she is going to play; a pianist will play the piano, a violinist will play the violin. This is very different from the case for example of the second keyboard in the premiere of the *Konzert für E-Cello und Orchester* by Fabrice Bollon.[494] Here the keyboardist arrived at the rehearsals to meet an instrument that sported a keyboard but produced sounds she had never heard before and to which she had to become accustomed rather rapidly.

2. The soloist in a concerto will likely have the possibility to learn the score with a pianist playing the piano reduction of the concerto.

3. A conductor will guide the players through the performance.

4. The soloist sits right in the middle of the orchestra and can hear the other players very well. A monitor loudspeaker is only a substitute for this.

The argument that musicians need to know the music they perform is not only being challenged by promoters: instrumentalists who do not invest in basic electronic equipment and learn how to use it are putting themselves in the same position. After all, it is the performer's responsibility to find a way in which to practise a composition adequately and demand rehearsal patches from the composers. If they do not find a way to practise the electronics which or with which they play, they will not know if the electronics work, how to play musically with them and how to react when things do not go as they are intended. As Catherine Vickers notes, 'Only a performer intimately acquainted with the spirit and functional expression of the interaction between the instrument and the live electronics and endowed with improvisational talent, ambition and training can offer compensation'[495] when the electronics start failing in the concert.

In order to practise with a live-electronic set-up the machinery has to be set up somewhere. Since in most cases the performer will have to do without the help of a studio, a personal investment to provide at least a minimum technical set-up has to be made. This investment must be seen as a parallel to a flutist investing in a special mouthpiece that enables glissando playing or a clarinettist investing in a bass clarinet. However, dealing with electronics can easily be seen as counterproductive to the daily practise routine of a professional musician since it is very time-

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[493] Brümmer, "Interview with Ludger Brümmer"; Fineberg, "Interview with Josh Fineberg."
[494] The premier took place on April 15, 2011 in Saarbrücken. Bollon, Fabrice, *Konzert für E-Cello und Orchester* (Frankfurt: C.F.Peters, 2011).
[495] Vickers, "An Innovative Opportunity."

consuming and will not better them as instrumentalists. At this point, the musician has to decide if he or she wants to commit to being a specialist in music with electronics.

5.3.3 Performers not using their own equipment

Most composers simply use the equipment available in their own working environment. It is equipment they own, buy or even make, and the performer must replicate this process. Considering that the success of a composition and its reproduction cannot be guaranteed it is unknown if this investment will be returned. For this reason, composers will often lend performers their equipment. Unfortunately, it will often not be possible to lend the item for a prolonged time, for example if the item is obsolete software that is still running on the composer's computer. This then leads to the situation that the performer only gets the required material when composer and performer meet on the day of the concert. Here the issue of technical intimacy comes into play: a performer can only get a 'feel' for a musical instrument after playing it for a long time. This is not only true for analogue instruments but also for electronic devices such as MIDI controllers. Although it might seem that a button or a slider should be easy to use, since they only have to be pressed or pushed, the same could be said about piano keys, and any pianist will protest that notion. As with a piano key, the resistance of a slider is something the player has to get used to and the more familiar the musician is with the equipment, the better the performance will be – a notion widely supported by performers when they say that 'musical expressivity will reach higher levels of subtlety through extensive practise on a given digital signal processing instrument'[496] and 'practising with the equipment is therefore every bit as important as practising with the score'.[497] However, it is often neglected by composers and novice players of electronics who expect the simple pressing of a button to be easily integrated into the performance of the piece.

No doubt, some standardization of technology would improve the reliability of producing music with live electronics. A model could be the automobile: after some familiarization, everybody who knows how to drive an automobile can ride any similar vehicle (cp. footnote 341). At 92%, the most used operating system is an Apple OS X (cp. chapter 6.3.1.1). The overwhelming majority of the patches received in recent years are for Max/MSP (27), with Pure Data (2) and other programs (samplers, virtual instruments) a distant second and third. It is also supported by Alexander Harker, Assistant Technical Supervisor at the International Computer Music Conference 2011, who says that 95% of the compositions played in the main hall used Max/MSP, one Supercollider and one pd. The same

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[496] Pierre Alexandre Tremblay, Nicolas Boucher, and Sylvain Pohu, "Real-time Processing on the Road: a Guided Tour of [iks]'s Abstr/cncr Set-up," in *Proceedings of the International Computer Music Conference 2007* (presented at the International Computer Music Conference 2007, Copenhagen: International Computer Music Association, 2007).

[497] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 299.

numbers are reported by Akin[498] and Polfreman, Sheppard and Dearden,[499] but these studies date from 2006 and might not be current enough in the short-lived computer world.

Whatever the majority of programs are, no set-up will suffice under any given circumstances, since pieces might have been written using obsolete or obscure software and no standard whatsoever can be set up. What is more, since the hardware and software changes constantly, one must theoretically keep older versions of operating systems and programs, too. This means that the performer has to deal just as publishers and composers with aspects new to their work which are archiving and updating.

As has been shown in the case studies in chapters 4.1, 4.3 and 4.4, the sound creation and reproduction chain which is not to be broken includes the computer, the software, the patches and the audio card – in other words, the digital chain. This is confirmed by the tech team of the Ensemble Modern[500] as well as by Sarah Nicolls, who suggests that one should 'always take your own kit unless you really know they have good stuff and a technician to plug it together. This doesn't mean taking your own PA but everything up to the mixer.'[501]

The notion that the entire digital set-up should be provided by the performer stems from the fact that the theoretical modularity of electronic devices is practically not given. Several examples where the audio interfaces and the MIDI controllers could not be easily replaced have been given in chapter 4.4 and a look at the driver readme files for example for the RME Fireface drivers for the 400/800 models clearly show interdependencies.[502] These interdependencies between firmware, driver, operating systems and even hardware connectors are complex and the connections rather volatile. It must also be noted that even standardized connections do not always work to the full extent of their specifications – an example would be for a USB bus not distributing enough power for mounting certain USB sticks.

Nevertheless, not only the sound generating devices but also the controllers must be brought by the performer. It is startling for example to see how often 'simple' foot pedals do not work with devices by other manufacturers. Three arbitrarily chosen examples shall shed some light on the issues:

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[498] Joseph Akins, "Facilities Used for Introductory Electronic Music: A Survey of Universities with an Undergraduate Degree in Audio" (presented at the 121st AES Convention, San Francisco, 2006).
[499] Polfreman, Sheppard, and Dearden, "Time to Re-wire? Problems and Strategies for the Maintenance of Live Electronics."
[500] Buchberger and Steeb, "Interview with Mariko Steeb and Stephan Buchberger."
[501] Nicolls, "Brief Thoughts on Using Live Electronics - Preliminary Version of an Article for eContact! 13.2."
[502] "RME," n.d., accessed 19 June 2012, http://www.rme-audio.de/en_techinfo_content.php?page=content/downloads/en_driver_updates_readme_firewire.

- Yamaha pedals: neither sustain pedals nor expression pedals work with M-Audio keyboards.[503]

- for Midisport MIDI interfaces the following advice is given on M-Audio's help forum in regard to Apple laptops: 'If you have a Uni-Body Aluminum MacBook or MacBookPro, and an Oxygen8, Radium, Keystation 49 (non "e"), Keystation 61 (non "es"), or Midisport device that stops working after a short period of time, connecting the device to a USB hub fixes this problem.'[504]

- the question when and why a 25k or a 250k resistance volume pedal should be used creates an ongoing confusion amongst musicians, as for example a discussion on an internet forum shows where several authors confess they still do not know what to think of it searching and reading for a long time. [505]

However, it is not only the incompatibility of the devices: playing one's own controller is essential for the technical intimacy that is needed for a good performance. Even mp3 players work and react all differently and there is no time to get acquainted with a technical device only in the dress rehearsal. Since playing music is very much the release of a long trained course of action, changing that course of action – for example by replacing an mp3-player which has a vertical volume slider on the left side with a CD-player which features the volume button in form of a slew ring on the front – is a major distraction to the performer's trained motion sequence.

5.3.4 No knowledge what information to convey

One of the most crucial prerequisites for a successful production is the flow of information between performer and venue. Since performers are not being trained in writing tech sheets and drawing plans – if they even know such things exist – it is a matter of trial and error until they arrive at reliable tech writers. This is not made easier by composers not writing all the information down, but also by the fact that there is no standardization. Chapter 6.6.1 tries to give some advice on this matter.

5.3.5 Wrong expectations about the published material

We have seen in the analysis of the practices of the publishers that the business model has changed: musicians do not get material which is ready to perform as they are used to with printed scores. This

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[503] M-Audio, "MIDI Keyboard Controller Sustain & Expression Pedal Compatibility," *M-AUDIO - Knowledge Base*, n.d., accessed 20 May 2012, http://www.m-audio.com/index.php?do=support.faq&ID=221b8ec8fc63b4b1bb034105ca4b379a.
[504] Ibid.
[505] "The Final Word: Active or Passive Volume Pedal... - The Gear Page," n.d., accessed 20 May 2012, http://www.thegearpage.net/board/showthread.php?t=259176.

results in the performer buying or hiring the material too late, if they are even aware of all the intricacies they can expect from starting such an endeavour. When the musicians run into problems, they often do not know where to get help. As James Eggleston of Boosey & Hawkes confirms, performers rarely get back to the publishers[506] – probably because the publishers send the material and a bill, but do not indicate where further information or support could be obtained.

Since performers expect the publisher to take on the role of being solely responsible for the composition once they took on the composition, they do not look into the circumstances of the patch creation: where it was created, who coded it, where it is stored now. Performers are not aware that when dealing with music with electronics they will have to do research, as they would have to do with unpublished pre-classical music. It would be easy to say that this is only the fault of the publishers, however musicians have to know how to work with the situation and are just not aware that they have to work differently with material involving live-electronics.

5.3.6 Conclusion

The interviews as well as personal communication with the performers seem to convey that instrumentalists arrive at reliable live-electronic set-ups by trial and error. Until then, it is often a long way of mishaps and performers often

- push all responsibility to the tech personnel,

- do not ensure that they can practice with the electronics by setting up a rehearsal space including electronics,

- do not invest in the electronics,

- do not see electronics as part of their instrument,

- do not know how to collect and convey information about the electronics,

- have wrong expectations about the published material,

- and have no knowledge about archiving.

Since playing with live-electronics is a specialization of any instrumentalist – as is the playing of an uncommon instrument – it will probably not become part of the basic curriculum of music schools. However, since there is a need to convey this information the creation of degree programmes for instrumentalists who want to specialize in the performance of electroacoustic music is proposed. Until then some proposals on how to solve common problems instrumentalists face in the production of music with live-electronics are presented in chapter 6.

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[506] Eggleston, "Interview with James Eggleston."

5.4 Music Technology

Music technology is a new stakeholder in the production of music with the most striking feature possibly being its indefiniteness. Whereas the tasks of performers, composers and publishers are defined by tradition and their responsibilities have only become blurred since the advent of electronics, music technology is yet undefined and encompasses a wide variety of activities from balancing the sound on a mixing console to being a recording engineer to being an expert in music informatics. This variety of techniques and abilities is being noticed by performers, for example by Sarah Nicolls who says: 'My experience with technicians is of course always different but basically everyone wants to help – it's just that there are different pockets of knowledge and someone who knows all about microphones may well not know anything about Max/MSP.'[507] The earlier mentioned remark to 'hire a technician' to solve all problems concerning technology must therefore be questioned, because a look at some of the technical problems described in chapter 3 alone make it clear that high levels of expertise in several different fields including (copyright) law, computer programming, data archaeology, musicology, as well as the plain technical knowledge of studio equipment and sound engineering is required:

- being able to recode any code, for example from a NeXT system, on a newer machine

- being able to read-out data from old and possibly deteriorated or broken data carriers

- attach current connectors and write drivers for said data carriers

- doing musicological research to find the stereo tape of *...sofferte onde serene...*, something nobody yet has accomplished.

- doing musicological research and prepare a set-up for *Aitsi*, which at this point seems equally impossible.

- recode the old Max patch for *Head over Heels* and code a virtual replacement for the obsolete Yamaha TG-77 synthesizer, which seems at this time impossible because of its closed source wave tables.

- completely recode *Wheel of Fortune* as well as virtually replicating the studio of the Heinrich-Strobel-Stiftung as it was in 1995 (and finding a way for remuneration on the side).

- solve the legal responsibilities concerning the patch of *Arbeit*.

- help the composer to find the microphone set-up for *N381.*

- to become musically intimate with *Zellen-Linien* to be able to perform a powerful mix of the piece while simultaneously reading the performer's score to check for erroneous foot pedal triggers by the pianist.

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[507] Nicolls, "Brief Thoughts on Using Live Electronics - Preliminary Version of an Article for eContact! 13.2."

Even without the legal challenges, this list shows that music technology is indeed a field where many different specializations are being summarized and that no single person can deal in a timely manner with its entirety.

Additionally, it must be noted that an error of the music technician – as does a slip of an instrumentalist when playing with electronics – often has much more severe consequences than that of a singer missing the right note. For example, when a performer misses hitting the key that starts a recording there is often no other possibility than to actually restart the whole piece. Recent observations by the author of such slips was forgetting to turn on the visual click tracks for the singers at the Sophiensäle Berlin[508] and forgetting to turn on the wireless transmitter at a concert at the BKA Berlin[509] – in both cases the sound technicians were very well versed audio/video engineers.

It is outside the realm of this study to define the still evolving field of music technology. Moreover, since the field is so diverse it will not be possible to pinpoint discrete 'failures' of technicians that can easily be solved. What needs to be discussed though is the relationship between music technology and the performers on stage as well as cases where music technology is responsible for compositions not being performed.

5.4.1 Do technicians and performers form an ensemble?

As has been shown earlier, the most common way of cooperation between sound engineers and performers is often rather ephemeral: technical information is exchanged in the weeks before the concert and on the day of the concert performers and music technicians meet in the hall to discuss the set-up further. After the set-up, there might be some time for a quick run-through and later the concert is played. In 21 of the 25 concerts that serve as source for this research this has been the mode of operation, simply because it is the cheapest and most efficient one.

Does a sound engineer who hears the piece for the first time on the day of the concert and the instrumentalist on stage form a duo? Arguably not in the classical sense: a piano trio or more famously a string quartet for whom it took several years to grow together to eventually form one sonic entity, share a much tighter connection compared to this ad hoc ensemble. The relationship between the sound engineer and instrumentalist thus needs to be discussed and since similarity is given between the above-examined aspects of instrumentation (cp. chapter 5.2.3.1) and this discussion it will mostly employ the same compositions.

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[508] On May 10, 2012 in the production of *Freizeitspektakel* by Hannes Seidl and Daniel Kötter.
[509] On May 15, 2012 in a concert of the Ensemble Mosaik.

Arbeit by Enno Poppe[510] uses a keyboard, a virtual Hammond organ, a Max/MSP patch and two loudspeakers, which are situated right next to the keyboards. The piece can easily be played and set up by the performer and is basically similar to that of a rock guitarist setting up for a concert. No engineer is needed, although it is certainly helpful to have somebody in the hall to check on the volume. The same holds true for any instrument whose sound distribution is located right next to the player and who can thus control the volume like they would with an acoustic instrument. Similar examples are pieces where the instrument is augmented by small scale electronics like mobile media players (CD, mp3 or cassette players) with integrated loudspeakers or other loudspeakers in the immediate vicinity to the instrument like *#[unassigned]* by James Saunders[511] or *Slot machine* by Johannes Kreidler.[512] Compositions that turn small-scale electronic devices into veritable music instruments with local sound diffusion like Thomas Wenk's *Taurus CT-600* for two cassette recorders[513] or *Recordame* for piano and cassette recorder[514] fall into this category as well. Often open scores like Terry Riley's *Keyboard Studies*[515] will be realized in such a manner if they are being realized by performers working outside a studio. Further examples are Evan Johnson's *Dehiscenes, Lullay ('Thou nost whider it whil turne')* using a cassette player,[516] Kostia Rapoport's *typenarmut* which employs a toy recording machine,[517] and *theme from* by Jennifer Walshe, which uses walkie-talkies.[518]

...sofferte onde serene... by Luigi Nono is a piece for piano and tape. The 'Technical Notes for the Sound Engineer' by Alvise Vidolin in the second Ricordi edition from 1992[519] calls for an elaborate distribution of sound although there is no explicit score for the sound diffusion. If we pretend that these notes are correct, then playing a tape piece in a concert hall without a sound technician could be compared to playing a tape piece on a stereo in the living room. Speaking from my own experience, I have had composers on the soundboard who would not touch the sliders at all as well as technicians who constantly twisted every knob available. If one was indeed better than the other is difficult to say from a performer's perspective (see discussion below), but it is probably safe to say that a piece with tape music will likely sound better when its distribution lies in the hand of a good and experienced sound engineer, however it is not guaranteed that such a sound engineer is at hand at the respective venue nor that the sound engineer prepared for the concert. Dennis Smalley sums

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[510] Poppe, *Arbeit*.
[511] Saunders, *#[unassigned] - Version for Sebastian Berweck*.
[512] Kreidler, *Slot machine*.
[513] Wenk, *Taurus CT-600*.
[514] Thomas Wenk, *Recordame* (Manuscript, 1997).
[515] Riley, *Keyboard Studies #1*.
[516] Johnson, *Dehiscences, Lullay ("Thou Nost Whider It Whil Turne")*.
[517] Kostia Rapoport, *typenarmut* (Manuscript, 2006).
[518] Jennifer Walshe, *Theme From* (Manuscript, 2002).
[519] Nono, *...sofferte onde serene...*, cp. chapter 3.2.

this up by saying, 'it depends on who is doing the piece and how trustworthy they are, if they have the right diffusion instincts.'[520,521] As ephemeral as this cooperation is it can result in very successful performances, as for example have been the performances of *...sofferte onde serene...* with Hans Tutschku, Kilian Schwoon and Hannes Seidl on the soundboard. Nonetheless, it is hard to argue that these cooperations, or collaborations for that matter, constitute a duo, especially since the performances with no sound engineer or a less active one 'worked' as well. This results in the conclusion that a composition that is played without musical rehearsals and with sound engineers who rely on their experience only is indeed a solo piece. This definition would then hold true for every composition that uses a fixed tape and which can be played in such a set-up, regardless in what way the tape is stored (tape reel, CD, hard disc drive) or by whom it is being started (by the technician on a signal by the interpreter on stage, by the interpreter on stage, or by the composer) and by what means (pressing the play button on a CD player, pressing the space bar on a computer, playing keys on a keyboard).

In fact, it could even be argued that the performance of a piece where the sound engineer is not as intimate with the composition as the performer on stage can lead to a performance of lesser quality than a solution with a pre-produced tape. This might have been the motivation of Stockhausen to produce in 2002 a 'final' tape version for *Kontakte,*[522] which can be played back without further balancing the live instruments and the tape in the performance.[523] Further examples of compositions, which can probably be played without further balancing the sound once a balance has been found could be *Samstag morgen – Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch*. by Maximilian Marcoll,[524] Johannes Kreidler's *Klavierstück 5,*[525] and Kerry Yong's solutions for *Monody* by Roger Smalley[526] and *Aitsi* by Giacinto Scelsi.[527]

I have played Hans Tutschku's *Zellen-Linien,*[528] a composition for piano and live-electronics with no explicit electronic score, numerous times in different venues, on different pianos and with many different sound engineers. All of these engineers, except in the cases where the composer himself was responsible for the sound distribution, have only heard the piece on the day of the concert. The

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[520] Larry Austin, "Sound Diffusion in Composition and Performance: An Interview with Denis Smalley," *Computer Music Journal* 24, no. 2 (2000): 17.
[521] Tremblay, Boucher, and Pohu, "Real-time Processing on the Road: a Guided Tour of [iks]'s Abstr/cncr Set-up" provides some information on the experiences of a contemporary jazz trio touring with an electroacoustic set-up.
[522] Karlheinz Stockhausen, *Kontakte* (Kürten: Stockhausen Verlag, 2002).
[523] Stephan Maier in a personal communication per telephone, May 16, 2012.
[524] Marcoll, *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.*
[525] Kreidler, *Klavierstück 5.*
[526] Roger Smalley, *Monody* (London: Faber, 2000).
[527] Scelsi, *Aitsi.*
[528] Tutschku, *Zellen-Linien.*

attitude towards the sound distribution was again as diverse as are the personalities of the people: some go with the music and some do the set-up and lean back. As is the case in tape music, it is extremely difficult for the performer on stage to tell if their ad hoc chamber musician partner is playing the piece well or not, since the performer on stage is sitting in an acoustically unfavourable place.[529] The reactions of the listeners afterwards however, did not hint at any noticeable differences in the performances, although it must be said that for most people it was the first time they heard the piece as well and thus had no comparison. It seems though that most pieces will 'work' in almost all settings, just as a Partita by Bach will sound beautiful in almost all acoustic spaces.

The problem that the performers on stage make mistakes while controlling the electronics as described in chapter 3.8.2.1 and the resulting need for somebody on the computer expressly correcting the performance of the instrumentalist on stage can hardly qualify to call a solo piece a duet; correcting someone else's mistakes is not chamber music and does not serve the musical expression of the piece. Further examples for this arrangement can be found in *Elsewhere is a Negative Mirror* and *Of Dust and Sand* by Per Bloland,[530,531] *hundert rahmen, hochkant* by Maximilian Marcoll[532] and *venus_5* by Martin Schüttler.[533]

Finally, *Mikrophonie I* by Karlheinz Stockhausen,[534] *Prometeo* by Luigi Nono,[535] and *Répons* by Pierre Boulez[536] are famous examples of the relatively few scores that explicitly require performers solely for sound diffusion. The scores by Karlheinz Stockhausen and Pierre Boulez are so meticulously notated they are brilliant examples of how much accuracy is needed to write down all the technological aspects.[537] A look at the above scores makes it immediately clear that they fall into a different category. Here the electroacoustic part cannot be played in any other way than by one or more full members of the ensemble.

5.4.2 Knowledge and equipment of specific studios

Important studios for electronic music like IRCAM or the Experimentalstudio Freiburg have wonderful possibilities to help composers to create music with electronics. Unfortunately, this

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[529] It is hoped that new research by Pierre Alexandre Tremblay and Scott McLaughlin, "Thinking Inside the Box: A New Integrated Approach to Mixed Music Composition and Performance," in *Proceedings of the International Computer Music Conference 2009* (presented at the International Computer Music Conference 2009, Montreal: International Computer Music Association, 2009), will remedy this problem.

[530] Bloland, *Elsewhere Is a Negative Mirror*.

[531] Bloland, *Of Dust and Sand*.

[532] Marcoll, *hundert rahmen, hochkant*.

[533] Schüttler, *venus_5*.

[534] Karlheinz Stockhausen, *Mikrophonie I* (Vienna: Universal Edition, 1964).

[535] Luigi Nono, *Prometeo. Tragedia dell'ascolto* (Milan: Ricordi, 1985).

[536] Pierre Boulez, *Répons* (Vienna: Universal Edition, 1981).

[537] Unfortunately the same cannot be said about the scores by Luigi Nono, cp. for example Bernardini and Vidolin, "Sustainable Live Electro-Acoustic Music."

sometimes results in the paradox that a composition that was made possible by a studio is not played anymore because of said studio – or rather because of the fees that such studios demand.

If a composition uses the specific soft- and hardware of a studio or is dependent on specific knowledge of that studio, and if that knowledge is not being passed on to outsiders of the studio, the piece cannot be played without the studio. The studio then acts like an instrumentalist who owns a specific instrument nobody else has and acts like a business partner who expects remuneration.

Five examples are given for this scenario:

- *Abraum* for piano trio and live-electronics by Detlef Heusinger[538] was composed in the studios of the Heinrich-Strobel-Stiftung in 1995. Having heard the piece on a recording, the author asked the Heinrich-Strobel-Stiftung in 1998 if it was possible to perform the composition, but the fee was so high that it was impossible to program the piece. The piece was subsequently not been played for almost 15 years and only when the composer himself became director of that studio a version for Max/MSP was produced, which can now be played without the studio.

- Kerry Yong was able to perform *Pluton* by Philippe Manoury[539] during his doctoral studies. He notes however that 'a performance of *Pluton* does have numerous obstacles beyond musical ones: they are mainly financial, such as the hire fees for performance [and] the work material [...] Performances of *Pluton* have understandably been very limited.'[540]

- the problem is also described by Michael Zwenzner of Ricordi München who, as cited above, reports that the financial demands of technicians and studios have at times been such that the performance of pieces has become impracticable (cp. chapter 5.1).

- it is also supported by the Ensemble Modern, who say that 'it makes a difference if the Experimentalstudio Freiburg takes part [in a production], because they arrange things in such a way that they are always needed for performances. This is a problem for us and one must be careful to agree contractually that [the composition] can be performed without them.'[541]

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[538] Detlef Heusinger, *Abraum* (Bad Schwalbach: Edition Gravis, 1995).
[539] Manoury, *Pluton*.
[540] Yong, "Performance Practices in Music for Piano with Electroacoustics," 258.
[541] '*Ein Unterschied ist es wenn das Experimentalstudio Freiburg dabei ist, die die Sachen so aufbereiten, dass sie immer wieder mit auftreten. Das ist für uns ein Problem. Da muss man darauf achten, dass es vertraglich festgehalten wird, dass man es auch ohne sie aufführen kann. Inzwischen geht da immer der Zeigefinger hoch: Achtung!*'; Buchberger and Steeb, "Interview with Mariko Steeb and Stephan Buchberger."

- finally, Miller Puckette commented in 2004 about his old employer IRCAM by writing that 'composers [...] were often unwilling to realize music at IRCAM knowing that IRCAM would then control any possibility of performing the music.'[542]

It is not a novelty that composers write for specific performers or for instruments that are rare and therefore often demand a specific performer – examples would be pieces for extended contrabass clarinet that can play the low C or pieces that include videos of the performers like *Studie für Klavier, Audio- und Videozuspielung* by Johannes Kreidler[543] or *zig gesetze angewendet auf rei nakamura* by Christoph Ogiermann.[544] However, in all these cases it is possible to substitute the performers with other instrumentalists who have the same instrument or by re-recording the video (or by having different performers on the video and on stage).[545] It is therefore a novelty that a composition cannot be played any other than by having to hire a specific institution. The only other instance where a performer claims exclusive performance rights are the cases where a performer commissions a composition. However, the common rule is that these exclusive rights expire after a few years and allow other interpreters to work on the pieces.

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[542] Miller Puckette, "Who Owns Our Software?," *eContact!* 11, no. 3 (2009).
[543] Johannes Kreidler, *Studie für Klavier, Audio- und Videozuspielung* (Manuscript, 2011).
[544] Christoph Ogiermann, *zig gesetze angewendet auf rei nakamura* (Manuscript, 2009).
[545] An exception is probably *Freizeitspektakel* by Hannes Seidl and Daniel Kötter, which is expressly written for and filmed in the private rooms of the Vocalsolisten Stuttgart.

5.5 Promoters

Organizing electroacoustic concerts differs from organizing acoustic concerts to an extent that might easily be overlooked. Not only are most traditional venues hardly optimized for such music, the scheduling of such a concert must be adapted as well. The most important challenge however, can be noticed in the change in which the programming has to be tailored to the new challenges.

5.5.1 Unsuitable venues

Concert halls have over the centuries emerged into very special rooms in our busy society where we can play in silence and focus on the sound. These venues are optimized for musicians to come and test the hall and play acoustic music in the evening. A pianist giving a classic piano recital will need the facility manager to open the house and the telephone number of the stand-by piano technician in case something in the piano breaks. A piano trio will need two more chairs and two more music stands. This is all being catered for and is by no means a bagatelle: a city that wants to build a new concert hall will be busy doing so for years – the building of the Sydney Opera House is just one example of this.

Concert halls are already expensive but the musician playing with electronics needs more: an acoustic that is good for the acoustic instruments as well as for the electronic sound from the loudspeakers. An environment where electronics can easily be set up and do not interfere with security issues like escape routes and the safety curtain. A built-in sound system that is compatible with the electronics brought to the venue and very powerful, too, because some composers like to push things to the edge. And last but not least personnel that understand the special kind of treatment contemporary classical music needs which is very different from the needs of other amplified music like rock and pop music. As Karlheinz Stockhausen puts it, 'most of the time we must work in halls which really are not suitable for the electroacoustic music of today and tomorrow.'[546]

Most concert halls will not be equipped with all this additional machinery and personnel if the concert does not happen in one of the specialized studios for contemporary electronic music. This means that everything has to be brought into the hall, set up, and checked for faults.

5.5.2 Scheduling for the concert

Since the venue is likely to have a busy schedule and cannot afford to lose revenue the hall will usually be available for the set-up only on the day of the concert. This means that the instrumentalist, who needs calm and quietness to hear the acoustics and prepare for the concert, will

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[546] Stockhausen and Kohl, "Electroacoustic Performance Practice."

come into a very busy hall where people carry loudspeakers, set up mixing consoles and lay out cable during what was traditionally the dress rehearsal.

Depending on the amount of things that have to be brought into the hall this set-up will take several hours and only then will there be a line check to see if everything works correctly. Next is the sound check, where the pianist will be asked to play very loud and very quiet passages and the loudspeakers and the PA will be set accordingly. Only then will the rehearsals begin, which take longer than those of acoustic concerts because there is an additional player in the room: the sound engineer. Since the sound engineer is not on stage like the other musicians, every change takes longer because the sound engineer must walk from the mixing console to the stage and back.

It should be clear by now that the rehearsal time that is scheduled for an acoustic concert is in almost all cases insufficient for a concert including electronics. Since every concert is different, there is no possibility for even a rough schedule on how much time must be reserved for an electroacoustic concert in a hall. However, the promoter of such a concert must keep in mind that three more phases (1-3) must be added to the regular scheme (4-5):

1) set-up

2) line check

3) sound check

4) rehearsal

5) resting period

Unfortunately, the amount of time that is necessary for setting up an electroacoustic concert is not yet common knowledge amongst promoters. A statement from the interview with the Ensemble Modern will stand *pars pro toto*:

> It starts with the promoter; if you tell the promoter that you have a piece and that there's live-electronics and so on, then the promoter has to know: achtung, vorsicht, this is not just some instruments and will need a piano or a keyboard for which some electricity will be found somewhere and that's it, but that there is also amplification, and that someone is needed for care for the amplification and so on. And then one or the other item must probably be miked in order to sound like it's in the same room [with the amplification] and

not in another one, and so on. I would say, as a rule, promoters are not aware of all this considerations, in most cases.[547]

5.5.3 Programming

There is no general method how concerts are programmed: the motivation to program a concert can be as diverse as financial, artistic, congenial and other considerations. The order in which programmes are decided upon is equally diverse: the Projektgruppe Neue Musik Bremen, for example, chooses the pieces according to an overarching theme and only later looks for a performer, whereas other promoters will probably ask a performer first and then discuss the programme. In both cases, one will try to match the programme and the instrumentalist: a promoter who wants to present an evening with the *Goldberg Variations* will probably not ask a pianist who has never played music by Johann Sebastian Bach before. Likewise a promoter who wants to program an evening of electroacoustic music likely to ask a performer who has dealt with electronics before. However, and unlike a programme with acoustic music, it is actually not possible for both promoter or instrumentalist to know how much effort an unknown piece with electronics will require. Taking the example from the first chapter of this study, a musician who is asked to play three Beethoven sonatas will be able to estimate the amount of work that will go into preparing these pieces. This is not possible with music using electronics, because it is actually not known in what condition the electronics are in. In the case of Richard Festinger, one would have to find out little by little that the piece is not so easy to revive as originally thought (cp. chapter 3.3) and in the case of Orm Finnendahl one would find out that the piece actually needs to be completely reprogrammed (cp. chapter 3.4). That this not only applies to older pieces was demonstrated with *Arbeit* by Enno Poppe, a composition that only two years after its composition was difficult to stage (cp. chapter 3.5).

Another aspect that is unknown is the question whether the piece can actually be played by the number of players given in the instrumentation or if one or more technicians are needed in order to realize the composition. Also unknown is what the financial cost of the endeavour will be: the prices given in the publisher's catalogues may not include the electronics and there may be hiring fees that can vary depending on circumstances under which the piece is being played.

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[547] '*Es fängt ja tatsächlich schon mal beim Veranstalter an: Wenn man dem Veranstalter sagt, ich habe da ein Stück, und da ist live-elektronik und so weiter dabei, dann muss ja der ja erstmal Wissen: Achtung, Vorsicht, das ist eben nicht nur ein bestimmtes Instrumentarium und da stellt man ein Klavier hin und ein Keyboard, das wird schon irgendwo Strom finden, und das war's dann, sondern auch mal 'ne Beschallung, und dann muss man jemand haben, der sich darum kümmert, und so weiter, und dann muss das ein oder andere vielleicht auch mikrofoniert werden damit sich das in einem Klangraum befindet und nicht in zwei verschiedenen, und so weiter. Alle diese Fragen sind in aller Regel, würd ich sagen, meistens, bei den Veranstaltern nicht wirklich da.* 'Buchberger and Steeb, "Interview with Mariko Steeb and Stephan Buchberger."

It is therefore not only necessary to discuss electroacoustic programmes much earlier than acoustic programmes, but actually to adapt the programming process to these new circumstances. Since it is mainly the performer who will have to press for this change, this process will be described in detail in the next chapter.

6   Solution Proposals for Performers

The use of electronics has changed the role of the performer in drastic ways. The focus of the concert preparation has seemingly shifted away from performers and their needs to the demands of the electronic set-up. For the performer this shift is unfortunate, since the act and the difficulty of performing have not changed.

The solution seems to be clear: 'Performing with technology requires players to develop new skills and flexibility.'[548] In other words, performers have to take their fate in their own hands and have to become specialists. This task consumes much time and money, which is often difficult for an instrumentalist, who wants to concentrate on playing and practising the original instrument. As Sarah Nicolls notes: 'that's what makes working with electronics hard: one has to be ready to get involved in setting up, understanding cabling, being able to control your own sound, owning your own equipment, trying to fix things whilst receiving instructions from a composer via Skype... .'[549] However, it is the only way to regain some control over what is happening in the concert hall, and to quote Stockhausen, 'as a musician, you must assume responsibility for how you sound when recorded.'[550] This is of course not only true when being recorded and requires not only investing in an electronic set-up and setting up a rehearsal space but also becoming acquainted with electronic equipment. It also means that performers must acquire the skills to communicate their needs to the colleagues with whom they perform – the stage technicians and the sound engineers.

The study has also shown that the material sent by composers and publishers often requires a lot of work to make it usable. Whereas publishers shy away from the financial and organizational burden that scores with electronics bring, composers often only document the work in such a way that only they know what is needed for a performance of the piece. Again, performers need to communicate their needs and demands to these parties.

Finally, performers have to adjust their business attitude towards promoters for two reasons: promoters often seem to be unaware or have only a shady idea about the differences between an acoustic and an electroacoustic concert. Furthermore, it must be made clear that the work needed to restore old patches and computer programs as well as the technical set-up cannot be the task of the performer alone and that the financial and temporal burden must be shared.

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[548] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 297.
[549] Nicolls, "Brief Thoughts on Using Live Electronics - Preliminary Version of an Article for eContact! 13.2.", Preliminary version.
[550] Stockhausen and Kohl, "Electroacoustic Performance Practice," 84.

Since we are dealing with so many persons and with so many topics, no general solution to these problems can be offered. This means that interpreters have to find ways of dealing with the situation as it is and the proposals below – despite sometimes being only temporary and necessarily highly personal – hope to give some ideas that will result in concerts given with a stress level no higher than that of an acoustic concert.

6.1 Programming

Music is often programmed in order to fit an overarching festival theme or a certain programme. This practice is easy to follow with programmes consisting solely of acoustic music – it just requires hiring a performer who agrees to perform the piece. With works using electronics the method has to be adapted, since – even if the music has been printed and announced in the publisher's or composer's catalogues – it is not clear what state the electronics are in and if they require obsolete hardware and/or software. If we see the electronics as part of the instrument the performer plays, it becomes clear that a piece for which the whereabouts and condition of the only such instrument in the world is unknown would not be programmed. However, it is exactly the way we program music with electronics.

If the electronics are in no state that they can be easily set up and are ready to go – and the case studies have shown that this is usually not the case – a lengthy phase of data archaeology might commence. It can also lead to finding that a composition is lost because the data is simply not recoverable or that the cost to hire an obsolete device is too high. This should logically lead to programming only pieces that performers already have in their repertoire. However, this is not the current approach and performers have to deal with the demands of promoters.

When a composition with live-electronics is programmed and an interpreter is being asked to realize the piece, the two parties will have to start immediately communicating about how they want to acquire all things necessary to bring the composition to the stage and who will sign as responsible for which task. The following list sums up the tasks that need to be done:

- Getting in contact with composer and publisher to
  - enquire about the state of the piece
  - ask how much the fee for renting the score and the electronics are
  - ask what additional instruments are required for the piece and if they can be lent or borrowed
  - ask if the piece is indeed for the number of players written in the instrumentation or if additional technical personnel is required
- get in contact with former performers of the piece to ask about their experiences setting up and playing the piece (and if any changes have been made to the set-up or are recommended)
- demand a fully working patch from composer or publisher or get in negotiations on how to restore the piece

- agree on the operating system the patch will run on

- check if the patch is actually working on a current computer system

- enquire with the tech team of the concert hall on their technical equipment

- enquire about the fee for the rental of additional equipment

- enquire about the fee for the rental of obsolete equipment

- try to get information on the technology available to the composer when the piece was written (in case of a rather old piece)[551]

As can be seen, there can be many more steps needed to organize just one piece of music with electroacoustics as compared to a purely acoustic piece. It is also clear that the performance of such a piece requires more than just performing the piece. It includes restoration, additional hiring fees and technical assistance, all of which can be quite costly. It is therefore necessary to agree with the promoter on a fee that is split in three parts:

1. The learning and performing of the piece itself.
2. The restoration of the piece until it works again.
3. Technical assistance and equipment.

It is then the performer's decision if they want to take on the task to restore the piece and make an offer, and the promoter's decision if they want to take that offer or hire a firm specialized in these things.

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[551] See below for a discussion on *Pendulum Music* by Steve Reich.

6.2 Restoration / Coding

As strange as it seems, it is often the interpreters who have to deal with data archaeology, whether they are commissioned by a promoter to play a certain piece or if they want to learn a piece in order to add it to their repertoire.

The methods of restoration vary between trying to find the old set-up, a method used for example in a performance of *Differenz/Wiederholung* by Bernhard Lang,[552] using the old hardware and recoding the software as exemplified in chapter 3.3, or completely recoding the whole set-up like in chapter 3.4. Another option that is sometimes discussed is emulating old hardware on new computers.

The three principal methods, which can of course be mixed, are therefore

1. using old hard- and software
2. emulating old machines on newer computers
3. rewriting the composition with new code

6.2.1 Using old hard- and software

When using the original set-up, the old machinery has to be found and it must be in working condition. With hardware sound modules, for example synthesizers, this could probably be compared to trying to find an electric drill from 1986 and hoping it will run smoothly and reliably once plugged in. This method only works if the machinery is not too old and it might happen that the physical connectors need to be exchanged. These machines can sometimes be found in the archives of studios for electronic music. Another solution is studio rental shops like Studiohire,[553] from which quotes on the rental fees can be obtained. In any case, the availability of the old hardware cannot be guaranteed since the equipment might be too expensive to hire, too esoteric to be quickly set up, or unreliable due to its age.'[554]

If the hardware can be found, the patches must somehow find their way into the hardware, which can in consequence mean that old software must be found and installed. The impracticability of this procedure has been described in chapter 3.3. Once the hardware is finally set up, 'the lack of clear and complete documentation regarding the technical implementation'[555] poses yet another problem.

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[552] Lang, *DW 16 Songbook I.*
[553] "Studiohire Rents Pianos, Vintage & New Synthesizers, Guitars, PA Systems, Drum Kits, Amplifiers, Microphones, DJ Equipment, Percussion & All Musical Equipment from Our London Based Premises. London, Piano Hire London, Guitar Hire London, England, Synthesizer Hire, Drum Hire, Keyboard Hire, Backline Hire, Music Hire, Vintage Synth Hire, PA Hire London, PA System Hire, Amplifier Hire London, Amp Hire, Instrument Hire London, London, NW3, UK, Instrument Rental," n.d., accessed 20 June 2012, http://studiohire.net/.
[554] Bullock, "Modernising Live Electronics Technology in the Works of Jonathan Harvey."
[555] Ibid.

The usage of old software can also pose tremendous problems, for it runs on old computer hardware and therefore carries all the above described problems as well as several copyright and licencing issues. It is for example not easy to buy a software licence from a defunct firm, whether that firm is bankrupt like Opcode or has been taken over like Emagic.

6.2.2 Emulation

Emulating the old hardware is an option that seems to be more and more feasible since current systems now have the power to seamlessly emulate an old system. However, it is by no means an easy endeavour: although virtualization software like Virtual Box,[556] WINE,[557] or MESS,[558] can be used by a layperson, the difficulties are still immense. First of all, they require enough time to learn. Nevertheless, these are not the only programs that need to be learned since the virtualization only creates the environment for a completely new – or better old – operating system. If we take for example MESS, which claims to 'more or less faithfully reproduce computer and console systems'[559] for 'over 250 systems from the last 5 decades'[560] the question must be asked, which performer has the time to take up learning even one of these systems? Moreover, systems emulating or virtualizing old operating systems do not necessarily provide these operating systems. For example, in order to install a Mac OS 7 on MESS the following prerequisites have to be met:

1. a working installation of MESS with at least revision 9050

2. a working installation of OS 6

3. the installation disks of OS 7

4. the Basilisk II Mac Emulator

5. licences for OS 6 and OS 7

Only then, the old program, like an old music program, can be installed onto the system and only then can the work on the often not well-documented patches start – however, only if the assiduous user has not met the occurrence that something somewhere along the way did not work for reasons unknown. Orm Finnendahl, for example, had the experience that installing an old external for an old version of Max/MSP is impossible because of the licencing process needed to read out old hardware information – information that was simply not present in the virtualized computer.

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[556] *VM VirtualBox* (Oracle, 2012).
[557] *Wine*, 2012.
[558] *Mess*, n.d.
[559] "Mess Faq [mess]," n.d., accessed 22 May 2012, http://www.mess.org/faq.
[560] Ibid.

In summary, it must be said that apart from the many hours that will necessarily go into such a project the following programs have to be learned:

a) the virtualization program

b) the virtualized operating system

c) the program itself

d) the usage of the patch

Virtualization thus seems theoretically to be a possibility but the amount of time that goes into it can be a bottomless pit and a positive outcome is not guaranteed. It is at this time a rather uncertain endeavour.

6.2.3 Re-coding

Re-writing the composition in new code is an option, but few instrumentalists will have the knowledge to do so. A patch for Max/MSP can easily have dozens of subpatches and in order to recode the patch it first must be disassembled and its structure understood. David Brooke Wetzel has documented this process and it produced several research papers.[561] However, it is questionable if performers have the time to write a research paper every time they want to play a composition or are commissioned to do so. Another question is in which of the computer languages they are supposed to be as good or better[562] as the original composer: ChucK,[563] Csound,[564] Max/MSP,[565] Pure Data[566] and Supercollider[567] are just a few of the programs that are currently being used. In addition to this, they must theoretically be firm on old hardware as well, like the famous Akai Samplers and the aforementioned Yamaha synthesizers and they must be able to reverse engineer their software and coding them anew, emulating their sonic characteristics on the side. It can be assumed that most performers will shy away from such work and probably simply decline the notion that they should become computer specialists in addition to their full time job as instrumentalists.

As has been shown, all of these solutions are extremely time consuming, require money and will probably still need the expertise of a software programmer or a technician. Viable options for the performer are therefore not to find solutions on how to resurrect the composition but find the

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[561] Wetzel, "A Model for the Conservation of Interactive Electroacoustic Repertoire: Analysis, Reconstruction, and Performance in the Face of Technological Obsolescence"; David Wetzel, "Building A Sustainable Repertoire: A Performer's Approach to Realizing Interactive Electroacoustic Works." (presented at the 2007 SEAMUS National Conference, Ames: Society for Electro-Acoustic Music in the United States, 2007).
[562] In case the patch does not work due to insufficient programming skills.
[563] Ge Wang and Perry Cook, *ChucK*, 2009.
[564] Barry Vercoe, *Csound*, 2012.
[565] *Max/MSP*.
[566] Miller Puckette, *Pure Data*, 2012.
[567] James McCartney, *SuperCollider*, 2012.

people interested in the resurrection and work together with them. Composers should have an interest in resurrecting their old compositions but as the cases of Orm Finnendahl (cp. chapter 3.4) and Richard Festinger (cp. chapter 3.3) shows this, too, has its impasses. A seasoned programmer knows how much time will be spent on the recoding and it means less time to write new music.

As for publishers, it must be clear that they will pay for the rewriting only if their commercial interests are being fulfilled. This will be the case if the composition will be played more than once, which is similar to the deal reached with Orm Finnendahl. James Eggleston from Boosey & Hawkes says that their customers often do not even get back to them so there is certainly room for talk.[568] It is in the publisher's interest that the music is played and they are the first to contact.

The publisher and the composer are also the ones who know who coded the patch and programmers might not want their work to become obsolete. It must be noted, however, that this way can have its quirks as long as the programmer does not work on a contractual basis (compare the case study on *Arbeit,* chapter 3.5), and that the cost of this endeavour can easily be too high for a promoter's budget.

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[568] Eggleston, "Interview with James Eggleston."

6.3 Equipment

Since the performer has to be intimately acquainted with the machinery used on stage, it is paramount to rehearse with the exact same devices. Since it is only possible to be acquainted with a limited range of devices, they must be flexible enough to be used in a wide range of settings. As has been demonstrated in chapter 4.6, they must also be easily portable and replaceable. Finally, the devices should be of good quality in terms of durability and sound. Devices should therefore be bought with regard to flexibility, portability, replaceability, durability and sound quality.

6.3.1 Hardware

The hardware used in the production of music with electronics – apart from the acoustic instrument itself – comprises the computer, audio and controller interfaces, microphones, and controllers.

6.3.1.1 Computer and operating system

At 92%, the most widely used operating system in music technology is the Mac operating system,[569] which runs on Apple computers only. Since laptops provide portability and are for the most part powerful enough to compute music in real-time, a user of a laptop from this maker has the best chances to find a replacement in case the computer breaks and also to easily find another user to help solving problems.

The idea to bring an extra computer for every composition played, as is for example the case in *error_05/auto_face* by Michael Pinter,[570] is not feasible for several reasons:

- the amount of computers performers can carry with them on tour, for example, the one described in chapter 4.6, is limited, since it is not only the computer but also several other interfaces like keyboards and foot pedals that have to be transported to the venue.

- they would also have to be proficient with every operating system and every version of them and it could prove difficult to quickly find someone proficient in for example an obscure Linux derivative in case something goes wrong.

- the digital chain must not be interrupted, which means that not only the several laptops must be carried but also tested audio/MIDI interfaces.

- having several computers and interfaces multiplies the amount of logistics and also the requirements for the set-up.

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[569] Akins, "Facilities Used for Introductory Electronic Music: A Survey of Universities with an Undergraduate Degree in Audio."

[570] Michael Pinter, *error_05/auto_face* (Manuscript, 2006).

6.3.1.2 Audio- and control interfaces

For portability reasons it is a good idea to use an audio interface with an integrated control interface. With Open Sound Control (OSC) still not being supported by standalone instruments and Yamaha not producing devices with mLAN support anymore, MIDI is still the standard in control protocols. Since in many compositions with live-electronics the acoustic instrument is being picked up by microphones, integrated microphone pre-amps are also recommendable. In order to play with one's own set-up in larger rooms, eight audio outputs are reasonable. For larger set-ups, it is likely that generic hardware of that institution must be used and/or an interface with more channels in the form of a digital out can be used.[571] The interface must further possess the ability to save several settings and be able to import these settings from a file. Finally, a model of a maker who is known for developing and keeping stable drivers should be chosen. Again, exchangeability is necessary in case the audio interface breaks and no backup interface can be brought.

It must be mentioned that these interfaces are in effect small computers and need time to be learned. As has been shown in several case studies, it is not possible even for learned personnel to understand every such device immediately, let alone its quirks and peculiarities. It is therefore necessary to get acquainted with the device and get an understanding similar to that of the playing of an acoustic instrument.

6.3.1.3 Microphones

Microphone is a generic term for a whole set of devices used for picking up audio and transform the signal into electrical current. Since the information is transferred as current and not as digital data, it is not part of the digital chain and it is arguable if an instrumentalist needs to own one. However, each microphone has its different sound characteristics, and using a microphone provided by the promoter might not only alter the sound fundamentally but also require different settings for amplification – which in turn could prove difficult with some patches.

6.3.1.4 Controllers

As is the case with microphones, *controller* is an umbrella term for all kinds of human-machine interfaces. This comprises not only commercially available devices like computer keyboards and the computer mouse but also many ingenious items inventors around the world conceive. Even a look at interfaces designed expressly for music reveals a multitude of devices.[572,573] New interfaces are being

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[571] Unfortunately this would mean breaking the digital chain.
[572] Joseph A. Paradiso, "Electronic Music Interfaces," n.d., accessed 24 May 2012, http://web.media.mit.edu/~joep/SpectrumWeb/SpectrumX.html.
[573] Joseph A. Paradiso and Sile O'Modhrain, "Current Trends in Electronic Music Interfaces. Guest Editors' Introduction," *Journal of New Music Research* 32, no. 4 (2003): 345–349.

invented on such a scale that since 2001 a conference on New Interfaces for Musical Expression (NIME)[574] is held annually.

However, the large majority of these instruments are not widely used and fail the requirement of replaceability. Therefore commercially available devices must be considered, and already they offer a wide range of control surfaces with the most common being piano keyboards, faders, buttons, rotary knobs, pads, wheels (like in pitch wheels) and foot pedals (pivot pedals and momentary/temporary switch pedals).

Despite the assumed modularity in musical devices – which might be fostered by the fact that they usually use the same hardware connectors and by the possibility to go in a shop and buy 'a foot pedal' – the devices often use different specifications and are in fact not easily interchangeable. It is therefore necessary for the player of electronic devices to learn about the different devices and which ones work together. Fortunately, this can be done without actually knowing if a 25k or a 250k resistor is needed in for example a volume pedal but by trial and error. It is important though, that this trial and error phase takes place in the rehearsal studio well before the concert and not when attaching a foot pedal to an unknown keyboard in the hours before the concert.

As with the audio/MIDI interfaces, it is necessary to play with these instruments. It is for example not possible to change quickly from one fader box to another because they could use different scales.[575] It is also unknown how a rotating button will react when turned at greater speeds: it could jump in tens rather than in single units, scroll to predefined numbers, behave like current smartphones and continue scrolling for a little longer or simply stay with the original speed. Using a controller therefore must be practised just like any instrument.

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[574] "New Interfaces for Musical Expression," n.d., accessed 24 May 2012, http://www.nime.org/.
[575] Linear or logarithmic, for example.

It might be worth mentioning, that commercial equipment is often catered to other musical styles and might not be suited for classical contemporary music.

Figure 53: A guitar effects pedal featuring a common mechanical design[576]

In the guitar effects pedal depicted above, the player must overcome some resistance until the knob snaps in or out of the positions, thereby satisfying the need of the performer to sense which state the device is in (cp. chapter 3.8). Unfortunately, this mechanism is too loud for most concerts with classical music, which is why in such concerts mostly momentary foot switches (like keyboard sustain pedals) are used. It must be noted however, that these also often squeak or emit the sound of plastic being bent. A hands-on approach to building or tweaking commercial devices is therefore required.

6.3.1.5   *Earphones*

Since headphones are often used in the production of music with electronics – for example if click tracks are being used – they should be part of the equipment of a performer. Generally, the information that is being conveyed to the performer via the headphones should not be heard by the listeners, which often turns into the problem that either the performer cannot hear the click track in loud passages or the listeners in the first rows are able to hear the click track.

This problem can be overcome by in-ear headphones. Commercial models often come with several sizes of ear tips that are supposed to fit any ear canal. However, in my experience, the ear tips often do not fit comfortable, but more importantly have a tendency to fall out of the ear in lively passages. An otoplastic (a cast of the ear) in-ear headphone provides a solution that will fit the ear perfectly,

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[576] Re-printed with kind permission of the Valco Instruments Company, Inc.

resulting in comfortable wearing without the danger of the earplug falling out (see Figure 54: Otoplastic).

Figure 54: Otoplastic

Specialized dealers demand prices around £ 400[577] for the casting and a combined otoplastic – earphone solution. A cheaper solution is to ask a hearing aid acoustician to produce a cast of both the ear as well as that of an earphone (see Figure 55). The price will then depend on the price of the earphones – which can still be used as regular earphones – and the cast, which can range between £ 15 - 70.[578]

Figure 55: Otoplastic as in-ear headphone

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[577] Internet research, May 26, 2012.
[578] Ibid.

6.3.2 Software

Composers have, in recent decades, used a wide variety of software to produce music with live-electronics. Many of these programs are now obsolete or require a decent amount of time to learn them. As has been mentioned earlier, performers cannot possibly know all this software. It is therefore imperative that composers provide patches that are indeed self-explaining or come with instructions that can be handled by someone who is proficient in using computers. However, this proficiency, or computer literacy, lacks a general definition and it is probably more helpful to resort to analogies using other music instruments. An instrumentalist in the western music tradition is usually not the maker of the instrument they play – a violinist needs a luthier, a horn player refers to a brass instrument maker, and pianists and organists need specialists to even tune their instruments. However, a horn or clarinet player can make sure that the instrument works by being able to assemble it, watering the reed and generally knowing how to prepare the concert for playing – this knowledge reversely includes knowing when something needs repair and then knowing where to turn to.[579] Just like the acoustic instrument players the performer of electronic music needs to know how to use the computer enough that it can be guaranteed that the instrument is working. This would, for example, mean that they can set up the equipment in a way that sound is coming from the audio outputs and that the MIDI information from the controller is being read by the computer. This knowledge requires not only being able to connect the hardware interfaces physically with each other but to know how to install and use the drivers and the software that come with them, for example software mixers and programming editors for controllers.

It could be argued that with the prevalence of Max/MSP it can also be expected that they know how to check the same routings from inside the program and to have a general knowledge about how the program functions. This would include, for example, knowing how to set search paths and other routines. However, these basic skills can be learned very quickly.

This focus on Max/MSP does not mean that software like ChucK, Csound, pd, SuperCollider, or whatever software that can be used to make music should not be used, quite the contrary. When it is said that a performer today can be expected to have a Max OS X system and Max/MSP it is not a plea in favour of these programs but a requirement for the current performer of music with electronics to have a platform on which, at this time, most music is being produced. It is in no way a statement that these programs should be used and is not part of the discussion concerning copyright or longevity.

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[579] This combination of instrumentalist/instrument maker could easily be misunderstood as the combination electronic instrument/music technician but the comparison does not hold for very long since a violinist can virtually play every piece that has been written for the instrument and only needs the violin maker once the violin is broken. Since it has been shown that virtually every piece for instrument and live-electronics needs repair this could only be compared if the violinist would have to have the violin repaired with every piece that is played.

Apart from the aforementioned programs, two other types of usage of electronics must be discussed: samplers and tape music.

Since samples are an often-used format to enable a player to produce other sounds than those of the acoustic instrument, it seems necessary that a performer is fluent in a sampling program. Many free programs can be found on sites like kvraudio.com.[580] However, 70% of OSS developers do not care for usability[581] and it can be a very tedious task to find software that is reliable and flexible enough to perform many different tasks and that is properly documented. Both commercial software and free software must be learned and ample time must be reserved for this – using a program for the first time in concert preparation might lead to a conflict, since time that was planned to learn the score is spent learning the program. As has been mentioned before, composers cannot expect performers to have every commercial sampler on their computers. It is therefore not recommendable to provide the samples in a proprietary format that can only be read by one program alone, but by providing the samples in an open format, for example wav-files, along with the instructions on how to map the samples.

In order to prepare for performances with tapes, it would certainly be good if the tape could be slowed down for practising purposes. Many computer based software media players are able to do this, for example the VLC Media Player[582] or the Windows Media Player.[583] However, tape music has the great advantage for performers that it does not require a full computer set-up for rehearsal but only a portable media player. Several portable media players feature variable playback speed; however, it is important to note that the function is often implemented only rudimentarily and might only work with spoken content. An alternative operating system for some devices of the popular iPod range by Apple as well as many other players called RockBox[584] features much enhanced functionality like adjustable playback speed with and without pitch change as well as changing channels and different volumes on both channels, dithering, bookmarking and looping. It can be dual-booted with the original system and features also a basic metronome.

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[580] www.kvraudio.com

[581] Arif Raza and Fernando Capretz, "Do Open Source Software Developers Listen to Their Users?," *First Monday* 17, no. 3 (2012).

[582] VideoLAN organisation, *VLC Media Player*, 2012.

[583] *Windows Media Player* (Microsoft, 2009).

[584] *Rockbox*, 2012.

6.4 Rehearsal Space

Once a player owns all necessary devices, a rehearsal space can be set up that allows for practising routines that can be almost as quickly set up as an acoustic instrument.
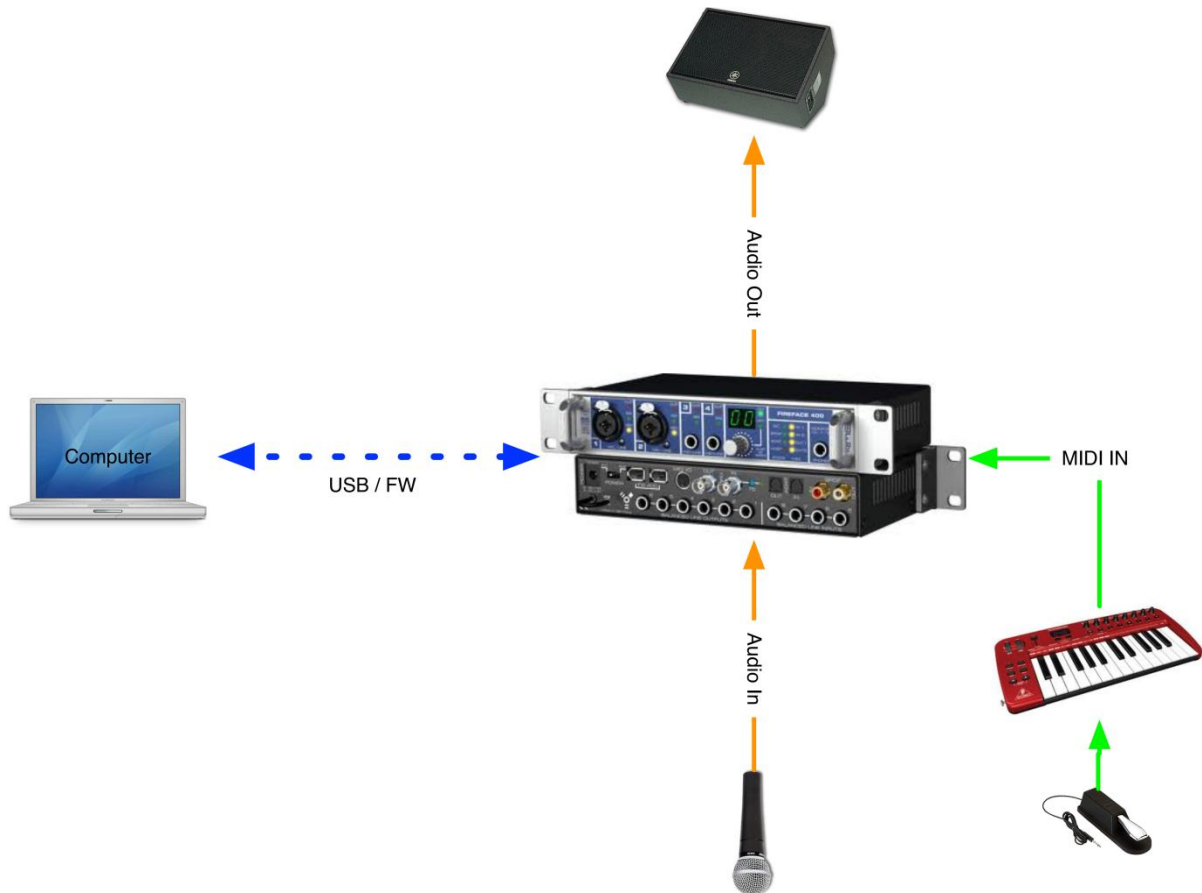
Figure 56: Set-up for practicing electronic music

In the set-up depicted above the audio/MIDI interface is at the core of the set-up with loudspeakers, microphone and MIDI controllers plugged into the interface and the power already turned on. Using a power strip with a power plug, once the power is turned on all the devices are ready to go. With the USB or Fireface cable already being connected to the interface all that is needed on the hardware side is the computer to be plugged in and the microphone attached to the instrument. Once the program and the patches are loaded, the instrumentalist can immediately start practising. The ease of such a set-up is of course only given if it is actually set up and not stowed away. This means that the performer of music with electronics has to organize a fixed rehearsal space in a secure environment.

6.5 Network of Technological Experts

For an interpreter of music with electronics it is vital to build up a network of experts. Over 50 years of live-electronic music has seen huge changes in the technological equipment and often important technological platforms like the NeXT system were only short-lived.

Since the amount of knowledge regarding technology and software used for the production of music in the past and present is so vast, a network of experts must be set up. For a performance of Steve Reich's *Pendulum Music*[585] it is, for example, very interesting to know that the piece was premiered with loudspeakers with the power of a mere 70 W, resulting in feedback that was far quieter than would be obtained with current models. This is information only an expert in the history of loudspeakers can give, which hardly any performer is.

This same group of experts can also be helpful in finding the right gear – the music instrument market provides such a variety of products it is no easy feat to find products with reliable software and drivers, for example. To know which makers provide these, one must rely on experience, and if that experience is not given by many years of practise, it is necessary to ask for advice.

It is probably not possible that this network of experts knows immediately everything that needs to be known – however, they might be able to give hints of where to search or can make the connection to persons who do know.

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[585] Steve Reich, *Pendulum Music* (Vienna: Universal Edition, 2000).

6.6 Concert Preparation

The preparation of a concert with several pieces demanding different set-ups can be a complex matter, since it is not in the hands of the performer to make 'a sonic sacrifice'[586] but to render the composer's intentions faithfully. This can easily lead up to a multitude of devices that need to be brought into the concert venue by the performer. In case of failure, it is important that these devices are replaceable. The concert set-up itself must be prepared to guarantee a hassle free flow of the process, and finally the concert itself needs preparation in order to be able to concentrate fully on the playing and not on the setting up.

Concert preparation can therefore be divided into technical preparation (technical riders), preparation for backups, concert set-up preparation and concert preparation.

6.6.1 Technical preparation (technical rider)

1. What is needed first is a list of requirements for each piece. This list includes all the devices needed for the playing of the piece including:

   a. instruments

   b. number and type of stands, for example music or instrument stands

   c. chairs, benches, tray tables

   d. the electronic core audio set-up (computer and interface)

   e. software

   f. controllers

   g. microphone and microphone boom

   h. any other item like stopwatches, E-bows, portable media players

   i. number and position of power plugs needed

2. It can then be decided if more than one piece can easily be played in this set-up.

3. After contacting the venue and an inquiry what the options for multiple *stations*[587] are – for example in the form of a second piano that can be prepared before the concert – it can be decided which piece is going to be played at what station.

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[586] Tremblay, Boucher, and Pohu, "Real-time Processing on the Road: a Guided Tour of [iks]'s Abstr/cncr Set-up."
[587] A *station*, also called position, set-up or location, are different places in the concert hall with a fully working set-up for a piece. For example a concert with a piece played on a grand piano, one on an upright piano and one on a keyboard would necessarily result in three different positions, which all need amplification, lighting and soundchecks.

4. Then the list of devices required at each station can be written. It is advisable to check with the first list of requirements for each piece if something has been forgotten in the process. This can easily happen if a device is needed at two stations.

5. After the list of devices at each station has been written, the specifications of the electronic devices must be listed:

    a. name and version

    b. connectors (type and form factor)

    c. power requirements

    d. adaptors

6. It must then be confirmed again with the venue which devices will be provided by the venue and which will be brought into the venue by the performer. The digital chain must not be interrupted.

7. After this has been agreed upon, the list of devices is split into as many lists as there are people providing devices. The importance of this list can be seen in a quote from the technical questionnaire of the Huddersfield Contemporary Music Festival, which reads: 'Any equipment not requested in this questionnaire or an attached list will not be provided. Any equipment requested but not used will be re-charged to artists as per the contract.'[588]

8. A diagram depicting the set-up is being drawn along with the connections (analogue audio/video, digital audio/video, control signals).

9. The requirements for lighting and a stage plot need to be written. The first describes the different light settings (spot on different locations, general stage light, hall light, darkness) and the latter the sequence in which the light settings are used.

10. The following information is sent to the promoter:

    a. the program order and on what station the piece is being played

    b. the positions with their respective devices

    c. a material list, divided into sections as to who provides what item

    d. the scores and the electronics

    e. the set-up for each composition

    f. the lighting settings and the stage plot

11. The contact information of every person involved in the project.

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[588] TG Events, "Technical Questionnaire 2009" (TG Events, 2009).

It is essential to call the venue to make sure that they have read the list and agree with it in the weeks before the concert.

It is not advisable to skip any of this information, since the set-up forms an instrument that can only work once all the connections are made. For example, it cannot be foreseen at which point in time hardware makers change hardware connectors on their devices, which can lead to incompatibility (cp. chapter 4.4). Assumptions should also be avoided at all times, as the same case study with the missing 88-key master keyboard shows. Since the setting up of the concert, unlike in bigger pop productions, cannot be rehearsed,[589] it is imperative that the preparation for the set-up is as meticulous as possible.

However, the amount of detail may differ from venue to venue and depending on the venue. For example, if the performer brings the whole amplification and the loudspeakers into the hall, a diagram for the amplification and the mixer must be drawn. If the venue takes responsibility for the audio set-up and has an audio engineer organizing the audio lines, the diagram must only include the connections.

The difference between the two strategies is depicted in two diagrams for the same concert on November 11, 2011 at the ZKM Karlsruhe. Figure 57 shows the set-up with the signal flow with analogue signals in yellow, amplified audio signals in pink and blue control signals.

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[589] Since players, technicians and the different devices might meet the first time at the day of the concert in the concert venue.
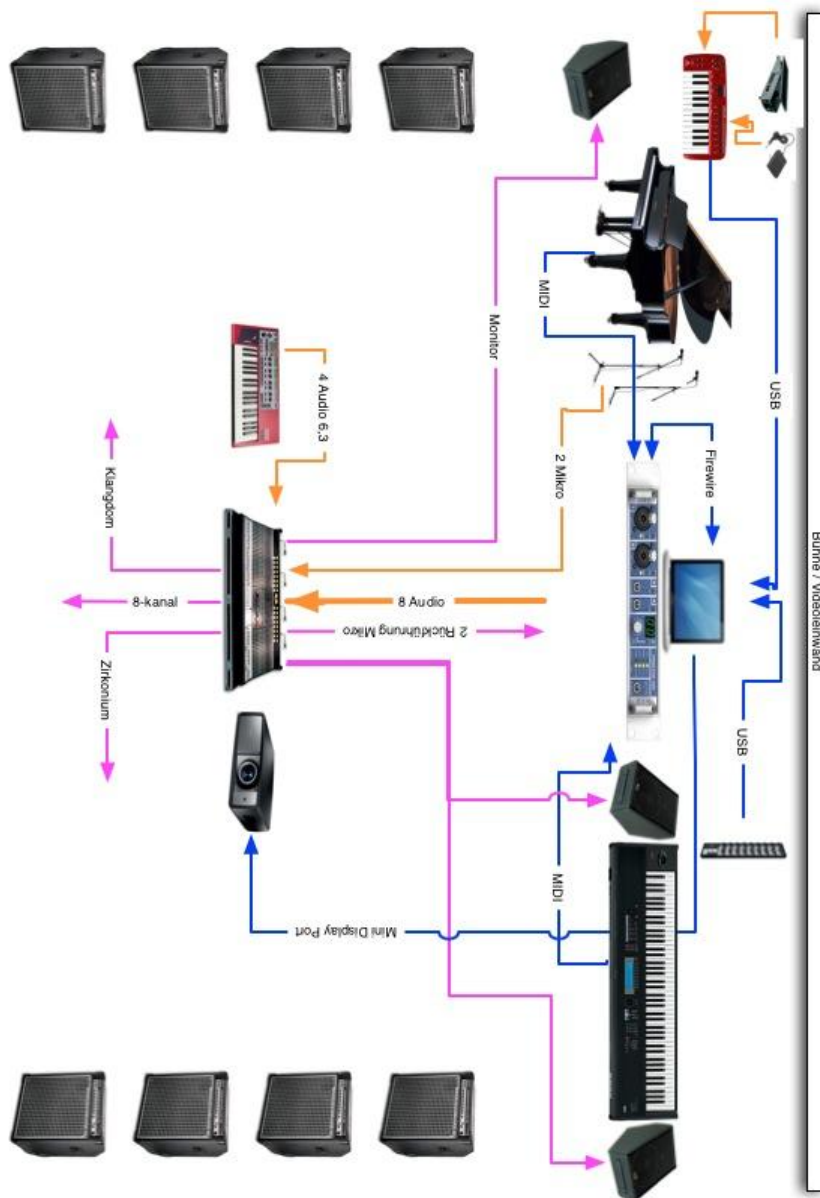
Figure 57: Set-up with signal flow, Zentrum für Kunst und Medien (ZKM), November 11, 2011

Since this diagram is not very clear and since there was no need for the performer to tell the ZKM how to make the connections, a second version was drawn, which is depicted in Figure 58. Here the different stations can clearly be seen, with each station having a material list with devices expected to be provided by the house, devices brought with by the performer and the connections the station

requires.

Position links: Tutschku, Marcoll

Haus:
- Steinway
- Klavierbank
- Monitorbox
- kleiner Tisch für Noten
- Stütze/Audio (2 Mikrofone)

Sebastian:
- MIDI-Keyboard + Pedal
- Präparierung
- Plektren etc.
- patches auf dropbox

Verbindung:
- Mikrofone -> Mischpult/Computer ZKM
- Mischpult -> Monitorbox
- MIDI Keyboard -> Computer ZKM

Position Mitte: Finnendahl

Haus:
- MIDI-Flügel
- Klavierbank
- Bildschirm
- Stütze (2 Mikrofone)
- Controllerpedal -> MIDI Übersetzung (z.B. kleiner Synth, Keyboard)

Sebastian:
- Controllerpedal (Earnie Ball Jr.)(TRS Klinke)
- Präparation

Orm:
- patch

Verbindung:
- MIDI Pedal -> Computer ZKM
- MIDI-Flügel -> Computer ZKM
- Stütze -> Mischpult
- Screen Computer ZKM -> Bildschirm
- Video "WoF" -> Beamer

Position rechts: Poppe

Haus:
- 88 MIDI Keyboard mit Sustainpedal
- Keyboardständer (sitzend)
- Klavierbank
- 2 Notenständer (solider Rücken)
- 2 Lautsprecher, quasi als Lautsprecher des Keyboards
- 3 Steckdosen
- kleiner Tisch für Laptop

Sebastian:
- Laptop (MacBook Pro mid-09)
- Fireface 400
- Faderbox (NanoKontrol 2)
- Instrumente & Patch auf Dropbox

Verbindung:
- 2x Großklinke aus Fireface zum Mischpult
- Nach Möglichkeit Röhrenverstärker
- Zurück zu den Boxen

Bühne / Videoleinwand

Figure 58: 2nd version of set-up, Zentrum für Kunst und Medien (ZKM), November 11, 2011

Both set-ups feature the material lists on an extra sheet for easy reading (see Figure 37, page 152).

6.6.2 Preparation for back-ups

Back-ups can be provided by either carrying a surplus device or by using devices that can be expected to be hired or lent and therefore need only the software. Although it would be desirable to transport a complete hardware back-up, it will in most cases not be possible for financial and weight reasons.

In order to provide a back-up of the computer settings quickly a new user account for concerts can be installed and stored, for example, on a hard disc drive. This user account can be optimized for

concert situations (for example by turning off power saving features), will feature all the necessary drivers and provides an uncluttered desktop (see Figure 59).
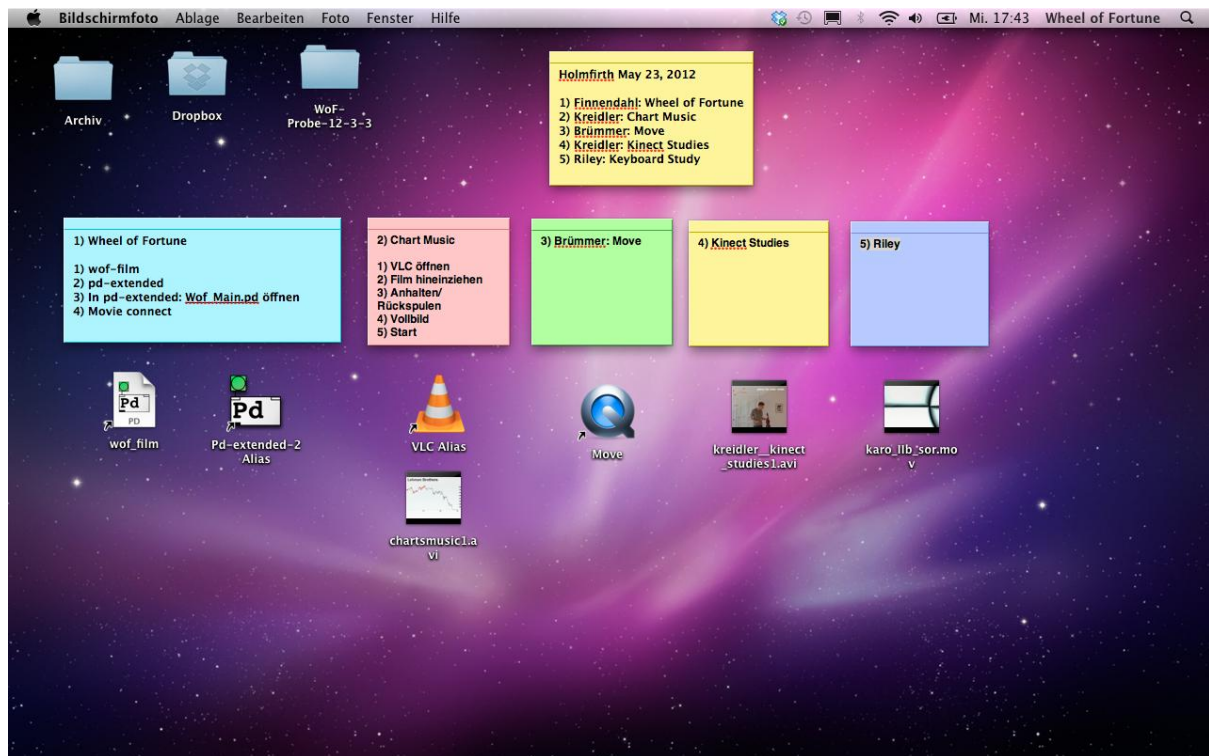
Figure 59: Desktop for concert on May 23, 2012

Since the requirements for making working connections between computer hard- and software are high, the electronic audio set-up cannot be called modular in the true sense. Together with the unreliability of the internet to produce information quickly this necessitates that the complete set of information must be stored prior to the tour in places easily accessible. This can be USB drives, portable hard drives and internet storage with ftp-access or *in the cloud*. In order to achieve redundancy several options should be chosen and the following information must be collected:

1. Scores

2. Hardware

   a. Manual for the hardware

   b. Drivers

   c. Firmware

   d. Firmware flashing program

   e. Programs

   f. Manual for the program

   g. Licence for the program

3. Patches

   a. Software

   b. Manuals for the software

   c. Serial numbers for the software

   d. Patches for the software

4. Samples and other information needed by software

It is also a good idea to bring an installation CD for the operating system in case the computer's hard drive needs to be thoroughly cleaned.

Since this information will be used in many concerts, it has to be set-up once and will only need updating when a new software or new hardware is used. The folder depicted in Figure 60 shows an instrument folder on the file hosting server Dropbox, including manuals, licences and installation files for the software Max/MSP 5, MidiPipe, Pianoteq, and Native Instruments B4 II as well as the manuals, drivers, and additional software for the MIDI controllers Behringer UMA-25S and Korg NanoKontrol.

The files for the individual compositions are stored in their respective folders and need only up- and downloading when they are being played.

Figure 60: Drobox folder 'Instruments'

6.6.3 Concert set-up preparation

In order to guarantee a seamless set-up and to keep the mind free for the concert, the set-up must be prepared in such a way that it is only a question of connecting devices in a given order and starting programs in a given order. This is no different from preparing non-electroacoustic concerts with many additional items, like the above-mentioned stopwatch, CD-players, plectrums, and any other item composers come up with. With detailed set-up instructions, a complete program can be set-up in a very short time.

A set-up for Christoph Ogiermann's *lebend durchführung 19*[590]could look like this:

1. score on piano
2. metal bar on piano
3. UMA 25-S on right side of table
4. laptop and soundcard (right) next to UMA
5. megaphone next to soundcard
6. schedule above UMA
7. stopwatch next to schedule
8. power strip under table
9. connect computer -> plug
10. start computer: Alt+ Boygroup
11. connect soundcard -> laptop
12. connect UMA -> laptop
13. start Paax Sampler
14. check Audio/MIDI
15. load Patches: Desktop -> Ogiermann -> Samples
16. test samples

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[590] Ogiermann, *lebend durchführung 19*.

Great care is taken to make this list as foolproof as possible to avoid wasting any energy on the concert day. The above set-up consisting of a piano, a sampler and other devices like stopwatch, megaphone and metal rod is ready to go in five to ten minutes.

6.6.4 Concert preparation

In my experience, the act of setting up for a composition and the playing of a composition require two different mind-sets. Therefore, lists have to be written to guarantee that everything that needs to be in the piano is in the piano, and that the right files that need to be loaded are loaded into the computer. A momentary lapse, for example forgetting to switch on a device, can indeed disrupt not only the flow of the concert but might create feelings of shame or a sense of inattentiveness, when exactly the opposite was the case: the player was concentrating on the piece to be played. However, this concentration is then lost.

In order to be able to concentrate while setting up for the next piece, lists can be used which can look like the following list from a concert on March 14, 2011 (cp. chapter 4.5), which start with the last preparations right before the concert and end with the instruction to go to the next position:

- Scelsi:
    - Schüttler completely on
    - Preset 6
    - Mic Input 60
    - Light out
    - Pedal
- Schüttler:
    - Mic Input 30
    - Fireface Preset 5
    - Preparations:
        - Plastic: e-eb1
        - Alu: a1-e2
        - Plasticine: G, g3
        - Bolts: G1 -> g; F1 -> g1; A2 -> g
        - Markers: E2 -> b1; C#2 -> b
        - paper clip: f#3
    - Schüttler completely on
    - UMA 25 Preset 2
    - 2 octaves lower
    - keyboard in grand piano
    - test faders: same level as 1
    - pedal

- Schüttler dismount
    - Bolts out
    - Plasticine out
    - Plastic and aluminium out

- o   Paper clips out
- o   Keyboard out
- o   change scores
- o   Fireface Preset 7

- Kreidler:
  - o   cloth
  - o   iron in piano
  - o   turn off loudspeaker
  - o   everything in piano
  - o   plug headphones
  - o   listen if correct, otherwise wind
  - o   Correct? Rewind. Correct channels?
  - o   Turn on loudspeakers

- Dismount Kreidler:
  - o   Turn off loudspeakers

- Go to keyboard in centre position

6.7 Set-up

The set-up of a concert including electroacoustics can take considerably more time than that of an acoustic concert. The set-up routine can roughly be divided into the following steps:

1. delivery

2. setting up

3. line check

4. sound check

5. rehearsal (technical and musical)

As opposed to most acoustic concerts, which often follow a concert ritual defined by tradition, the rehearsal of an electroacoustic concert is also a technical rehearsal. This means that the turning on and off of devices and the loading of computer patches is rehearsed, rendering it into a much longer rehearsal than a mere musical one.

Insufficient preparation and breaking of devices often leads to a prolongation of phases 2 – 4. This is confirmed by Sarah Nicolls, who says that 'if it's a gig day then you can be sound-checking and tech checking until one minute before changing and practically running on!'[591] Therefore, a careful planning of a timetable for the set-up as well as methods on how to deal with problems is necessary.

Since every concert will require a different set-up, no recommendations can be given here. Depending on the size of the hall and the number of loudspeakers, the setting up (stage 2) is likely to be the longest, if no protracted search for errors takes place in the line check. If the instrumentalists are not part of the technical team, they can calculate their time of arrival by taking the time of the start of the line check and adding the amount of time they estimate for their own setting up.

In the sound check, the loudspeakers will be balanced with each other and the players. This can be a lengthy process and it is necessary to check for a balance between the needs of the players on stage and the sound technicians striving for the best sound. Another common misunderstanding is the expectation from the technicians that the performers will play just as they will in the evening – something performers will not do because they want to keep their energy for the performance. This can lead to drastic results, such as score follower not functioning properly: 'It is very frequently noticed that a pitch follower actually performs worse -- sometimes much worse -- in concert than in

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[591] Nicolls, "Brief Thoughts on Using Live Electronics - Preliminary Version of an Article for eContact! 13.2."

rehearsal. This is because the musician plays differently, more musically, in concert. The better the instrument is played, the worse the computer will track it.'[592]

Therefore, 'careful management of time improves both rehearsal and performance.'[593] This can be achieved by setting up strict timetables and being adamant that they are adhered, too. This is certainly not an easy task, or in the words of Richard Teitelbaum: 'Before the concert, it is a war.'[594] In order to reduce the risk of such a war of interests, it is a good method to allow a certain buffer time in the set-up of each piece. If a problem occurs that cannot be solved in the allotted time, the setting up should be shifted to the end of the rehearsal. This way there is more time to think about the problem and the set-up will go on as planned. This method also guarantees that the whole set-up will not become delayed; which is likely to result in the performer's rehearsal and resting time becoming void.

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[592] Puckette and Settel, "Nonobvious Roles for Electronics in Performance Enhancement."

[593] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 299.

[594] Richard Teitelbaum, "Interview with Richard Teitelbaum" interview by Sebastian Berweck, Digital Recording, February 2, 2010.

6.8 Archiving

Performers have to deal with the accelerated aging of new media just as composers and publishers do. Since congruent solutions are yet to be found, it is futile to search for methods that will ensure long-time storage of the compositions. However, this should not lead to renouncement, but looking for easy ways to ensure medium term retention.

Since the archiving of digital data and learning about archiving methods is a form of computer literacy, it cannot be discussed here in its entirety and the reader is referred to popular computer magazines and books like 'Data storage for beginners'[595] and websites like the 'JISC Beginner's Guide to Digital Preservation'.[596] However, a method to store sounds from near obsolete machines or programs using an automated sampling program will be presented, since it is a method especially for music technology.

In the cases of Richard Festinger (cp. chapter 3.3), where a Yamaha TG-77 synthesizer is used, and Enno Poppe (cp. chapter 3.5), which uses the now obsolete Native Instruments B4 II organ, the sounds are rather simple with no intricate modulations or complex volume envelopes. In these cases, it is an option to sample the sounds from the machines and loading the sounds into a sample player – a method already mentioned in Bullock and Coccioli.[597] The sampling can be automated by specialised software like AutoSampler,[598,599] which will send out MIDI data to the device and record the audio via an audio interface in the case of a hardware instrument or digitally in the case of software. The software stores the audio in several formats and an open format like .wav-files in high quality should be chosen to guarantee longevity of the format. These samples can be automatically mapped and loaded into a number of current sampling programs as well as digital audio workstations.

However, it must be understood that despite all this automation, the process is lengthy. For example, the Yamaha TG-77 did not understand the program change messages from the sampling program and therefore the change between the 11 sounds that needed to be stored had to be done by hand. To sample all 88 notes of a keyboard properly with all 127 velocity layers and a volume envelope with a sustain phase of 8 seconds and a medium release phase of 2 seconds requires the sampling of 88*127*(8+2) = 111760 seconds of sound, which is a little over 31 hours. For the piece by Richard

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[595] "Datensicherung für Anfänger," *Datensicherung für Anfänger*, n.d., accessed 26 May 2012, http://de.wikibooks.org/wiki/Datensicherung_f%C3%BCr_Anf%C3%A4nger.

[596] "JISC Beginner's Guide to Digital Preservation," n.d., accessed 26 May 2012, http://blogs.ukoln.ac.uk/jisc-beg-dig-pres/.

[597] Bullock and Coccioli, "Modernising Musical Works Involving Yamaha DX-Based Synthesis."

[598] *AutoSampler*.

[599] The author has in 2010 also tested another software called *ReSampler* (Nexoe, 2011). This software cannot be recommended.

Festinger, theoretically 11 sounds would have to be sampled like this, which would mean a fortnight of sampling and thereby producing a very large amount of data. Depending on the abilities of the sample player, up to two controllers can be sampled as well – which would multiply the required time again by 16129!

It is obvious that a strategy with a reduced number of samples must be employed, for example by sampling only one note per octave and only eight velocity layers. This means that the samples will have to be transposed, which is likely to generate artefacts and will require more work to smooth out.

It is probably worth mentioning, that a sample instrument like the Vienna Imperial by Vienna Instruments[600] is able to provide a truthful rendition of a grand piano using 60 GB of samples and a powerful sample playing algorithm.[601] However, it cannot be expected, that a self-sampled instrument will be as powerful as this specialized program, which also requires an up-to-date computer. However, with simple wave files the mentioned method might trigger useful results in the short term and can provide long-term storage of otherwise obsolete sounds.

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[600] *Vienna Imperial* (Vienna Instruments, 2011).
[601] Sebastian Berweck, "VSL Vienna Imperial," *Bonedo.de - Das Musikerportal*, n.d., accessed 31 May 2012, http://www.bonedo.de/artikel/einzelansicht/vsl-vienna-imperial.html.

7 Afterword

The study originated from the author's experience, namely that there are challenges in the production of electroacoustic music that are specific to this music. It tried to find out where these problems come from and sought to propose practices in the music production process that diminish these problems. After having analysed the situation practical guidelines for performers of such music have been presented.

In chapter 1, the motivation and the research questions have been presented. Chapter 2 outlined the methodology, which consists of case studies and of Why-Because Analyses on selected case studies. In chapter 3, case studies on single compositions spanning a wide range of topics have been discussed: chapters 3.1 and 3.2 (Scelsi: *Aitsi*, Nono: *...sofferte onde serene...*) dealt mainly with the possibilities of a truthful rendition of the pieces without having the necessary information and proper material at hand. Chapters 3.3 and 3.4 (Festinger: *Head over Heels,* Finnendahl: *Wheel of Fortune*) discussed the problem of obsolete computer hard- and software, which makes a re-performance of pieces with electroacoustics often very difficult. Chapters 3.5 – 3.7 were all partially employed discussing cooperations in the production of electroacoustic music: in chapter 3.5 (Enno Poppe: *Arbeit*), the unclear relationship between original programmer and performer has been described and the discussion revolving around the compositions by Scott McLaughlin in chapter 3.6 (McLaughlin: *Bifurcations in a continuous system* and *Dissolution*) introduced a differentiation between cooperation and collaboration. Ambiguities about the tasks performer and composer have to fulfil when it comes to the realization of the electronics were discussed in chapter 3.7 (Dodo Schielein: *N381*). In all three chapters, the unfinished descriptions of the technical set-ups played a decisive role. The composition by Hans Tutschku discussed in chapter 3.8 (Hans Tutschku: *Zellen-Linien*), on the other hand, features a very good technical description and a set-up that is easy to realize. Nonetheless, the performing of the electronic part, which resides in the computer like in a black box, poses some problems that require an additional person checking on the performance of the instrumentalist. Although every composition will have its individual challenges it is believed that the case studies give a wide overview of the severity and the variability of problematic issues performers face when (re-)performing electroacoustic music.

Chapters 4.1 – 4.4 described the development of a method that guarantees a functioning and stress-free working environment for performers without having to hire an extra music technologist. The method is then put to a successful test in chapter 4.5. The limits of this method are described in chapter 4.6, which establishes at what point helping hands must reasonably be called in to ensure a successful concert. The result of the chapters is an heightened workload on the performer when

preparing for concerts with electroacoustic music – a workload that in an ideal world would be shouldered by an assistant but will, for practical and financial reasons, in most cases have to be organized by the instrumentalist.

The interviews and the observations made while working on the case studies as well as the experiences made in other concerts have led to a summary in chapter 5, where – from the viewpoint of a performer – the origins of the many challenges were being presented. These difficulties find their roots partially in grander problems of our society than can be discussed in this study, most importantly the rapid ageing of our digital heritage. Nonetheless, since many of the difficulties seem to stem from the fact that the persons who produce this kind of music often rely on techniques successfully employed when producing acoustic music – techniques, which prove to be insufficient when producing electroacoustic music – erroneous work processes could be identified. Since the study is directed at the people working in the process, the results have been grouped according to the trades the performers deal with most, which are apart from themselves the publishers, the composers, music technologists and promoters.

It lies in the nature of a study that deals with things not working that in order to get things to work erroneous practices must be pinpointed. However, in all chapters it has been tried to propose alternative ways on how for example the archiving of works as well as the performance of electroacoustic music could be facilitated. This has been demonstrated for example by trying to provide all the information that is needed to describe the instrumentation and the electronic part of an electroacoustic composition (cp. chapter 5.2.3), and by describing what a good rehearsal patch must look like (cp. chapter 5.2.2.5). It is believed that many good-practices are being proposed in chapter 5 that could easily be followed and that would better the situation immediately.

Chapter 6 finally provides a wealth of practical information for performers including a listing of all the information that is needed to write a good technical rider (cp. 6.6.1) and how a rehearsal space for electroacoustic music could look like (cp. chapter 6.4).

The findings in this study certainly do not apply to any performer and any music under all circumstances. As has been described in the introductory chapter, the study does not deal with the performer being part of a bigger set-up and fulfilling the traditional function of an instrumentalist with trained personnel taking care of the electronic part. It is also restricted in that it deals mainly with notated music produced in the conventional way with a separation of composer and instrumentalist. It is finally restricted in the assumption that for a soloist or a very small group of performers it is mostly not possible to hire external personnel.

With the availability of powerful mobile computers, playing with electronics has become an integral part of the performance of classical contemporary music. Producing and performing electroacoustic music has become much cheaper and can now be played without a team of experts. It was therefore deemed important to explicate why – from the viewpoint of a performer of such music – it is still so difficult to bring this music to the stage. It is hoped that some of the proposed ideas will ease the process of preparing and performing electroacoustic music and that 'these steps allow the most vital equipment in a performance – that is, performers – to function properly'.[602] It is also hoped that many more performers will specialize in this kind of music in the future.

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[602] McNutt, "Performing Electroacoustic Music: a Wider View of Interactivity," 299.

Resources

Bibliography

Adams, John. "Die Maschine im Garten." Translated by Jens Hagestedt. *Lettre International*, December 2009.

AG Rechnernetze und Verteilte Systeme. "Why-Because Analysis." Bielefeld University, n.d. Accessed 20 June 2012. http://rvs.uni-bielefeld.de/research/WBA/wba_on_one_page.pdf.

———. "Why-Because Analysis (WBA)." Bielefeld University, n.d. Accessed 20 June 2012. http://rvs.uni-bielefeld.de/research/WBA/WBA-shortHistory.pdf.

Anwander, Florian. *Synthesizer. So funktioniert elektronische Klangerzeugung*. 6. ed. Bergkirchen: PPVMedien, 2011.

Applebaum, Mark. "Progress Report: The State of the Art After Sixteen Years of Designing and Playing Electroacoustic Sound-Sculptures." *eContact!* 12, no. 3 (June 2010).

Appleton, Jon. "Reflections of a Former Performer of Electroacoustic Music." *Contemporary Music Review* 18, no. 3 (1999): 15–19.

Ariely, Dan. *Predictably Irrational: The Hidden Forces That Shape Our Decisions*. 1st ed. HarperCollins, 2008.

de Assis, Paulo. *Luigi Nonos Wende. Zwischen Como una ola fuerza y luz und .....sofferte onde serene...* Hofheim: Wolke, 2006.

Auhagen, Wolfgang, Claudia Bullerjahn, and Holger Höge. *Die Musikerpersönlichkeit*. Jahrbuch der deutschen Gesellschaft für Musikpsychologie 15. Göttingen: Hogrefe-Verlag, 2000.

Austin, Larry. "Sound Diffusion in Composition and Performance: An Interview with Denis Smalley." *Computer Music Journal* 24, no. 2 (2000): 10–21.

Beil, Michael. "AV — Music and Video." *eContact!* 13, no. 2 (April 2011).

Belet, Brian. "Live Performance Interaction for Humans and Machines in the Early Twenty-First Century: One Composer's Aesthetics for Composition and Performance Practice." *Organised Sound* 8, no. 03 (2003): 305–312.

Berweck, Sebastian. "The Game Changer - Playing with Electronics as a Soloist." *eContact!* 13, no. 2 (April 2011).

———. "VSL Vienna Imperial." *Bonedo.de - Das Musikerportal*, n.d. Accessed 31 May 2012. http://www.bonedo.de/artikel/einzelansicht/vsl-vienna-imperial.html.

———. "Was macht der Computer im Konzertsaal." In *Kulturmanagement konkret 2008: Interdisziplinäre Positionen und Perspektiven*, edited by Gesa Birnkraut and Karin Wolf, 147–161. Hamburg: Institut für Kulturkonzepte, 2008.

Bigwood, Robin. "MOTU Traveler." *Sound on Sound*, June 2005. Accessed 18 June 2012. http://www.soundonsound.com/sos/jun05/articles/motutraveler.htm.

Bonardi, Alain, and Jerome Barthélemy. "The Preservation, Emulation, Migration, and Virtualization of Live Electronics for Performing Arts: An Overview of Musical and Technical Issues." *Journal on Computing and Cultural Heritage* 1, no. 1 (2008).

Brümmer, Ludger. "Extending the Piano." *eContact!* 13, no. 2 (June 2011).

Bullock, Jamie, and Lamberto Coccioli. "Modernising Musical Works Involving Yamaha DX-Based Synthesis: A Case Study." *Organised Sound* 11, no. 03 (2006): 221–227.

Burns, Christopher. "Realizing Lucier and Stockhausen: Case Studies in the Performance Practice of Electroacoustic Music." *Journal of New Music Research* 31, no. 1 (2002): 59–68.

Casal, David. "Gravikords and Pyrophones." *eContact!* 13, no. 2 (April 2011).

Casserley, Lawrence. "'Plus ça Change:' Journeys, Instruments and Networks, 1966-2000." *Leonardo Music Journal* 11 (January 1, 2001): 43–49.

Chlapik, Herbert. *Die Praxis des Notengraphikers: Wie entstehen unsere Noten?* Doblinger, 1987.

Cube-Tech International. "Virtual Crown Jewels." Cube-Tech International, n.d. Accessed 11 May 2012. http://www.cube-tec.com/downloads/maas_VirtualCrownJewels2010_07.pdf.

Dillenbourg et al. "The Evolution of Research on Collaborative Learning." In *Learning in Humans and Machines: Towards an Interdisciplinary Learning Science*, edited by Peter Reimann and Hans Spada, 189–211. Oxford: Pergamon, 1995.

Dinescu, Violeta, ed. *Begegnungen - mit Musik unserer Zeit*. Saarbrücken: Pfau, 2011.

Ding, Shai-uen. "Developing a Rhythmic Performance Practice in Music for Piano and Tape." *Organised Sound* 11, no. 3 (2006): 255–272.

Drott, Eric. "Class, Ideology, and Il Caso Scelsi." *The Musical Quarterly* 89, no. 1 (2006): 80–120.

Dursley, Danny. "Interactivity." *eContact!* 10, no. 4 (October 2008). Accessed 9 May 2012. http://cec.sonus.ca/econtact/10_4/dursely_interactivity.html.

Emmerson, Simon. "In What Form Can 'Live Electronic Music' Live On?" *Organised Sound* 11, no. 03 (2006): 209–219.

———. *Living Electronic Music*. New ed. Aldershot: Ashgate Pub Co, 2007.

Emmerson, Simon, and Denis Smalley. "Electro-acoustic Music." *Grove Music Online*. Oxford Music Online, n.d. Accessed 30 April 2012. http://www.oxfordmusiconline.com/subscriber/article/grove/music/08695.

d'Escrivan, Julio, and Nick Collins, eds. *The Cambridge Companion to Electronic Music*. 1st ed. Cambridge: Cambridge University Press, 2008.

Filippini, Riccardo. "Scelsis Stück mit den Gläsern." Translated by Friedrich Jaecker. *MusikTexte* 105 (2005): 19–20.

Finnendahl, Orm. "Wheel of Fortune - Description of the Project" Pdf, 1997.

Freud, Sigmund. *Zur Psychopathologie des Alltagslebens Über Vergessen, Versprechen, Vergreifen, Aberglaube und Irrtum*. Kindle. Seattle: Amazon, 2011.

Gagné, Peter. *Overview: General Study 04: Survey of Recordkeeping Practices of Composers*. Université Laval: InterPARES 2 Project, 2006.

Garnett, Guy E. "The Aesthetics of Interactive Computer Music." *Computer Music Journal* 25, no. 1 (2001): 21–33.

Gieseking, Walter, and Karl Leimer. *Piano Technique*. Mineola: Dover, 1972.

Gorges, Peter. *Synthesizer Programming.Die Kunst des Sound-Designs für jeden erlernbar*. Wizoo Publishing, 2008.

Green, Owen. "Pondering Value in the Performance Ecosystem." *eContact!* 10, no. 4 (October 2008). Accessed 9 May 2012. http://cec.sonus.ca/econtact/10_4/green_ecosystem.html#technology.

Gronemeyer, Gisela, and Reinhard Oehlschlägel, eds. *Alvin Lucier - Reflexionen/Reflections*. MusikTexte 003. Köln: Edition MusikTexte, 2005.

Haecker, Julia. "The Digital Mind." *eContact!* 13, no. 2 (April 2011). Accessed 9 May 2012. http://cec.sonus.ca/econtact/13_2/haecker_digitalmind.html.

Harris, Yolande. "Inside-out Instrument." *Contemporary Music Review* 25, no. 1–2 (2006): 151–162.

Harvey, Jonathan. "The Metaphysics of Live Electronics." *Contemporary Music Review* 18, no. 3 (1999): 79–82.

Helbing, Volker. "Zyklizität und Drama(turgie) in Scelsis viertem Streichquartett." *Zeitschrift der Gesellschaft für Musiktheorie* 7, no. 3 (2010). Accessed 23 December 2011. http://www.gmth.de/zeitschrift/artikel/575.aspx.

Henck, Herbert. *Experimentelle Pianistik*. Mainz: Schott, 1994.

Heo, Keumok. "Quattro pezzi per orchestra (1959) von Giacinto Scelsi." Diplom, Robert Schumann Hochschule Düsseldorf, n.d.

Hoenig, Uwe G. *Workshop Synthesizer. Klangsynthese und Programmierung für Musiker.* Bergkirchen: PPVMedien, 2001.

Hughes, Edwin. "Musical Memory in Piano Playing and Piano Study." *The Musical Quarterly* 1, no. 4 (1915): 592–603.

Iber, Michael. "WDR3open 'Studio Elektronische Musik': Virtual Machines," November 19, 2008.

Intellectual Property Office. "Patent Factsheets: Description." Intellectual Property Office, 2007. Accessed 14 May 2012. http://www.ipo.gov.uk/factdescription.pdf.

Jack, Susan, and Pamela Baxter. "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers." *The Qualitative Report* 13, no. 4 (December 4, 2008): 544–559.

Jaecker, Friedrich. "Der Dilettant und die Profis." *MusikTexte* 104 (February 2005): 27–40.

———. "Explodierende Asteroiden." *MusikTexte* 100 (2004): 65–72.

Jette, Christopher. "In Vitro Oink." *eContact!* 13, no. 2 (April 2011).

Kanach, Sharon. *Les anges sont ailleurs...* Arles cedex: Actes Sud, 2006.

Kimura, Mari. "Creative Process and Performance Practice of Interactive Computer Music: A Performer's Tale." *Organised Sound* 8, no. 03 (2003): 289–296.

Klein, Julieanne. "Voice and Live Electronics." *eContact!* 10, no. 4 (October 2008).

Kurzweil Music Systems. "Musician's Guide - Kurzweil K1000 Keyboard." Kurzweil Music Systems, 1988.

Ladkin, Peter B. *The X-31 and A320 Warsaw Crashes: Whodunnit?* Research Report. Bielefeld: Bielefeld University - Faculty of Technology, 1996.

Lanza, Alcides. "Plectros III [1971-I], for Piano and Synthesized Sounds." *eContact!* 13, no. 2 (April 2011).

Lemke, Oliver. "Die Anwendung der Why-Because-Analyse zur Aufnahme, Untersuchung und Darstellung komplexer Unfallabläufe." Diplom, Technische Universität Carolo-Wilhelmina zu Braunschweig, 2002.

Lindborg, PerMagnus. "Reflections on Aspects of Music Interactivity in Performance Situations." *eContact!* 10, no. 4 (October 2008).

Litke, Hans-Dieter, and Ilonka Kunow. *Projektmanagement: Einfach! Praktisch!* 5th ed. Planegg: Haufe, 2006.

Longton, Michael. *Survey of Recordkeeping Practices ofComposers*. InterPARES 2 Project, rev 2004.

Lopez-Lezcano, Fernando. "A Very Fractal Cat." *eContact!* 13, no. 2 (April 2011).

Manook, Hendrik. "Aspekte der Reproduzierbarkeit von Zeitgenössischer Musik mit Live-Elektronik und ihrer Interpretationspraxis." Diplom, Hochschule für Musik Detmold, 2006.

Marchini Camia, Chiara. *Digital Art Works - The Challenges of Conservation*. Karlsruhe: ZKM, 2012.

Matthay, Tobias. *Musical Interpretation: Its Laws and Principles, and Their Application in Teaching and Performing*. Boston Music, 1913.

———. *On Memorizing and Playing from Memory and on the Laws of Practice Generally*. Oxford University Press, 1926.

McNutt, Elizabeth. "Performing Electroacoustic Music: a Wider View of Interactivity." *Organised Sound* 8, no. 3 (2003): 297–304.

Menke, Johannes. *PAX. Anaylse bei Giacinto Scelsi: Tre canti sacri und Konx-Om-Pax*. Hofheim: Wolke, 2004.

Moore, Adrian, and David Moore. "Sonic Art: Recipes and Reasonings." Sheffield, 2011.

Motz, Wolfgang. *Konstruktion und Ausdruck: Analytische Betrachtungen zu "Il canto sospeso" (1955/56) von Luigi Nono*. Saarbrücken: Pfau, 1996.

Nakamura, Rei. "My Cyber Chamber Music Partner." *eContact!* 13, no. 2 (April 2011).

Nance, Rick. "Plastic Music, Aural Models and Graphic Representation." *eContact!* 12, no. 3 (June 2010).

Nicolls, Sarah. "Brief Thoughts on Using Live Electronics." *eContact!* 13, no. 2 (April 2011).

———. "Interacting with the Piano." PhD, Brunel University, 2010.

Noyle, Linda J. *Pianists on Playing: Interviews with Twelve Concert Pianists*. Lanham: Scarecrow, 1987.

Paradiso, Joseph A., and Sile O'Modhrain. "Current Trends in Electronic Music Interfaces. Guest Editors' Introduction." *Journal of New Music Research* 32, no. 4 (2003): 345–349.

Pasoulas, Per. "An Overview of Score and Performance in Electroacoustic Music." *eContact!* 10, no. 4 (October 2008).

Patton, Karen. "Future Traces." *eContact!* 11, no. 4 (December 2009).

Paul-Stüve, Thilo. "Performing a Why-Because-Analysis." Bielefeld University, 2005.

Pestova, Xenia. "Models of Interaction in Works for Piano and Live Electronics." Doctor of Music, McGill University, 2008.

Polfreman, Richard, David Sheppard, and Ian Dearden. "Time to Re-wire? Problems and Strategies for the Maintenance of Live Electronics." *Organised Sound* 11, no. 3 (2006): 229–242.

Project Management Institute. *Project Management Body of Knowledge (PMBOK Guide)*. 4th ed. Newtown Square: Project Management Institute, 2008.

Puckette, Miller. "Who Owns Our Software?" *eContact!* 11, no. 3 (2009).

Ratcliff, Robert, Jon Weinel, and Zubin Kanga. "Mutations (megamix)." *eContact!* 13, no. 2 (April 2011).

Raza, Arif, and Fernando Capretz. "Do Open Source Software Developers Listen to Their Users?" *First Monday* 17, no. 3 (2012).

Rebelo, Pedro. "Haptic Sensation and Instrumental Transgression." *Contemporary Music Review* 25, no. 1–2 (2006): 27–35.

Risen, Clay. "Inside the Pac-Man Archives." *The Atlantic*, March 2010.

Robusté, Joan Riera. "Piano, Sensors and Live Electronics." *eContact!* 13, no. 2 (April 2011).

Roche, Heather. "Dialogue and Collaboration in the Creation of New Works for Clarinet." PhD, University of Huddersfield, 2011.

Ross, Seamus, and Annette Gow. *Digital Archaeology: Rescuing Neglected and Damaged Data Resource*. Glasgow: Humanities Advanced Technology and Information Institute (HATII), University of Glasgow, February 1999.

Ruschkowski, André. *Elektronische Klänge und musikalische Entdeckungen*. Stuttgart: Reclam, 2010.

Schenker, Heinrich. *The Art of Performance*. Oxford University Press, 2000.

Sciannameo, Franco. "The Birth of a Masterpiece." *Creare* no. 5 (2011).

Scott, Richard. "Getting WiGi with It." *eContact!* 12, no. 3 (June 2010).

Serexhe, Bernhard, and Chiara Marchini Camia, eds. *The Digital Oblivion*. Karlsruhe: ZKM, 2010.

Stake, Robert E. *The Art of Case Study Research*. Thousand Oaks: Sage, 1995.

Stockhausen, Karlheinz, and Jerome Kohl. "Electroacoustic Performance Practice." *Perspectives of New Music* 34, no. 1 (January 1, 1996): 74–105.

Tanaka, A. "Musical Performance Practice on Sensor-based Instruments." In *Trends in Gestural Control of Music*, edited by Marcelo Wanderley and Marc Battier. Paris: Ircam, 2000.

Teruggi, Daniel. "Is There a Right Way to Deal with Rights?" *Organised Sound* 11, no. 3 (2006): 205–207.

TG Events. "Technical Questionnaire 2009." TG Events, 2009.

Tosatti, Vieri. "Giacinto Scelsi c'est moi." *Il Giornale della Musica* no. 35 (1989).

Tutschku, Hans. "Max/MSP Vs. the iPhone." *eContact!* 13, no. 2 (April 2011).

University of Reading - IT Services. "Starting a Thesis." University of Reading - IT Services, 2010. Accessed 13 May 2010. http://www.reading.ac.uk/web/files/its/Thesis1_07.pdf.

Vaes, Luk. "Extended Piano Techniques." PhD, Leiden, 2009.

Vaughan, Mike. "The Human-machine Interface in Electroacoustic Music Composition." *Contemporary Music Review* 10, no. 2 (1994): 111–127.

Vickers, Catherine. "An Innovative Opportunity." *eContact!* 13, no. 2 (April 2011). Accessed 9 May 2012. http://cec.sonus.ca/econtact/13_2/vickers_innovative.html.

Vidolin, Alvise. "I documenti sonori della musica elettronica." *Musica/Tecnologia* no. II (2008): 49–65.

———. "Synthetische Resonanzen." Translated by Harald Muenz. *MusikTexte* no. 81/82 (1999): 100–102.

Welmer, Anne, and Peter Adriaansz. *Everything Is Real: Alvin Lucier in Den Haag*. Amarillo: TAG Publishing, 2010.

Wetzel, David. "A Model for the Conservation of Interactive Electroacoustic Repertoire: Analysis, Reconstruction, and Performance in the Face of Technological Obsolescence." *Organised Sound* 11, no. 3 (2006): 273–284.

Whittall, Arnold. "Electroacoustic Music." Edited by Alison Latham. *Oxford Companion to Music*, June 2, 2012.

Yamaha Corporation of America. "Yamaha SY99 Music Synthesizer- Operating Manual." Yamaha Corporation of America, n.d.

Yin, Robert K. *Case Study Research: Design and Methods*. 3rd ed. Thousand Oaks: Sage, 2003.

Yong, Kerry. "Electroacoustic Adaptation as a Mode of Survival: Arranging Giacinto Scelsi's Aitsi Pour Piano Amplifée." *Organised Sound* 11 (2006): 243–254.

———. "Performance Practices in Music for Piano with Electroacoustics." PhD, Royal College of Music, 2007.

Zich, Christian. "IT-Kompaktkurs 'Organisation'." Fachhochschule Deggendorf, 2000.

Concerts

April 4, 2000, E-Werk Freiburg (GER)
      Philip Glass: *Two Pages* (1968), version for keyboard
      Alvin Lucier: *Music for piano with two slow sweep pure wave oscillators* (1992)
          for piano and tape
      Steve Reich: *Pendulum Music* (1968/1973) for suspended microphones and loudspeakers
      Terry Riley: *Keyboard Study #1* (1966)
      Terry Riley: *Keyboard Study #2* (1966)
June 8, 2002, Zentrum für Kunst und Medientechnologie, Karlsruhe (GER)
      Martin Schüttler: *venus_5* (2002) for piano and live-electronics
July 15, 2002, Orangerie, Darmstadt (GER)
      Tristan Murail: *Winter Fragments*
      Tristan Murial: *L'Esprit des dunes*
July 27, 2007, Dock 4, Kassel (GER)
      Terry Riley: *Keyboard Study #1* (1966) with a movie by Jan-Peter E. R. Sonntag
      Michael Maierhof: *splitting 28.1* (2007) for grand piano
      Thomas Wenk: *Taurus CT-600* (2002/03) for two cassette recorders
November 4, 2007, Harvard University, Cambridge (USA)
      Luigi Nono: *...sofferte onde serene...* (1976) for piano and tape
      Johannes Kreidler: *Klavierstück 5* (2006) for piano and tape
      Per Bloland: *Elsewhere is a Negative Mirror* (2005) for piano and electronics
      Brian Kane: *Another cascando* (2007) for piano and tape
      Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics
November 23, 2007, *Hamburger Klangwerktage*, Kampnagel, Hamburg (GER)
      Wolfgang Rihm: *Wölfli-Liederbuch* (1980/81) for bass bariton and piano
      Michael Maierhof: *daily songs 1* (2006/07) for countertenor and grand piano
      Alan Hilario: *Karaoke exotique* (2007) for voice, piano and electronics
      Carola Bauckholt: *Vollmond, unter null* (2004) for voice and piano
      Martin Schüttler: *taped & low bit* (2002) for countertenor and synthesizer
      Jennifer Walshe: *moving in / love song / city front garden with old men* (2006/07)
          for tenor and piano
July 18, 2008, Sant Joan de Vilatorrada (E)
      Joan Riera Robusté: *Deformacios n.2* (2008/09) for piano, sensors and real-time electronics
      Manel Ribera Torres: *Say thanks to Mr. Franz Joseph Beethozart* (2007)
      Terry Riley: *Keyboard Study #1* (1966)
January 22, 2009, Phipps Hall, Huddersfield (GB)
      Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics
      James Saunders: *#220109* (2003) for piano, CD, e-bow and Dictaphones
      Maximilian Marcoll: *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait.*
          Mit Hirsch. (2007) for piano and recordings
      Terry Riley: *Keyboard Study #1* (1966) with a movie by Jan-Peter E. R. Sonntag
February 19, 2009, Zentrum für Kunst und Medientechnologie, Karlsruhe (GER)
      Gier (2007-2009) for ensemble and live-electronics
February 20, 2009, Zentrum für Kunst und Medientechnologie, Karlsruhe (GER)
      Martin Schüttler: *schöner leben 2* (2006) for amplified and distorted piano and tape
      Martin Schüttler: *taped & low bit* (2002) for countertenor and synthesizer
      Martin Schüttler: *schöner leben 1* (2008) for countertenor
June 2, 2009, Hochschule für Künste Bremen (GER)
      Luigi Nono: *...sofferte onde serene...* (1976) for piano and tape
      Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano

June 26, 2009, UB Garage, Freiburg (GER)
>   Alexander Grebtschenko: < (2002/2003) for ten small loudspeakers
>   Alvin Lucier: *Gentle Fire* (1971) for synthesizer
>   Alvin Lucier: *Music for piano with two slow sweep pure wave oscillators* (1992)
>   for piano and tape
>   Alvin Lucier: *Clocker* (1978/88) for amplified clock, performer with galvanic skin response
>   sensor and digital delay system

August 15, 2009, Leibniztempel, Hannover (GER)
>   Luigi Nono: *...sofferte onde serene...* (1976) for piano and tape
>   Dodo Schielein: *N381* (2008) for piano
>   Michael Maierhof: *splitting 16* (2002) for grand piano

September 24, 2009, Faust, Hannover (GER)
>   Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics

December 2, 2009, Tesdorpf 13, Hamburg (GER)
>   Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano
>   Giacinto Scelsi: *Suite No. 9 'Ttai'* (1953) for piano
>   Giacinto Scelsi: *Quattro Illustrazioni* (1953) for piano

December 9, 2009, Hochschule für Musik und Theater Hannover (GER)
>   Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics
>   Terry Riley: *Keyboard Study #2* (1966)
>   Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano
>   Maximilian Marcoll: *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait.*
>   *Mit Hirsch.* (2007) for piano and recordings
>   Enno Poppe: *Arbeit* (2006/07) for virtual Hammond organ

April 15, 2010, Phipps Hall, Huddersfield (GB)
>   Scott McLaughlin: *Dissolution* (2006/2010) for piano and live-electronics
>   Scott Hewitt: *on_radio_midi* (2010) for electronics
>   Johann Sebastian Bach: *Praeludium and Fugue c# minor BWV 849* (1722) for pianoOliver
>   Korte: *zögern...schweigen* (1995/96) for piano

September 26, 2010, Staatsoper Hannover (GER)
>   Nicolaus A. Huber: *Faustschlag zu einem Statement Nonos* (1990) for piano
>   Luigi Nono: *...sofferte onde serene...* (1976) for piano and tape

November 24, 2011, *Huddersfield Contemporary Music Festival*, Huddersfield (GB)
>   Enno Poppe: *Arbeit* (2006/07) for virtual Hammond organ
>   Johannes Kreidler: *Klavierstück 5* (2006) for piano and tape
>   Michael Maierhof: *splitting 16* (2002) for grand piano
>   Benjamin Lang: *ABDucensparese* (2001) for grand piano
>   Thomas Wenk: *Taurus CT-600* (2002/03) for two cassette recorders

March 14, 2011, St. Pauls, Huddersfield (GB)
>   Györgyi Ligeti: *Etudes pour piano – premier livre –*
>   Johannes Kreidler: *Slot machine* (2009) for piano and mp3-player
>   Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano
>   Martin Schüttler: *schöner leben 2* (2006) for amplified and distorted piano and tape
>   Terry Riley: *Keyboard Study #1* (1966) with a movie by Jan-Peter E. R. Sonntag

March 17, 2011, Zentrum für Kunst und Medientechnologie, Karlsruhe (GER)
>   Terry Riley: *Keyboard Study #1* (1966)
>   Enno Poppe: *Arbeit* (2006/07) for virtual Hammond organ
>   Giacinto Scelsi: *Aitsi* (1974) for amplified and distorted piano
>   Johannes Kreidler: *Slot machine* (2009) for piano and mp3-player
>   Ludger Brümmer: *move* (2006) for piano, live-electronics and visuals

April 15, 2011, Congresshalle, Saarbrücken (GER)
>   Fabrice Bollon: *Konzert für E-Cello und Orchester* (2011)

October 27, 2011, St. Pauls, Huddersfield (GB)
      Pat Allison: *Anything you do is a lie and nothing that happens to you is true/IV* for solo piano (2011)
      Jack Coleman: *Keyboard Sonata* (2011)
      Ben Isaacs: *too expanding* (2011) for piano and CD
      Colin Tucker: *tips of the fingers direct the uncontrollable surface* (2011) for piano
      Chris Ruffoni: *Piano Grinds* (2011) for Piano and Recordings
      Richard Glover: *Logical Harmonies 1* (2011) for piano
      Ray Evanoff: *A Series of Postures* (2011) for piano
      Scott Mc Laughlin: *Bifurcations in a Continuous System* (2011)
          for MIDI keyboard and Max/MSP
      Joseph Kudirka: *Sebastian Berweck Plays the Keyboard* (2011) (from: Berweck Songs)
November 26, 2011, *piano+ festival*, Zentrum für Kunst und Medientechnologie (ZKM), Karlsruhe (GER)
      Terry Riley: *Keyboard Study #2* (1966), version for Klangdom
      Orm Finnendahl: *Wheel of Fortune* (1993-95/2011) for MIDI piano and live-electronics
      Enno Poppe: *Arbeit* (2006/07) for virtual Hammond organ
      Maximilian Marcoll: *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.* (2007) for piano and electronics
      Hans Tutschku: *Zellen-Linien* (2007) for piano and live-electronics
January 27, 2012, *Ultraschall*, Haus des Rundfunks, Berlin (GER)
      Ondrej Adamek: *Jardin perdu* (2011) for solo voices, orchestra and electronics
May 23, 2012, *Holmfirth Film Festival*, Holmfirth (GB)
      Orm Finnendahl: *Wheel of Fortune* (1993-95/2011) for MIDI piano and live-electronics
      Ludger Brümmer: *move* (2006) for piano, live-electronics and visuals
      Terry Riley: *Keyboard Study #1* (1966) with a movie by Jan-Peter E. R. Sonntag

Conference Papers and Presentations

Aiello, Rita. "Memorizing Two Piano Pieces: The Recommendations of Concert Pianists." In *Proceedings of the Sixth International Conference on Music Perception and Cognition*. Keele: Keele University Department of Psychology, 2000.

Akins, Joseph. "Facilities Used for Introductory Electronic Music: A Survey of Universities with an Undergraduate Degree in Audio." presented at the 121st AES Convention, San Francisco, 2006.

Bachor, Dan. "Reformating Reporting Methods for Case Studies." Sydney: Australian Association for Research in Education, 2000.

Bernardini, Nicola, and Alvise Vidolin. "Sustainable Live Electro-Acoustic Music." In *Proceedings of the Sound and Music Computing Conference '05*. Salerno: Sound and Music Computing Conference, 2005.

Berweck, Sebastian. "The Man/machine Interface in Music with Electronics." presented at the National Music Performance Symposium, Coventry, June 10, 2009.

———. "Zwischen allen Stühlen. Der Interpret im digitalen Zeitalter." presented at the Ambiant Creativity - Digital Creativity and Contemporary Music, Karlsruhe, March 17, 2011.

Bullock, Jamie. "Modernising Live Electronics Technology in the Works of Jonathan Harvey." In *Proceedings of the International Computer Music Conference 2005*. Barcelona: International Computer Music Association, 2005.

Castagne, N., C. Cadoz, J. Florens, and A. Luciani. "Haptics in Computer Music: a Paradigm Shift." In *Proceedings of EuroHaptics 2004*. Munich: EuroHaptics Society (EHS), 2004.

Chafe, Chris. "Tactile Audio Feedback." In *Proceedings of the International Computer Music Conference 1993*, 76–79. Tokyo: International Computer Music Association, 1993.

Gahn, Peter. "Execution, Intuition and Chance: Exploration and Interpretation of Musical Structures with Live Electronics." In *Proceedings of Korean Electro-Acoustic Music Society's 2011 Annual Conference*. Seoul: Korean Electro-Acoustic Music Society, 2011.

Guercio, Mariella, Jerome Barthélemy, and Alain Bonardi. "Authenticity Issue in Performing Arts Using Live Electronics." In *Proceedings of the Sound and Music Computing Conference 2007*. Lefkada: Sound and Music Computing Conference, 2007.

Hayes, Lauren. "Vibrotactile Feedback-Assisted Performance." In *Proceedings of the International Conference on New Interfaces for Musical Expression 2011*. Oslo, 2011.

Hewitt, Scott, and Sebastian Berweck. "on_radio_MIDI." presented at the RMA Study Day: Collaborations in Practice Led Research, Leeds, 2010.

McCartney, James. "SuperCollider: A New Real Time Synthesis Language." In *Proceedings of the International Computer Music Conference 1996*, 257–258. Hong Kong: International Computer Music Association, 1996.

McLaughlin, Scott, and Sebastian Berweck. "Dissolution." presented at the RMA Study Day: Collaborations in Practice Led Research, Leeds, n.d.

Michailidis, Tychonas, and Sebastian Berweck. "Tactile Fedback Tool: Approaching the Foot Pedal Problem in Live Electronic Music." In *Proceedings of the International Computer Music Conference 2011*. Huddersfield: International Computer Music Association, 2011.

O'Modhrain, Sile, and Chris Chafe. "Incorporating Haptic Feedback into Interfaces for Music Application." In *Proceedings of ISORA*. Maui: World Automation Conference, 2000.

Puckette, Miller. "New Public-Domain Realizations of Standard Pieces for Instruments and Live Electronics." In *Proceedings of the International Computer Music Conference 2001*. San Francisco: International Computer Music Association, 2001.

Puckette, Miller, and Zack Settel. "Nonobvious Roles for Electronics in Performance Enhancement." In *Proceedings of the International Computer Music Conference 1993*. Tokyo: International Computer Music Association, 1993.

Tremblay, Pierre Alexandre, Nicolas Boucher, and Sylvain Pohu. "Real-time Processing on the Road: a Guided Tour of [iks]'s Abstr/cncr Set-up." In *Proceedings of the International Computer Music Conference 2007*. Copenhagen: International Computer Music Association, 2007.

Tremblay, Pierre Alexandre, and Scott McLaughlin. "Thinking Inside the Box: A New Integrated Approach to Mixed Music Composition and Performance." In *Proceedings of the International Computer Music Conference 2009*. Montreal: International Computer Music Association, 2009. Accessed 18 June 2012.

Wetzel, David. "Building A Sustainable Repertoire: A Performer's Approach to Realizing Interactive Electroacoustic Works." Ames: Society for Electro-Acoustic Music in the United States, 2007.

Discography

ensemble 2e2m. *Chamber Music for Winds* CD. ADDA, ADDA 581189, 1988.

Bärtschi, Werner. *KlangKlavier* LP. RecRec Music, RecRec 04, 1984.

Fafchamps, Jean-Luc. *Tre Canti Popolari* CD. Sub Rosa 51, 1992.

GERM. *Keyboard Study 2 / Initiative 1 (+ Systèmes)G* LP. BYG Records, BYG 529.327, 1970.

Hinterhäuser, Markus. *...sofferte onde serene...* CD. col legno, WWE 1CD 31871, 1994.

Karlsson, Kenneth. *...sofferte onde serene...* CD. Alberdo, ALBCD015, 2000.

Kiebler, Sven Thomas. *Wheel of Fortune* DAT. Institut für Neue Musik Freiburg, DC91, 1995.

Lucier, Alvin. *Clocker* CD. Lovely Music, LCD1019, 1994.

Michener, Leon. *Imaginary Landscape* CD. future music recordings, FMRCD95, 2003.

Pollini, Mauricio. *...sofferte onde serene...* LP. Deutsche Grammophon, DG 2531004, 1979.

Riley, Terry. *Organ of Corti 2 - Reed Streams* LP. Mass Art. M-131, 1966.

Takahashi, Aki. *Scelsi: The Piano Works 3* CD. Mode, mode159, 2006.

Interviews

Black, Annesley. "Interview with Annesley Black" Interview by Sebastian Berweck. Digital Recording, Frankfurt, May 19, 2010.

Böckmann, Martin, and Dominik Pahnke. "Interview with Martin Böckmann and Dominik Pahnke" Interview by Sebastian Berweck. Digital Recording, Karlsruhe, December 3, 2010.

Bovard, Bob. "Interview with Bob Bovard" Interview by Sebastian Berweck. Digital Recording, Troy (NY), February 1, 2010.

Brady, Tim. "Interview with Tim Brady" Interview by Sebastian Berweck. Digital Recording, Montreal, January 28, 2010.

Brümmer, Ludger. "Interview with Ludger Brümmer" Interview by Sebastian Berweck. Digital Recording, Karlsruhe, September 2, 2009.

Buchberger, Stephan, and Mariko Steeb. "Interview with Mariko Steeb and Stephan Buchberger" Interview by Sebastian Berweck. Digital Recording, Frankfurt, June 17, 2010.

Bullock, Jamie. "Interview with Jamie Bullock" Interview by Sebastian Berweck. Digital Recording, Birmingham, May 5, 2011.

Chippewa, Jef. "Interview with Jef Chippewa" Interview by Sebastian Berweck. Digital Recording, Berlin, January 18, 2010.

Coleman, Gene. "Interview with Gene Coleman" Interview by Sebastian Berweck. Digital Recording, Berlin, May 10, 2010.

Croft, John. "Interview with John Croft" Interview by Sebastian Berweck. Digital Recording, London, June 29, 2011.

Denis, Jean-Francois. "Interview with Jean-Francois Denis" Interview by Sebastian Berweck. Digital Recording, Montreal, January 27, 2010.

Dipper, Götz. "Interview with Götz Dipper" Interview by Sebastian Berweck. Digital Recording, Karlsruhe, December 3, 2010.

Drescher, Erik. "Interview with Erik Drescher" Interview by Sebastian Berweck. Digital Recording, Berlin, August 19, 2009.

Drouin, Jacques. "Interview with Jacques Drouin" Interview by Sebastian Berweck. Digital Recording, Montreal, January 29, 2010.

Dufort, Louis. "Interview with Louis Dufort" Interview by Sebastian Berweck. Digital Recording, Montreal, January 31, 2010.

Eggleston, James. "Interview with James Eggleston" Interview by Sebastian Berweck. Digital Recording, London, June 28, 2011.

Emmerson, Simon. "Interview with Simon Emmerson" Interview by Sebastian Berweck. Digital Recording, Leicester, June 3, 2011.

Fineberg, Josh. "Interview with Josh Fineberg" Interview by Sebastian Berweck. Digital Recording, Boston, February 9, 2010.

Fischer, Christine. "Interview with Christine Fischer" Interview by Sebastian Berweck. Digital Recording, Berlin, November 29, 2010.

Fricke, Stefan. "Interview with Stefan Fricke" Interview by Sebastian Berweck. Digital Recording, Frankfurt, June 21, 2010.

Garton, Brad. "Interview with Brad Garton" Interview by Sebastian Berweck. Digital Recording, February 3, New York City, 2010.

Gobeil, Gilles. "Interview with Gilles Gobeil" Interview by Sebastian Berweck. Unrecorded, January 30, Montreal, 2010.

Goebel, Johannes. "Interview with Johannes Goebel" Interview by Sebastian Berweck. Digital Recording, Troy (NY), February 1, 2010.

Harrison, Jonty. "Interview with Jonty Harrison" Interview by Sebastian Berweck. Digital Recording, Birmingham, May 6, 2011.

Heintz, Joachim. "Interview with Joachim Heintz" Interview by Sebastian Berweck. Digital Recording, Hannover, January 8, 2010.

Hymer, Jennifer, and Georg Hajdu. "Interview with Hymer/Hajdu" Interview by Sebastian Berweck. Digital Recording, Hamburg, May 12, 2010.

Kimura, Mari. "Interview with Mari Kimura" Interview by Sebastian Berweck. Digital Recording [corrupt], New York City, February 5, 2010.

Kline, Phil. "Interview with Phil Kline" Interview by Sebastian Berweck. Digital Recording, New York City, February 5, 2010.

Kreidler, Johannes. "Interview with Johannes Kreidler" Interview by Sebastian Berweck. Digital Recording, Berlin, August 18, 2009.

Lancaster, Margaret. "Interview with Margaret Lancaster" Interview by Sebastian Berweck. Digital Recording, New York City, February 7, 2010.

Lanza, Alcides. "Interview with Alcides Lanza" Interview by Sebastian Berweck. Digital Recording, Montreal, January 30, 2010.

Laplante, Chantale. "Interview with Chantale Laplante" Interview by Sebastian Berweck. Digital Recording, Montreal, January 29, 2010.

Lehmann, Matthias. "Interview with Matthias Lehmann" Interview by Sebastian Berweck. Digital Recording, Berlin, November 10, 2010.

Lippe, Cort. "Interview with Cort Lippe" Interview by Sebastian Berweck. Digital Recording, Buffalo (NY), January 26, 2010.

Lucier, Alvin. "Interview with Alvin Lucier" Interview by Sebastian Berweck. Digital Recording, Middletown (CT), February 8, 2010.

Marcoll, Maximilian. "Interview with Maximilian Marcoll" Interview by Sebastian Berweck. Digital Recording, Berlin, January 3, 2010.

Marhulets, Damian. "Interview with Damian Marhulets" Interview by Sebastian Berweck. Digital Recording, Hannover, January 8, 2010.

McKenzie, Graham. "Interview with Graham McKenzie" Interview by Sebastian Berweck. Digital Recording, Huddersfield, August 2, 2011.

McKenzie, Richard. "Interview with Richard McKenzie" Interview by Sebastian Berweck. Digital Recording, Montreal, January 28, 2010.

Miljkovic, Katarina, and Mike Frengel. "Interview with Frengel/Miljkovic" Interview by Sebastian Berweck. Digital Recording, Boston, February 10, 2010.

Moore, Adrian. "Interview with Adrian Moore" Interview by Sebastian Berweck. Unrecorded, Sheffield, June 1, 2011.

Pestova, Xenia. "Interview with Xenia Pestova" Interview by Sebastian Berweck. Digital Recording, Montreal, January 28, 2010.

Pöllmann, Rainer. "Interview with Rainer Pöllmann" Interview by Sebastian Berweck. Digital Recording, Berlin, April 20, 2011.

Scheffler, Jennifer. "Interview with Ruben Scheffler" Interview by Sebastian Berweck. Digital Recording, Hamburg, May 12, 2010.

Schottke, Sebastian. "Interview with Sebastian Schottke" Interview by Sebastian Berweck. Digital Recording, Karlsruhe, September 3, 2009.

Schüttler, Martin. "Interview with Martin Schüttler" Interview by Sebastian Berweck. Digital Recording, Berlin, December 3, 2010.

Seidl, Hannes. "Interview with Hannes Seidl" Interview by Sebastian Berweck. Digital Recording, Berlin, December 3, 2010.

Silver, Micah. "Interview with Micah Silver" Interview by Sebastian Berweck. Digital Recording, Troy (NY), February 1, 2010.

Stoll, Rolf. "Interview with Rolf Stoll" Interview by Sebastian Berweck. Private conversation by telephone, 2011.

Surberg, Ernst. "Interview with Ernst Surberg" Interview by Sebastian Berweck. Digital Recording, Berlin, January 10, 2011.

Teitelbaum, Richard. "Interview with Richard Teitelbaum" Interview by Sebastian Berweck. Digital Recording, Red Hook (NY), February 2, 2010.

Trapp, Thomas. "Interview with Thomas Trapp" Interview by Sebastian Berweck. Digital Recording, Taunusstein, June 18, 2010.

Tremblay, Pierre Alexandre. "Interview with Pierre Alexandre Tremblay" Interview by Sebastian Berweck. Digital Recording, Berlin, May 22, 2010.

Tutschku, Hans. "Interview with Hans Tutschku" Interview by Sebastian Berweck. Digital Recording, Boston, February 11, 2010.

Vos, Todd. "Interview with Todd Vos" Interview by Sebastian Berweck. Digital Recording, Troy (NY), February 1, 2010.

White, Ean. "Interview with Ean White" Interview by Sebastian Berweck. Digital Recording, Boston, February 12, 2010.

Zwenzner, Michael. "Interview with Michael Zwenzner" Interview by Sebastian Berweck. Private conversation by e-mail, February 24, 2012.

Scores

Adamek, Ondrej. *Jardin perdu*. Paris: Gérard Billaudot Éditeur, 2011.

Babbitt, Milton. *Reflections*. New York City: C.F.Peters, 1976.

Black, Annesley. *4238 de Bullion*. Berlin: Edition Juliane Klein, 2007.

Bloland, Per. *Elsewhere Is a Negative Mirror*. Manuscript, 2005.

———. *Of Dust and Sand*. Manuscript, 2012.

Bollon, Fabrice. *Konzert für E-Cello und Orchester*. Frankfurt: C.F.Peters, 2011.

Boulez, Pierre. *...explosante-fixe...* Vienna: Universal Edition, 1991.

———. *Anthèmes 2*. Vienna: Universal Edition, 1994.

———. *Répons*. Vienna: Universal Edition, 1981.

Brümmer, Ludger. *Medusa*. Manuscript, 2000.

———. *move*. Manuscript, 2006.

Cage, John. *Credo in US*. Frankfurt: C.F.Peters, 1962.

———. *Two*. Frankfurt: C.F.Peters, 1987.

Davidovsky, Mario. *Synchronisms No. 6*. New York City: E. B. Marks, print on demand.

Emmerson, Simon. *Spirit of '76*. Manuscript, 1976.

Feiler, Dror. *Stormo V*. Manuscript, 2005.

Festinger, Richard. *Head over Heels*. Manuscript, 1992.

Finnendahl, Orm. *Wheel of Fortune*. Manuscript, 1995.

———. *Wheel of Fortune (rev. 2011)*. Manuscript, 2011.

Gorji, Ali. *Irrealis*. Manuscript, 2005.

Grebtschenko, Alexander. *<*. Manuscript, 2003.

Heusinger, Detlef. *Abraum*. Bad Schwalbach: Edition Gravis, 1995.

Hewitt, Scott. *on_radio*. Computer program, 2010.

———. *on_radio_midi*. Computer program, 2010.

Hilario, Alan. *Karaoke Exotique*. Manuscript, 2007.

Johnson, Evan. *Dehiscences, Lullay ("Thou Nost Whider It Whil Turne")*. Manuscript, 2005.

Kreidler, Johannes. *Klavierstück 5*. Manuscript, 2005.

———. *Slot machine*. Manuscript, 2009.

———. *Studie für Klavier, Audio- und Videozuspielung*. Manuscript, 2011.

Lang, Benjamin. *ABDucensparese*. Manuscript, 2002.

Lang, Bernhard. *DW 16 Songbook I*. Manuscript, 2005.

Ligeti, György. *Études pour piano: Premier livre*. Mainz: Schott, 1998.

Lindberg, Magnus. *UR*. Helsinki: Edition Wilhelm Hansen, 1986.

Lucier, Alvin. *Clocker*. Köln: MusikTexte, 2005.

———. *Gentle Fire*. Köln: MusikTexte, 2005.

———. *Music for Solo Performer*. Köln: MusikTexte, 2005.

Maierhof, Michael. *daily songs 1*. Manuscript, 2006.

———. *splitting 28.1*. Manuscript, 2007.

Manoury, Philippe. *Pluton*. Paris: Durand, 1988.

Marcoll, Max. *hundert rahmen, hochkant*. Manuscript, 2005.

Marcoll, Maximilian. *Samstag Morgen - Berlin Neukölln. Studie. Und Selbstportrait. Mit Hirsch.* Manuscript, 2007.

McLaughlin, Scott. *Bifurcations in a Continuous System*. Manuscript, 2011.

———. *Dissolution*. Manuscript, 2006.

Murail, Tristan. *Winter Fragments*. Paris: Éditions Henry Lemoine, 2000.

Nono, Luigi. *...sofferte onde serene...* 1st ed. Milan: Edizione Ricordi, 1977.

———. *...sofferte onde serene...* 2nd ed. Milan: Edizione Ricordi, 1992.

———. *Das atmende Klarsein*. Milan: Edizione Ricordi, 1987.

———. *Prometeo. Tragedia dell'ascolto*. Milan: Ricordi, 1985.

Ogiermann, Christoph. *lebend durchführung 19*. Manuscript, 2007.

———. *zig gesetze angewendet auf rei nakamura*. Manuscript, 2009.

Pinter, Michael. **error_05/auto_face**. Manuscript, 2006.

Poppe, Enno. *Arbeit*. München: Ricordi, 2007.

Rapoport, Kostia. *typenarmut*. Manuscript, 2006.

Reich, Steve. *Pendulum Music*. Vienna: Universal Edition, 2000.

Riley, Terry. *Keyboard Studies #1*. New York: Associated Music Publishers Inc, print on demand.

———. *Keyboard Studies #2*. New York: Associated Music Publishers, print on demand.

———. *Keyboard Study #1*. Manuscript, 1966.

———. *Keyboard Study #2*. Manuscript, 1966.

Robusté, Joan Riera. *Deformacions n.2*. Manuscript, 2008.

Ruffoni, Chris. *Piano Grinds*. Manuscript, 2011.

Saariaho, Kaija. *NoaNoa*. London: Chester Music, 1992.

Saunders, James. *#[unassigned] - Version for Sebastian Berweck*. Manuscript, 2003.

Scelsi, Giacinto. *Aitsi*. Paris: Editions Salabert, 1989.

———. *Suite No. 10 "Ka."* New York City: Schirmer, 2011.

Schielein, Dodo. *Fluida*. Manuscript, 2004.

———. *N381*. Manuscript, 2008.

Schüttler, Martin. *schöner leben 2 (Monument für T.H.)*. Manuscript, 2006.

———. *taped & low-bit*. Manuscript, 2002.

———. *venus_5*. Manuscript, 2002.

Smalley, Roger. *Monody*. London: Faber, 2000.

Steinke, Günter. *Arcade*. London: Boosey & Hawkes, 2000.

Stockhausen, Karlheinz. *Kontakte*. Kürten: Stockhausen Verlag, 2002.

———. *Mikrophonie I*. Vienna: Universal Edition, 1964.

———. *Oktophonie*. Kürten: Stockhausen Verlag, 1990.

Tremblay, Pierre Alexandre. *Un clou, son marteau, et le béton*. Manuscript, 2008.

Tutschku, Hans. *Das bleierne Klavier*. Manuscript, 1999.

———. *Zellen-Linien*. Manuscript, 2007.

Walshe, Jennifer. *Theme From*. Manuscript, 2002.

Wenk, Thomas. *Recordame*. Manuscript, 1997.

———. *Taurus CT-600*. Manuscript, 2002.

Zaldua, Alistair. *Inner and Outer Mind*. Manuscript, 2010.

Software

Alchemy (v. 1.25). Camel Audio, 2011.

Antescofo~. IRCAM (Cont, Arshia, Jean-Louis Giavitto, Florent Jacquemard, and José Echeveste), 2007.

AutoSampler (v. 2.3). Redmatica, 2011.

ChucK (v. 1.2.1.3). Wang, Ge, and Perry Cook, 2009.

Csound (v. 5.17.11). Vercoe, Barry, 2012.

Galaxy Editor. Opcode Systems, Inc., n.d.

Komplete (v. 8). Native Instruments, 2011.

Kontakt (v. 5). Native Instruments, 2011.

Kontakt 5 Player (v. 5.02). Native Instruments, 2012.

Logic Pro (v. 9.1.7). Apple Inc., 2012.

Max. Opcode Systems, Inc., n.d.

Max/MSP (v. 6.0.5). Cycling '74, 2012.

Mess (v. 0.145u3) Communal effort, n.d.

MidiPipe (v. 1.4.4). Wald, Nico, 2012.

MIDI Yoke (v. 1.75). O'Connell, Jamie, 2007.

Midi-OX (v. 7.0.2). O'Connell, Jamie, 2011.

Notator Atari. Emagic, 2002.

Pianoteq (v. 4.0.1). Modartt, 2012.

Pure Data (v. 0.43.2). Puckette, Miller, 2012.

Reason (v. 6.0.1). Propellerhead, 2011.

ReSampler (v. 1.01). Nexoe, 2011.

Rockbox (v. 3.11). Communal effort, 2012.

SoundDiver (v. 3.0). Emagic, 2001.

Soundflower (v. 1.6.2.1). Cycling '74, and Tim Place, 2012.

Structure (v. 1.1). Avid, 2011.

SuperCollider (v. 3.5.2). McCartney, James, 2012.

Vienna Imperial (v. 1.1). Vienna Instruments, 2011.

VLC Media Player (v. 2.0.1). VideoLAN organisation, 2012.

VM VirtualBox (v. 4.1.14). Oracle, 2012.

Windows Media Player (v. 12). Microsoft, 2009.

Wine (v. 1.4.1). Communal effort, 2012.

Web Pages

Berweck, Sebastian. "Musik und Strom :: bonedo.de," 2010. Accessed 11 May 2012. http://www.bonedo.de/artikel/einzelansicht/musik-und-strom.html.

———. "The Patcher's Toolbox," 2006. Accessed 15 January 2012. http://modular.sebastianberweck.de.

Boulez, Pierre, Andrew Carvin, and Joshua Cody. "Boulez Interview." *Paris New Music Review*, n.d. Accessed 6 April 2012. http://www.paristransatlantic.com/magazine/interviews/boulez.html.

Feldman, Linda. "Glenn Beck Leaving Fox: His 10 Most Controversial Statements (so Far) - Beck: 'The President Is A Marxist'; 'I Think That We Are Setting Up A Class System.' - CS Monitor.com," 2011. Accessed 4 July 2011. http://www.csmonitor.com/USA/Elections/2011/0407/Glenn-Beck-leaving-Fox-his-10-most-controversial-statements-so-far/Beck-The-President-Is-A-Marxist-I-Think-That-We-Are-Setting-Up-A-Class-System.

Festinger, Richard. "Solo Instrumental Works," n.d. Accessed 9 August 2011. http://www.rafestinger.com/Cat%20Solo%20Works.html.

Fondazione Isabella Scelsi. "- Fondazione Isabella Scelsi - Le Opere," n.d. Accessed 27 September 2011. http://www.scelsi.it/leopere/le_opere_copia(5).htm.

Friedman, Matt. "Yamaha SY-77 | Vintage Synth Explorer," n.d. Accessed 8 October 2011. http://www.vintagesynth.com/yamaha/sy77.php.

Haller, Hans Peter. "Raumklang_Klangraum," n.d. Accessed 27 March 2012. http://www.hp-haller.homepage.t-online.de/heft2.html.

Hoffman, Steve. "Lesson 4 on Echo/Reverb," n.d. Accessed 23 February 2012. http://www.stevehoffman.tv/dhinterviews/HoffLesson5.htm.

Ladkin, Peter B. "AG RVS - The Why-Because Analysis Homepage," February 3, 2012. Accessed 25 March 2012. http://www.rvs.uni-bielefeld.de/research/WBA/.

Maningo, Emerson. "Developing Wide Stereo Ambiance Sound in Your Recording," 2008. Accessed 27 February 2012. http://www.audiorecording.me/developing-wide-stereo-ambiance-sound-in-your-recording.html.

M-Audio. "MIDI Device Stops Working with Uni-Body Aluminum Mac's." *M-AUDIO - Knowledge Base*, n.d. Accessed 20 May 2012. http://www.m-audio.com/index.php?do=support.faq&ID=15201057295c3692359e13da97a9e93d.

———. "MIDI Keyboard Controller Sustain & Expression Pedal Compatibility." *M-AUDIO - Knowledge Base*, n.d. Accessed 20 May 2012. http://www.m-audio.com/index.php?do=support.faq&ID=221b8ec8fc63b4b1bb034105ca4b379a.

McLean, Barton. "What Might Happen To Your Music After You Die (and What You Can Do About It)," n.d. Accessed 9 May 2012. http://www.newmusicbox.org/articles/What-Might-Happen-To-Your-Music-After-You-Die-and-What-You-Can-Do-About-It/.

MIDI Classics. "OBSOLETE - Opcode Galaxy Plus Editors," n.d. Accessed 8 November 2011. http://www.midi-classics.com/p9524.htm.

Paradiso, Joseph A. "Electronic Music Interfaces," n.d. Accessed 24 May 2012. http://web.media.mit.edu/~joep/SpectrumWeb/SpectrumX.html.

Petazzi, Paolo. "Maurizio Pollini Edition Insights," n.d. Accessed 23 February 2012. http://www.deutschegrammophon.com/special/insighttext.htms?ID=pollini-edition&DETAIL=12.

Skerjanc, Robert. "Green Box: Yamaha SY99 - Vintage Synths - AMAZONA.de," May 1, 2010. Accessed 23 April 2012. http://www.amazona.de/index.php?page=26&file=2&article_id=2836.

Soy, Susan K. "The Case Study as a Research Method," n.d. Accessed 13 March 2012. http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm.

Tate, Jamie. "[Archive] Page 11 Albums Ruined by Sonic Solutions' NoNOISE Music Corner," 2009. Accessed 25 February 2012. http://www.stevehoffman.tv/forums/archive/index.php/t-120870-p-11.html.

Tchil, Doundou. "Classical Iconoclast," 2008. Accessed 27 February 2012. http://classical-iconoclast.blogspot.com/2008/05/nono-sofferte-onde-serenepollini.html.

Tellis, Winston. "Application of a Case Study Methodology," n.d. Accessed 15 March 2012. http://www.nova.edu/ssss/QR/QR3-3/tellis2.html.

Tepe, Christian. "Die Natur als geheimer Mittelpunkt," October 2009. Accessed 25 April 2012. http://www.nmz.de/artikel/die-natur-als-geheimer-mittelpunkt.

Vesco, Ben. "FX Tips - Delay: Extra Wide Stereo," 2008. Accessed 27 December 2012. http://www.benvesco.com/blog/mixing/2008/fx-tips-wide-stereo/.

Wetzel, David. "Research/iem," n.d. Accessed 22 May 2012. http://davidbrookewetzel.net/research/iem/.

"Albums Ruined by Sonic Solutions' NoNOISE [Archive] - Page 11 - SH Forums," January 5, 2009. Accessed 23 February 2012. http://www.stevehoffman.tv/forums/archive/index.php/t-120870-p-11.html.

"Aspen No. 9, Item 10: Dream Music/Keyboard Study #2," n.d. Accessed 23 April 2012. http://www.ubu.com/aspen/aspen9/dreamMusic.html#rile.

"Beck 'Lose[s]' His 'Mind;' Screams at Caller: 'Get Off My Phone You Little Pinhead!'," July 15, 2009. Accessed 10 February 2012. http://mediamatters.org/mmtv/200907150016.

"CASPAR Digital Preservation User Community," n.d. Accessed 11 May 2012. http://www.casparpreserves.eu/.

"Catalogue Ventes - Aitsi," n.d. Accessed 27 September 2011. http://www.durand-salabert-eschig.com/fiche_vente.php?id=13410〈=fr.

"Community List," n.d. Accessed 11 May 2012. http://www.mediaartbase.de/?locale-attribute=en.

"Datensicherung für Anfänger." *Datensicherung für Anfänger*, n.d. Accessed 26 May 2012. http://de.wikibooks.org/wiki/Datensicherung_f%C3%BCr_Anf%C3%A4nger.

"Digital Preservation (Library of Congress)," n.d. Accessed 11 May 2012. http://www.digitalpreservation.gov/.

"Do I Need a Second Licence to Install My NI Product on a Second Computer?," n.d. Accessed 29 March 2012. http://www.native-instruments.com/knowledge/questions/475/Do+I+Need+a+Second+Licence+to+Install+my+NI+Product+on+a+Second+Computer%3F.

"HANNOVER.DE - The Royal Gardens of Herrenhausen," n.d. Accessed 24 April 2012. http://www.hannover.de/herrenhausen_en/index.html.

"Improv/noise/etc.cd Sale Updt A.14 - Rec.music.classical | Google Groups," 1994. Accessed 14 February 2012. http://groups.google.com/group/rec.music.classical/browse_thread/thread/d53e0b053afe8ff7/980d55c7c45d0a1a%3Fq%3D%2522G%25C3%25BCnter%2BSommer%2522%23980d55c7c45d0a1a&ei=iGwTS6eaOpW8Qpmqic0O&sa=t&ct=res&cd=15&source=groups&usg=AFQjCNFTGVH2BvJKbzBCDC67f4hWh.

"Integra Project – Fusing Music and Technology," n.d. Accessed 11 May 2012. http://www.integralive.org/.

"JISC Beginner's Guide to Digital Preservation," n.d. Accessed 26 May 2012. http://blogs.ukoln.ac.uk/jisc-beg-dig-pres/.

"Mess Faq [mess]," n.d. Accessed 22 May 2012. http://www.mess.org/faq.

"New Macbook Pro with Lucent/Agere FW Chipset! - Gearslutz.com," n.d. Accessed 4 June 2012. http://www.gearslutz.com/board/music-computers/335773-new-macbook-pro-lucent-agere-fw-chipset.html.

"Peabody Computer Music," n.d. Accessed 2 June 2012. http://pcm.peabody.jhu.edu/main.php?menu=academics&pg=graduate&cat=performance.

"Ricordi & C. - Historical Archive," n.d. Accessed 14 June 2012. http://www.ricordicompany.com/archivio_index.php?lang=eng.

"RME," n.d. Accessed 19 June 2012. http://www.rme-audio.de/en_techinfo_content.php?page=content/downloads/en_driver_updates_readme_firewire.

"Salabert History," n.d. Accessed 27 September 2011. http://www.durand-salabert-eschig.com/english/historique2.php.

"Studiohire Rents Pianos, Vintage & New Synthesizers, Guitars, PA Systems, Drum Kits, Amplifiers, Microphones, DJ Equipment, Percussion & All Musical Equipment from Our London Based Premises. London, Piano Hire London, Guitar Hire London, England, Synthesizer Hire, Drum Hire, Keyboard Hire, Backline Hire, Music Hire, Vintage Synth Hire, PA Hire London, PA System Hire, Amplifier Hire London, Amp Hire, Instrument Hire London, London, NW3, UK, Instrument Rental," n.d. Accessed 20 June 2012. http://studiohire.net/.

"The Final Word: Active or Passive Volume Pedal... - The Gear Page," n.d. Accessed 20 May 2012. http://www.thegearpage.net/board/showthread.php?t=259176.

"The InterPARES Project:," n.d. Accessed 20 May 2012. http://www.interpares.org/.

"Universal Music Publishing Classical," 2009. Accessed 27 September 2011. http://umpgclassical.com/en/.

"Windows and Mac Patch Compatibility « Cycling '74 Forums," 2011. Accessed 28 March 2012. http://cycling74.com/forums/topic.php?id=31991.

"Yvar Mikhashoff Archive." *University at Buffalo - Music Library*, n.d. Accessed 14 February 2012. http://library.buffalo.edu/music/spcoll/ymhome.html.

"Yvar Mikhashoff Sound Recording Collection - Music Library - University at Buffalo Libraries." *University at Buffalo - Music Library*, n.d. Accessed 14 February 2012. http://library.buffalo.edu/music/spcoll/ymaudio.html.

"ZKM | Music & Acoustics :: Klangdom/Zirkonium," n.d. Accessed 30 April 2012. http://www.zkm.de/zirkonium.

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Appendix: The Interviews

Introduction of Interviewee, Place/Time, consent to record the interview

- What is your education?

- What is your position?

- Describe the work you're doing

- Music with and without electronics: how would you describe the differences in your approach?

- Who do you work with?

- How do you choose your set-up?

- Describe the flow of information concerning the technology between you and the other involved parties (organizer, performers)?

- Did you experience difficulties while rehearsing or performing your music with electronics?

- Could you describe them? If hardware: which one (computer, microphones, cables etc...)?

  o If other, describe :

- communication (e.g. it was not clear, who's responsible for the task?; a document didn't reach the responsible person

- work-flow (score arrived too late, performers didn't practice etc.)

- conception (faulty patch, patch didn't work on specific machine, inevitable feedback)

- money (lack of money resulted in a piece not being performed, e.g. studio wanted too much or a possible technical solution would have proved too costly)

- Do you see general problems concerning the technology or the work flow?

- Which of the participating parties are concerned?

- Do you have a solution how these problems can be avoided in the future?

- Do you think it's necessary that performers practice with the electronics?

- Are there works that cannot be performed without your presence?

- If so, what are your thoughts about the future of your works?

- Your general thoughts on how to deal with concerts with live-electronics under the current circumstances

- Back to your own work: do you ponder over the guaranteed future of the technology used and are you doing something about it?

Tracklist

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Black, Annesley.mp3   46759 KB
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Brady, Tim.mp3   76642 KB
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