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Introduction

This research project started from my need to understand what constitutes performance practice in computer music, how it differs from traditional instrumental practices, and how it can be further challenged and developed. The initial hypothesis for this research was developed during my years as a student at the Institute of Sonology at the Royal Conservatoire The Hague and, in particular, during my work as co-founder of the percussion and computer music trio The Electronic Hammer. This ensemble was active for eight years, in which time it created, promoted, and disseminated contemporary live computer music, focusing on the interaction of a traditional virtuoso instrumentalist and two computer performers.

The work methods developed within the ensemble, and later applied to other musical collaborations, helped define some of the main research questions for this project. Some of the tasks we dealt with within the ensemble included exploring instrument-independent musical notation, the disjointed relationship between physical action and sonic manifestation in electronic instruments, and the hierarchical dynamics between (traditional) instrumental and electronic components. The various strategies we developed to deal with these issues led towards a methodology for live performance of computer music.

In rigorously pursuing these methods, it became clear to me that it was necessary to investigate the extent to which composers approaching working with The Electronic Hammer were inspired by and tackled the notion of considering performers of computer music as equal to traditional instrumentalists, and how many of the performance decisions came through self-reflection on experiences garnered before the ensemble’s founding. My introduction to the particular historic and aesthetic contexts of electroacoustic music offered by the Institute of Sonology deeply influenced this reflection on the role of the computer music practitioner in a live performance.

Thus, in order better to situate the starting point of this research journey through the questions and experiences raised by my musical practices and explorations, I will
spend some time presenting a few key elements of my personal trajectory as a music practitioner.

**Guitarist by accident**

My entry into the world of music practice was through the guitar. This was not due to any special talent or affinity with the instrument and its repertoire; rather, because of a wrist and thumb injury suffered while playing in goal for a youth division football club, I took the decision to learn to play the guitar after my kinesiologist suggested it might help recover mobility in my right hand.

At the time I was too old to start a traditional instrumental career, but I had the good fortune to cross paths with a private guitar instructor who had just experienced a major change in his practice. Since I had no previous serious experience in the instrument, I agreed to approach learning my instrument using the principles my teacher had acquired from Guitar Craft, a pedagogical system developed by Robert Fripp, with which I would later assist and continue to be involved in for several years.¹ The most striking, salient feature of this approach is that the discipline transmitted has as much to do with life-learning as it has with learning a musical instrument.

According to its founder, “Guitar Craft is three things” (Fripp 2004: n.p.):

- A way to develop a relationship with the guitar;
- A way to develop a relationship with music;
- A way to develop a relationship with oneself.

In his introduction to Guitar Craft, Fripp (Fripp 2004: n.p.) touches only briefly upon the musical skills required of beginners, instead focusing more intently on aspects such as discipline and commitment:

The *Introduction To Guitar Craft* is open to all levels of experience, even none at all: the requirement is commitment. We ask that participants come with a clear aim, and the commitment to honor that aim. Emphasis is on how to play, rather than what to play. We

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¹ Founded in 1985, the activities of Guitar Craft are continued worldwide through the extended work of its related guitar circles. More information is available at [www.guitarcraft.com](http://www.guitarcraft.com).
address the principles underlying our practice. These principles are applicable in other areas of our lives.

In addition to the musical activities, done primarily in a circular formation using a tuning system closer to that of traditional orchestral bowed string instruments than that of the guitar (tuning by fifths rather than by fourths), other aspects of the Guitar Craft discipline were slowly revealed during the years of my involvement. These tasks included both extremely concrete ones, such as cooking and cleaning for large groups of people, and a careful introduction to applied practices and techniques that would facilitate the sharing of creative, musical and, potentially, more spiritual experiences.²

Musically speaking, one of the main aspects of the ensemble work within Guitar Craft is that it allows for the creation of very transparent or, conversely, complex counterpoint structures. Transparency relates to the uniformity of timbre (akin to the work of a string orchestra or a choir) and complexity relates to the large number of players and different voices of the core repertoire. The learning process for the repertoire provided a fascinating work dynamic between several players: each member of the ensemble would learn every voice of a particular piece, to the point of being able to play the whole melodic line, or some notes of the melodic line, while allowing a second (or third, or fourth) performer to fill in the notes that the first performer omits. Combined with the uniform timbre of the group, this technique helped to organise the ensemble as a collective, thereby approaching playing as if sharing a single instrument played by multiple performers instead of structuring the ensemble in a traditional orchestral hierarchy.

Another aspect of the work of this school that would later come to define my personal musical interests was the delicate use of spatialisation in performance. The main musical setting in the work of Guitar Craft, in both practice and concert, is a circular formation, where the notion of becoming a single instrument divided between several bodies is used to establish uniformity and coordination in sound. To achieve this, strong emphasis is placed on “circulations”, where single notes are passed from

² Perhaps the most prominent is Alexander technique, developed by F. M. Alexander and simply described as a learning process that aims to undo the tension patterns accumulated in our bodies. For a complete resource on Alexander technique, visit www.alexandertechnique.com.
guitarist to guitarist, challenging the attention of the performing group and creating for the audience sitting within the circle a sensory experience very rarely reproduced in other music performance settings. This suggests a distancing from the traditional model both of venues and of ensembles: the recital platform model that, in the words of Edward Said, situates the performer in a place where he or she becomes something “to be looked at, admired, and marvelled at by a worshipful, sometimes incredulous crowd […] The idea of the performer as a specialized object of wonderment for a middle-class paying public.” (Said 2006: 118)

While the practices and ideas within Guitar Craft left a very strong imprint on my early development as a musician, there were certain questions that remained unanswered. Being the performer of someone else's musical ideas, I can now articulate one of these questions as a limitation on creativity. I could never truly embrace the notion of creativity in the process of interpretation. In retrospect, this was perhaps a product of my lack of aesthetic affinity with not only the traditional classical guitar repertoire but also a large amount of the repertoire practiced within Guitar Craft. I perceived the timbral uniformity of the work when played by the ensemble, perhaps essential to reach the aural impression of communion and unity, as one of the biggest shortcomings on a purely artistic level. I soon realised, both as a listener and as a practitioner, that my main fascination with music was the sound itself; as a performer, I felt limited to the all-too-restrictive sonic palette of a single instrument.

These were some of the reasons that led me to continue seeking a development of music based in sound and a different approach to the guitar as a sound source.

Composer on purpose
I began studying composition initially to understand how I could apply the ideas about space organisation and polyphony that I had learned in Guitar Craft to sonic complexes richer than the guitar ensemble setting. I started to articulate certain concepts that helped focus my search for and fascination with musical practices in which timbre and its transformation over time were central to the creative process. I sought to find resonance in pre-existing repertoire that focused on the use and manipulation of the sound-print itself: timbre, the complexity (or lack of complexity) of an instrumental source and the play of voice densities in polyphonic vocal music.
The first result of this search manifested itself while listening to a recording of Anton Webern’s orchestration of J. S. Bach’s *Ricercare a 6* from *The Musical Offering*. The notion of *Klangfarbenmelodie* was introduced in 1911 by Arnold Schoenberg and is defined as “music in which consecutive tones differ timbrally.” (Cramer 2002: 1) Webern used Schoenberg’s notion to produce an orchestration that made me understand how, in the words of Theodor W. Adorno, a “normalised” (or dehierarchised) understanding of the musical structure suggested by the twelve-tone technique could be applied to the organisation of timbres: “The total construction of music permits constructive instrumentation to a surprising degree. The Bach arrangements by Schoenberg and Webern, which convert the most minute motivic relationships of the composition into relationships of colour – thus realising them for the first time – would not have been possible without twelve-tone technique.”³ (Adorno 2007: 63) I could hear the different timbres sharing melodic lines, which gave the piece a spatial dimension that for me transcended the spatial limitations of the recording through which I encountered this piece. It was in understanding this co-dependence between timbres and structures that I began to clarify how and why I appreciated music.

Around the same time, I had my first encounter with the aesthetics and techniques of *musique concrète* through listening to a piece by the Chilean composer Juan Amenábar. In *Los peces* (the fishes)⁴ from 1957, Amenábar created a magnetic tape composition by extracting all the timbres from a single sound source: the piano. Exploring the disassociation of the timbre from its original source, Amenábar removed the attack component from the recorded samples, creating sonorities closer to modulated sine waves; in so doing, he successfully transformed the spectromorphology of the original source material to create a “new” instrument. This first experience of musique concrète was followed shortly after by my exposure to the work of Pierre Schaeffer, in particular his *Etude violette* (1948), which, like Amenábar’s *Los peces*, was made solely from piano sounds.

³ Although this is not the only way to structure music through timbre, perhaps it is the sense of familiarity of Bach’s music, and what Webern does to it, that touched me in such a powerful way. In doing so, I cannot disagree with Adorno’s statement.
Nevertheless, whereas Amenábar restricted himself to pitch-oriented material, Schaeffer’s explorations went deeper, seeking to deconstruct the whole sonic identity of the instrument. To do so, he embraced and treated several sounds that pianists would not deem “musical”, such as the squeaking of the pedals. This radical attitude towards music composition led Schaeffer to define, create and use sound objects. My experiences of both Schaeffer’s and Amenábar’s works redefined my perception of the sonic palette emanating from a single instrumental source, and opened a doorway to the timbral complexity I was still seeking in traditional ensemble and orchestral settings. I thus began refining my creative experimentation with the aim of reproducing these sonic constructs using the tools that were familiar to me: my guitar and guitar effects processors.

The search for expanded timbres on the guitar, which at the time still felt like a restrictive instrument, led me to develop a performative approach to the instrument focused chiefly on manipulating and masking its traditional timbral characteristics. I found a source of inspiration in the work of improvisers such as Derek Bailey and Fred Frith – not only in their radical departure from traditional playing techniques but also in their incorporation of the full sonic potential of the guitar as a resonant object.

However, while Frith’s and Bailey’s approaches to the instrument inspired and refreshed my relationship with the guitar, there were certain boundaries, characteristic of traditional instruments, that I still wanted to cross.

**The transition to electronic media**

These experiences with improvisation on acoustic guitar allowed me to exercise in performance what I could point to as the most striking element from my experience of listening to the works of musique concrète: the recontextualisation of the sound material and the proposition of new meanings. Nevertheless, I was still missing my own “ricercare”.

My somewhat traumatic relationship with instrumental composition was due to the frustrating notion that, given the reality of classical composition in a country such as  

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5 I had the opportunity to participate in a workshop conducted by Fred Frith in 1997 in Chile; it was my introduction as a practitioner to graphic scores, free improvisation and a less traditional approach to the use of the instrument.
Chile, where the opportunities to have one’s music performed are extremely rare, the act of writing music was focused more on the writing itself – the production of the score – than on the actual manifestation in sound of such scores. Having been primarily involved with performance, I felt the only way I would be able to relate to music creation and creativity was if I had the definite opportunity to listen to the results of my musical explorations. This led to two choices: (1) create music for guitar, so I could always play it, or (2) find a way of creating music for instruments (or tools) that I could always rely on.

Following the second option led to my first steps in the understanding and use of electronic media, and later to the computer, as my main source for sound creations and manipulations. Early explorations in the use of recorded materials as a primary source and their transformation through direct manipulation of recorded media (tape) gave way to a first approach to the use of computer-based music languages such as Csound and several other computer-based signal-processing tools.

The results of these early works were confined to the final output of a recorded medium, and for this reason, I still did not have the opportunity for decision-making and creativity in front of an audience that working as a guitarist offered.

Thanks to the advice of Robert Fripp, who since the early 1970s has been experimenting in live performance settings with implementing certain techniques used in experimental recording studios, such as tape looping, first with his Frippertronics and later with Soundscapes, I began seeking inexpensive digital equivalents to realise my “one-man-orchestra” endeavours. Using a series of digital delays and effects processors, and an overly complicated signal-splitting and amplification

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6 Developed by Barry Vercoe in 1985, it was the first programming language based on C fully dedicated to the generation and processing of sound. Being free, multi-platform and available online, it was the sole resource for my early explorations into the world of computer music. For its current version, see http://www.csounds.com/.

7 Labelled as Frippertronics, the initial system created by Robert Fripp in collaboration with Brian Eno included two reel-to-reel Revox tape machines, set to record and play back incoming guitar improvisations and cascade the recordings into each other.

8 Soundscapes defines the continuation of Fripp’s explorations of looping and sound transformations, this time using MIDI and other digital instruments, with a system that, at the time of writing, continues to evolve.
system, I began performing semi-structured improvisations, working with the guitar as the starting sound source.

Although there was nothing technically groundbreaking in my approach, the novelty of the system at the time was its musical intention. Whereas the nature of Fripp's improvisations had been described as “the first public performances of ‘ambient' music,” (LaFosse 2012: n.p.) my aesthetic goals were still closer to the more complex sound worlds of Pierre Schaeffer and Anton Webern – not so much because of a clear aesthetic affinity to these composers' works, but, rather, because of the potential artistic value of a presenting the deconstructive processes of musique concrète and the structural development of *Klangfarbenmelodie* through a solo performance.

The generation – in real time – of multiple evolving sound-objects with their own timbral characteristics, which would be spread around the performance space and surround the audience, was a task that soon came up against technical limitations. Nevertheless, these initial explorations were satisfying enough to encourage me to keep pursuing the development of this work methodology. This search for development is what eventually led me to leave the guitar behind altogether.

**The Institute of Sonology and farewell to the guitar**

During my first period at the Institute of Sonology at the Royal Conservatoire The Hague, it became clear that I had only scratched the surface of what electroacoustic and computer music offered – namely, through integrating the performative expression I was seeking to develop from electronic and concrete sounds.

In the beginning, my deepening understanding of the techniques used by the different “schools” of electronic music,\(^9\) as well as of the historical repertoire attached to these techniques, led me to develop a strong affinity with the work of the complex analogue studio\(^{10}\) at the Institute. For a long time, my performative endeavours (including my

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\(^9\) Lacking a better word, by the term *schools* I refer to musique concrète in France, *Elektronische Musik* in Germany (and to a certain extent, in Sonology) derived from the work of Koenig and Stockhausen and computer music in the United States, derived from the work of Bell Labs and at Stanford University.

\(^{10}\) Codenamed “BEA 5” and ran by Kees Tazelaar, through use and manipulation it functions as the ultimate tool for understanding the techniques and tools used in the
participation in the 2000 - 2002 iterations of the SonoEnsemble) relied on my existent set-up of (touch-style) guitar and effects processors. It was not until I began working regularly with the ensemble [ie] that I started to develop a computer-based live processing system, the primary aim of which was to act as an extension of the acoustic instruments within the ensemble. Within that context, I began not only to define my role as a “sonic extender” of traditional instruments but also to find the limitations in the kind of interactions that as a performer I was able to create with my colleagues and the audience.

It was within the context of [ie] that I began working with percussionist Diego Espinosa, a great improviser and interpreter with a musical personality simultaneously refreshing, comforting and demanding. The subgroup that we formed within [ie] soon spun out of the large ensemble and started working on developing a more controlled and focused interaction between traditional instruments and electronic extensions than was possible within the large ensemble.

This focused laboratory work was soon enhanced by the presence of the composer and electronic performer Henry Vega, who had been working together with Espinosa in preparation for a performance of Cort Lippe’s Music for Hi-hat and Computer (1998), which is based on a Max/MSP patch created by the composer. In the spring

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11 Founded by recorder player Michael Barker and led by composer Richard Barrett at the time of my participation, the SonoEnsemble was (and still is) a performance-lab environment where collective creations were developed by an eclectic group of performance-motivated Sonology students. Snippets of the 2000–2001 iteration of the ensemble at work can be seen in a TV series about the Royal Conservatoire The Hague, produced by the Dutch company AVRO and available at http://cultuurgids.avro.nl/front/detailklassiek.html?item=8179600. For this particular project, composer and then director of the Sonology department Konrad Boehmer acted, next to Barrett, as coordinator of the project.

12 [ie] was a collective of improvisers based in Krakow and The Hague, founded by Keir Neuringer and formed mainly of composition and sonology students of the Royal Conservatoire The Hague.


14 Created by Miller S. Puckette, and further developed by David Zicarelli, Max/MSP is one of the most popular flexible music programming environments to follow the
of 2003, the trio started working towards creating a fluid improvisational set, the goal of which was to present the system as a meta-instrument with three performers, as well as to look for (and compose) a repertoire to complete a full concert.

The Electronic Hammer
Performing first at the DAFX conference in London in September 2013, Espinosa, Vega and I started a collaboration that rapidly transcended the laboratory nature of student work to become the main vessel for my creativity. In the context of the trio, notions of creativity in interpretation, collective composition, composer-performer interaction, instrument building and free improvisation began gaining strength and came close to those I had experienced as a traditional instrumentalist. At the same time, the differences and potential weaknesses rapidly became apparent when compared with a more traditional instrumental setting. Perhaps the clearest issue was the lack of a repertoire for our chosen media. The vast majority of pieces for percussion and electronics were written for electronic fixed media (tape or CD recordings), which acted as a soundtrack to showcase the virtuosity of the solo performer (this was also the case for the format of other works for solo instrument and electronics, such as Jean Claude Risset’s Invisible for soprano and tape (1996), Horacio Vaggione’s Taléas for recorders and electroacoustics (2004), and Jonathan Harvey’s Other Presences for trumpet and electronics (2006).

The task for the two electronic performers was to transform the way we presented the fixed media by adding slight filtering and spatialisation to both the soundtrack and the amplified percussion, as in pieces such as Javier Álvarez’s Temazcal (1984) for maracas and soundtrack or Alejandra Hernández’s Pies, para qué los quiero (2001) for multi-instrumental set and soundtrack. At the same time, we began an extensive collaboration process with several composers, commissioning new pieces. These collaborations revealed some of the interesting tensions and challenges of our novel format: composers were presented with the computer and its performer as an interpreter with whom to collaborate, raising a long list of questions that could only be answered through experimentation in an ensemble setting.

modular paradigm of Max Matthews’s Music-N programming system, only in a visual representation. For its current version, see http://cycling74.com/products/max/.
Another interesting point of creative tension for the trio was the desire to continue the improvisatory work side-by-side with the evolving repertoire. This led us to ask composers (and ourselves as part of the composer’s force for the trio) to push as far as possible the notion of the trio as a non-improvisatory entity, encouraging the fixing of instrumentation, notation and all other elements common in traditional instrumental composition.

The variety of approaches each composer took towards the different functions of the two computers within the ensemble, the clear difference in familiarity and results for structuring the instrumental and electronic parts of the compositions and my own frustrations and unanswered questions regarding notation, instrumental virtuosity in the computer and the tension between the roles (composer, performer and instrument designer) that were natural to the computer performers, led to the formalisation of the initial questions of the present research project:

- What is the role of the performer in electronic music?
- What can he or she contribute to a music practice that can be infinitely precise?
- Can the computer become a musical instrument?
- What are its possibilities, and what are its limitations?

The research I have conducted as a doctoral candidate is focused on the development of a performance practice in computer music; as such, I was confronted with the need to bring to light the unique performative qualities of a computer music performer. Therefore, it became necessary to find a methodology that would enable the development of a set of musical elements inherent to electronic media as well as their presentation in performance.

Some of the activities I was able to identify at the beginning of my research trajectory were as follows:

- Dividing the roles of composer, instrument builder, and performer.
- Composing, focusing on the importance of the generation of timbre and its manipulation over time.
- Instrument building, mapping, parameterisation; design of possibilities and limitations.
- Performing and interpreting.
In my experience as a performer of music with live electronics, composers often understand that electronic media makes a rich timbral contribution to their creative palette. They also think of a traditional instrument and its performer as an indivisible entity. But to think of electronic media as a material to be enriched by the interpretative musicianship of a human performer, it is necessary to conceive a strategy from both ends.

During my research journey of the last six years, a key shift took place in the way I considered the indivisibility of the roles of composer, performer and instrument builder in computer music. Having previously considered such indivisibility to be one of the problems that needed to be overcome in the field of live electronic music, I came to accept that – in light of the outcomes of the different experiences conducted and the nature of the media itself – composer, performer and instrument builder not only are indivisible in electronic music but also demand a set of skills from practitioners that can be understood and presented as what in traditional instrumental performance is defined as musicianship.

The case studies I am presenting in this thesis expose the different topics that I believe to be most relevant in the search towards formalising a performance practice in computer music. They emphasise an understanding of the multi-threaded role of the practitioner as it is, presenting aspects of each one of these roles in light of the influence of the other two and in different contexts. In doing so, these case studies emphasise the following two topics:

Interpretation, understood from three different perspectives:

- Reconstruction, as proposed in the interpretation of Luigi Nono’s A Pierre. Dell’azzurro silenzio, inquietum and Post-prae-ludium nr. 1 per Donau.
- Reinterpretation, as proposed in the interpretation of John Cage’s Aria/Fontana Mix.
- Re-appropriation, as proposed in the interpretation of Morton Feldman’s The King of Denmark.

Creation: five case studies focusing on different aspects of computer music practice:

- On Accumulation of Hesitation: Timbre Networks and mapping as compositional strategy.
- On *PLP*: the score as the condensation of improvisational processes.
- On KVSwalk: bringing sonification strategies onto the stage.
- On *Flux|Pattern*: the etude as a compositional form in live computer music.
- On Multiple Paths (omaggio a Nono): the transformation of physical space over time as a musical parameter

Given that computer music is frequently analysed, discussed and researched in relation to the technology involved – the ways of producing, transforming or transmitting sound – this research aims to contribute to shifting the focus of research and exploration in computer music towards an area that can benefit from other musical/philosophical and aesthetic discourses, such as historical context, the relationship between the performer and his or her instrument and the interdependence of composers and performers. Through this research process, I hope to be able to identify these relationships, use them to approach existing repertoire, and create new works informed by them.
References


