THE COMPOSITION OF CONCERT MUSIC WITHIN THE DIGITAL AUDIO WORKSTATION ENVIRONMENT

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Abstract

This research project includes a portfolio of compositions and a contextual document, the subject of which is the Digital Audio Workstation as a human computer interface for the composition of concert music, intended for live performance.

The portfolio of compositions consists of the music notation and audio recordings of five works, composed by the researcher within the context of the research project: *Variances* for jazz guitar, piano, percussion and indeterminate ensemble; *Rapprochement* for microtonal ensemble; *Transits* for bass flute, eight voices and electronics; *Shutterspeed* for clarinet and soundtrack; and *Fossils* for piano and live electronics. For each of the works, a distinct DAW-based concept and compositional approach has been developed and employed.

The contextual document investigates the implications of the DAW for the composition of concert music, and discusses the five portfolio compositions against the background of practices of selected composers; the history and development of the analogue studio, early computer and DAW composition; aspects of device interaction; and the topic of 'liveness'.

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Preface

In 2000, I obtained my first laptop computer. One of the first applications I installed was a Digital Audio Workstation (or DAW), *Audacity*. Within days I decided it would replace my home studio device at the time, a *Fostex X-28* four-track cassette recorder. Many things which so far had been laborious, now became comparatively easy. Tape hiss, wow and flutter were a thing of the past, as was the gradual loss of quality during long editing processes, due to magnetic tape degradation. And the DAW finally allowed me to see, on screen, what I was doing. My compositional projects started extending in scope, especially after changing software, from *Audacity* to *Logic*. The resulting fixed media appeared in my own concerts, and in a number of dance performances choreographed by Ederson Rodrigues Xavier.

Then, through these 'tape' works, I received a request for an instrumental work. I jumped into the deep end, and surfaced with *Synaps, Long, Knie, Voet, Mond*, for string trio. It was my first piece of concert music. Since then I have composed within and without the DAW; used other applications and tools, digital or analogue; worked directly in notation software; and sometimes produced handwritten scores. In particular, I have enjoyed combining any of these strategies in everchanging hybrid settings.

Since my first explorations of *Audacity*, the DAW has triggered a variety of compositional approaches, often dealing with specific DAW characteristics - something I also noticed in the work of others. My approaches were sometimes consciously planned; more often they simply manifested themselves. Over time I developed the desire to investigate my practice, and the practices of other composers, within the wider context of musico-technological composition. I aimed to gain deeper insights into the manifold DAW-based strategies in conceptualising, composing and realising new works. I also wanted to share these. This led to the research that I have been conducting in the past four years. This paper, and the five portfolio compositions that make part of the research project, are the result.

My research would not have been possible without the support and guidance of many individuals, who helped me throughout the process.

First and foremost, I would like to express my sincere gratitude to my supervisors Stephen Deutsch and Ambrose Seddon. In the past four years they have guided me through my research process with so much dedication, and provided me with their unwavering support. I have been lucky to benefit from their broad knowledge, and their keen eye for the substance of my research, its structure, narrative, and for a thousand details. I have immensely enjoyed our many meetings, whether analogue or digital. COVID-19 hasn't made any difference to their support.

I would like to thank my examiners Panos Amelides and Simon Emmerson for their reading of my work, and for urging me to deepen my insights, in preparation for the viva voce.

My sincere thanks goes to the wonderful musicians who blew life into my five portfolio compositions. You performed and recorded them so beautifully:

- *Rapprochement* Ensemble Scala: Stefan Gerritsen, Raymond Honing, Glenn Liebaut, Ere Lievonen, Michel Marang, Anne Veinberg, Manuel Visser
- *Variances* Stefan Gerritsen, Benjamin Kobler, Dirk Rothbrust, and Maat Saxophone Quartet: Daniel Ferreira, Catarina Gomes, Mafalda Oliveira, Pedro Silva
- *Transits* Silbersee: Romain Bischoff, Helen Bledsoe, Viktoriia Vitrenko, Viola Cheung, Michaela Riener, Rianne Wilbers, Steven van Gils, Joost van Velzen, Arnout Lems, Wouter Snoei, Maciej Straburzynski
- *Shutterspeed* Michel Marang
- *Fossils* Paolo Gorini

I would like to thank the composers who shared their insights with me: Yannis Kyriakides, John Psathas, Piet-Jan van Rossum, Wouter Snoei, Jorrit Tamminga, and Hildegard Westerkamp.

A special thanks goes to electroacoustic composer and technological wizard Danny de Graan, who provided me with so much help and insight.

A big thanks goes to Michiel Schuijer, lector at the Conservatorium van Amsterdam, who started me off on my research project, directed me to Bournemouth University, and remained a sparring partner throughout my research. And thank you very much, Conservatorium van Amsterdam and Amsterdam University of the Arts, for supporting my research.

A sincere thanks to Bournemouth University, and the team at the Faculty of Media and Communication; you made me feel at home right from the start.

I would like to thank Silvie, for her understanding, and her good company, when I was indulged in my research over the past four years. A final and most essential thanks goes to my soulmate and wife Katharina Gross, for sharing, in the past four years, so many thoughts, around my research, and otherwise. Her own work process toward her music theatre performance *Sehnsucht*, partly in parallel with my research, has been a big inspiration for me.

Arnold Marinissen, Amsterdam, 1 October 2021

1. Introduction

In this document, a portfolio of five musical compositions, created by the researcher in the environment of the Digital Audio Workstation, is contextualised and discussed. The following research question has underpinned the project:

What is the impact of the Digital Audio Workstation on the creation of live concert music?

1.1. Defining the DAW-based practice relevant to the portfolio compositions

The Digital Audio Workstation, or DAW, is a computer application for recording, editing, mixing and mastering audio. The first hardware DAWs, applying digital audio tape technology, were introduced in the late 1970s. Soundstream's four-track digital tape recorder with editing and cross-fading functionality, developed between 1976 and 1978, likely was the earliest hardware DAW (Barber, 2012). The first computer-based software DAWs appeared soon after the introduction of the MIDI (Musical Instruments Digital Interface) protocol in 1983. Since then, DAWs have undergone a process of continuous development. In particular, they have become increasingly comprehensive. Current DAWs accommodate and combine elements of the analogue studio, such as recording, playback, editing, the application of effects, mixing and mastering, with several other functionalities, such as sound synthesis, sound processing, emulation of musical instruments, note input through a piano-style keyboard or other interfaces, sequencing, meaning programmed note sequences being played back automatically, and in some cases the production of music notation. The totality of these affordances forms an interconnected and continuously developing working environment. The DAW is used widely, in any musical style and genre; indeed it is today the "predominant technology for music creation and production" (Marrington, 2016, pp. 52-63).

The DAW's primary use is in creating musical output for any context which calls for pre-produced audio, denoted as fixed media. Such DAW output is commonly disseminated in the form of an album, online release, film soundtrack, or through broadcasting. Fixed media may also play a role in settings involving theatre, dance, video art, exhibitions, or alongside performing musicians. Especially when applied in a live setting, when sounding through loudspeakers only, it is denoted as acousmatic music. Panos Amelides (2016, p. 213) uses the term acousmatic to indicate "the listening condition derived from the reproduction of sound through loudspeakers", rather than "acousmatic music as an established genre". While Pierre Schaeffer's use of the term involves the notion of bracketing sounds from their sources and causes (Kane, 2014), Amelides' definition is how the term acousmatic music will be applied hereafter.

Music captured as fixed media *may*, if the nature of the music allows, also be performed by musicians, since "it is the medium which is fixed, not the music" (Harrison, 1999, p. 1). And, especially in a stage setting, the application of fixed media can be subject to a performance purpose beyond mere playback (Stansbie, 2013, p. 147). Yet, the DAW-produced audio, as "the actual intended musical outcome" (Gatt, 2016, p. 150), is the basis for what audiences experience in the first place. Those interacting with the DAW toward the realisation of fixed media may be composers, musicians, recordings engineers, or producers, individually, or in collaborative settings.

However, the DAW can also be used to create music that is to be interpreted by musicians. In this case, the DAW is not used to create fixed media. It serves as a compositional device only; the resulting DAW audio is merely a virtual rendering of a musical work, and an intermediate product. This product is not shared with an audience; what audiences experience is a realisation of the work by musicians. The intended final outcome of such a DAW-based creation process is concert music. In most cases, music notation is used to capture DAW-generated concert music, and to communicate it to the performer. In this setting, the person interacting with the DAW is in almost all cases the composer.

This latter setting, in which a composer uses the DAW as a compositional device to create concert music, ordinarily communicated through music notation, and to be realised by musicians, is the context in which this research took place. It is my predominant practice, and my portfolio of five compositions was realised through this practice.

1.2. Defining the musico-technological context

To define the focus of the research, and subsequently conceptualise, compose, realise, contextualise and discuss each of the five portfolio compositions, boundaries were set within the extensive field of composition involving technology. Parameters to help setting such boundaries were found in 1) the framework of genre; 2) individual composers' practices; 3) issues of device interaction; and 4) the history of music technology.

Within the realm of concert music, most of my works are for chamber music instrumentation; they are generally written for under ten performers. The term chamber music commonly refers to music utilising music notation; this applies to the large majority of my works. Also, chamber music ordinarily is not conducted. This is true for most of my works; I cherish *musicking* which takes place on equal footing - to use Christopher Small's wonderful term (1998, p. 13), indicating the roles of, and relationships between, "those organized sounds which are conventionally thought of as being the stuff of musical meaning" and "the people who are taking part, in whatever capacity, in the performance". When referring to the act of making music, the term *musicking* will be often used in this paper. So, despite possible historic connotations with chamber music's origins in private rather than public performance, or associations with the classical and romantic repertoire, I consider chamber music an appropriate term to describe my general musical output. And while current chamber music practices range widely in style, the commonly used term contemporary may serve to distinguish it from historic chamber music practices, simply by defining it as music of today. The genre context of my portfolio

compositions, and consequently the genre around which this research project revolves, could thus be defined as concert music, and, within that larger genre, as contemporary chamber music. Placing stylistic boundaries is deemed neither useful nor desirable, for three reasons: firstly, I consider stylistic diversity a key asset of contemporary chamber music; secondly, the research focus was to be on musico-technological compositional practices rather than styles; and thirdly, allowing a variety of stylistic practices into the discussion was intended to bring richness to the project. Within the defined context of a DAW-based compositional practice aimed for live performance and involving music notation, and the genre boundaries, the five portfolio compositions could be conceptualised and realised, and relevant individual composers' practices selected for evaluation and comparison.

Device interaction is recognised as an important issue within technology-based compositional practices. User interfaces of devices in the analogue studio as well as those of computers and software applications impact on compositional practices; such notions triggered this research, and they will be discussed in relation to the portfolio compositions. Since "it is often difficult to rework the tool for customization" (Hamman, 2015, p. 22), most composers of concert music, including myself, generally don't interfere with the programming environment 'under the DAW's hood', but operate primarily within the framework of its user interface. Consequently aspects of interaction at the level of the user interface, rather than programming or coding aspects, determine the device-related boundaries of this research.

Although general issues around the development through time of technology impacting on musical and compositional practices are of great interest, they fall outside the context of this research project. The chain of late 19th and early 20th century inventions such as Elisha Grey's musical telegraph, the telephone, phonograph, microphone, loudspeaker, radio broadcasting, electric recording, and sound film; the development of instruments such as the *Telharmonium*, Luigi Russolo's *Intonarumori*, the *Theremin*, *Ondes Martenot*, *Trautonium*, *Hammond* organ, electric guitar, and many other 20th century musico-technological instruments; early phonograph work by Paul Hindemith, Ernst Toch and John Cage; the development of

the analogue studio; early computer music; the rise of the synthesizer; and finally digital technology becoming widely available to musicians; all these can be considered steps on the way to the prominence of technology in today's musical practices. But they will be discussed only inasmuch as they are relevant for the development towards, and compositional practices based upon, the DAW.

A few watershed moments and developments with special relevance for this research can be defined by judging the primary affordances of the DAW. These are recording; playback; editing; signal processing; sound synthesis; emulation of musical instruments; note input through a piano keyboard or other interfaces; sequencing; mixing and mastering; musical notation in some cases; and, as mentioned above, in particular the way these functionalities form a comprehensive working environment. The watershed moments and developments I have pinpointed are, in order of their appearance in compositional practice: 1) the introduction of the tape recorder, enabling recording, playback, editing, mixing and mastering, and leading to the rise of the analogue studio from the late 1940s; 2) the early musical use of the computer from the late 1950s, initially allowing for sound synthesis, and later on recording and signal processing as well; and 3) the development of the MIDI protocol between 1980 and 1983, providing easy communication between electronic music devices, allowing, amongst others, for sequencing and note input through a piano keyboard or other interfaces, and triggering the development of the comprehensive working environment of the computer-based DAW. These phenomena are first discussed separately, and then feed into the contextualisation and discussion of the portfolio compositions.

I would like to note here why the appearance of the synthesizer in the 1950s, and its development in the past half century, have not been included in the watershed moments and developments toward the birth of the DAW. Although synthesizers may feature several of the functionalities of the DAW, they fall primarily in the category of musical instruments, and do not provide a comprehensive compositional environment, as the DAW does. However, there is no doubt that the synthesizer has impacted strongly on the development of the DAW. The synthesizer's role in the

development of the MIDI protocol was mentioned above; sound synthesis is a key functionality of the synthesizer as well as the DAW; and aspects of synthesizers' user interfaces have impacted on DAW user interfaces.

The earliest of the three watershed moments, the birth of analogue studio composition, can now be defined as an appropriate historical starting point for contextualising the portfolio compositions. The highly idiosyncratic studio-based compositional practices of a number of composers from the 1940s influenced, and continue to influence, later musico-technological compositional practices, into the age of the DAW. Indeed, "many of the fundamental audio outcomes associated with electronic music originated with the pioneers", and "[m]ost of these techniques are still fundamental to the recording and manipulation of sounds using digital media and software" (Holmes, 2020, p. 108).

1.3. The researcher's practice within the research project

In my own compositional practice the DAW plays a central role; most of my works are created in this environment. Of the works that are not, some were written with pencil and paper, others directly in music notation software. Also, as noted above, the large majority of my work can be described as concert music: it is performed live, by musicians, for an audience, and communicated to the musicians through music notation. Of the works that are not concert music, most are acousmatic. These works were created for dance, theatre, film, sound installations, or for online and album release.

As mentioned above, ever since using the DAW I seemed to notice, in my own work as well as in work by others, its impact on conceptual and musical aspects of resulting concert compositions. Spicer (2004, pp. 29-64) describes how its impact has been responsible for engendering new ways of creating music. I also noticed an impact on the performance practice of such works. The urge to uncover, evaluate and

contextualise such impact, and the notion that this might inform, inspire and clarify compositional practices, are at the root of this research project.

When I speak about performance practice it is relevant to note that I was educated as, and remain active as, a performer. Trained first as a flautist, then as a percussionist, I have performed widely. Performance experience, an awareness of how it is to interpret music notation, and to realise works in concert, are integral to my musicianship. I have always sensed that this background in performing impacts on my composership.

Some of the composers I have been fortunate enough to work with are John Cage, Heiner Goebbels, Olivier Messiaen, Steve Reich, and Karlheinz Stockhausen. Their music has impacted on mine in various ways, and for various reasons. A few words about each of them:

- Cage's music asks for the undoing of musical habits. It also requires from the performer a deep understanding of the underlying musical concepts. Realising Cage's works in performance places strong interpretational demands on performers, making them, in a way, equal partners to the composer. The multifaceted use of electronics in the 1950s by Cage in collaboration with David Tudor; the amplification of microsound in works like *Child of Tree* (1975); and Cage's embedding of these practices in interdisciplinary settings, I find inspiring.
- The music of Steve Reich, process-based and with a strong aspect of pulse, is generally aurally coordinated within the ensemble, so that even large groups can function as in chamber music practice. As a member of his own ensemble, especially in the earlier part of his career, Reich developed his music collaboratively with his fellow musicians. Particularly relevant for some of my own works is a piece like *Different Trains* (1988), in which the pitch and rhythm of pre-recorded voice and field recordings inform instrumental composition.
- Heiner Goebbels' practice is also shaped around collaborative working processes, in which everyone’s active participation is desired, "to enrich one’s artistic perspective with the perspective of the other" (Goebbels, 2015, p. 90). In 2010-11 I experienced Goebbels's working process in the realisation of Harry Partch's music theatre work

Delusion of the fury (1964), for which he was stage director, and in which I participated as musical director. Goebbels' own music is shaped by his involvement with various disciplines, as well as by his interest in genres outside art music. He has a love for the natural voice, including the absence of structural vibrato. In his landmark piece *Surrogate Cities* (1994), a sampler is used as an integral ensemble partner. The use of historic audio footage in this work brings past and present together, and allows the ensemble to perform with 'absent musicians', across time and space.

- In the music of Olivier Messiaen, especially his rich and idiosyncratic harmonic language, and his modular dealing with form, have impacted on my own work. The prominent role of an electronic instrument, the *Ondes Martenot*, in many of his works for ensemble or orchestra, is still unique in the history of western art music.
- Stockhausen's early electronic music has impacted on many involved with music technology. Tape compositions such as *Gesang der Jünglinge* (1955-56) and *Kontakte* (1958-60) are not only innovative and imaginative musical works, but also set standards for technological craftmanship within the medium of analogue studio composition.
- Iannis Xenakis, finally, is a composer whose works I have performed extensively. In his composing he deployed instruments according to their timbral and expressive characteristics and possibilities, rather than common technical standards. This makes his instrumental and vocal works often highly demanding. It also makes his electronic music, in which he did not have to rely on instrumental craftmanship, occupy a special place within his oeuvre: in his electronic works, his involvement especially with timbre and musical density was not bound to the potential limitations of instrumental and vocal performance.

These composers, and many others, have informed and inspired, with their highly individual practices, my own compositional and technological practice. Several composers and works, relevant to the portfolio compositions, will be discussed in the subsequent chapters.

Finally, the DAW affords compositional practices involving performance, through audio recording and MIDI-input in real-time. This introduces liveness, or "the quality

or state of being live" (Merriam-Webster, 2020) into my own compositional DAW practice. Since most of my compositional output is realised through live performance, questions arise around the relationship between liveness in the DAW-based compositional phase, and in the realisation of the resulting works by live performers. Another aspect of liveness which plays a role in some of my works is the use of music technology in performance, in the form of fixed media and/or live electronics, and involving a performer who, as described by Simon Emmerson (2007, p. 90), "takes decisions and/or makes actions during a performance which change the real sounding nature of the music" and who "may cause, form or influence [the music] through electronically mediated interfaces under their immediate control". Issues of liveness have thus played a role in the research project on various levels.

1.4. Methodology

In the research project, two methodologies were applied:

1) The conceptualisation and creation of five portfolio compositions:
Five distinct DAW-based compositional concepts and approaches were developed. Each work was commissioned by a specific ensemble or performer. Each concept deals with particular aspects of DAW composition, and with distinct DAW characteristics. Work-specific artistic objectives, a literature review, and an orientation on historical and individual practices fed into the conceptualisation and compositional process. Each concept resulted in a chamber music composition, captured in musical notation. This work was then rehearsed, performed and recorded by the commissioning musicians. Revisions to the composition were made as needed. The totality of the notated music and audio recordings of the five works forms the portfolio of compositions.

2) The creation of a contextual paper:
The implications of the DAW as a human computer interface in the composition of five works of concert music has been researched against the background of the history

and development of music technology and electroacoustic composition; individual composers' practices; and issues of device interaction and liveness. A literature review was conducted. A number of selected relevant compositional practices were evaluated. Four composers were interviewed, each with their own innovative and idiosyncratic DAW-based musico-technological approach; aspects of these approaches were related to the concepts of the portfolio compositions. The totality of the findings fed into both the creation process, and the evaluation of the five works.

1.5. The chapters

In Chapter 2, general issues of device interaction are discussed in relation to musico-technological compositional practices. First, device interaction in analogue studio and early computer composition is discussed. This is followed by a discussion of the introduction of the MIDI protocol, and how MIDI enabled the development of the DAW. Finally the impact of the DAW environment on compositional practices is discussed, including those of the four interviewed composers. These aspects then feed into the chapters concerning the five portfolio compositions.

In Chapter 3, the first portfolio composition *Variances*, commissioned by the French Ensemble Variances, is contextualised and discussed. Next to fixed parts for jazz guitar, percussion and piano, the work features an indeterminate ensemble, in the spirit of Terry Riley's *In C*, in which "[a]ny number of any kind of instruments can play" (Riley, 1964). The aim for this composition was to research how a quasi-collaborative improvisational experience could be emulated in a DAW-based compositional setting, with the composer as a DAW performer, leading to a composition which would transport a sense of liveness and performative flexibility from the compositional phase, through music notation, to the performance setting.

Chapter 4 contextualises and discusses the portfolio composition *Rapprochement*, a microtonal work commissioned by the Amsterdam-based Ensemble SCALA. The ensemble specialises in microtonal music, and employs some unique microtonal

instruments, with distinctly different tunings. The role of the DAW was explored in composing a work involving different tunings, and in advancing accurate intonation throughout the process, from the conceptualisation and composition to rehearsing, performance and recording.

In Chapter 5, the portfolio composition *Transits* is contextualised and discussed. It is scored for eight voices (two sopranos, two altos, two tenors, two basses), bass flute and four channel electronics, and was commissioned by the Dutch vocal company Silbersee. Recordings of shortwave radio and of spoken word in many languages form the sonic basis of the composition. The use of the voice was explored as the primary vehicle of human presence in the DAW environment. The work is inspired by some specific compositional practices from the analogue studio.

Chapter 6 looks into on the portfolio composition *Shutterspeed* for clarinet and fixed media, commissioned by and composed for the Dutch clarinetist Michel Marang. Marang's double profession as a clarinetist and photographer was integrated into the concept and aim of the work: utilising the DAW to explore the dichotomy of the 'blink of an eye' of photography's exposure time and music's unfolding in time. The basis of the piece is formed by recordings of the shutter sound, as well as other sounds, of historical photo cameras, and snapshots from the existing clarinet repertoire. Issues of appropriation, and the realisation of meaning and identity of recorded and performed material in a new context, fed into the discussion.

Chapter 7 looks into the final portfolio composition *Fossils I-VII*, for piano and live electronics. The electronics are optional; the work can also be performed as a piano solo. Following the compositional phase, three different versions of the work were realised: an initial version for piano solo; a version for piano and live electronics (due to the COVID-19 circumstances only partly realised to date); and a full DAW-produced version with piano and electronics. Within these consecutive settings, the role of the DAW in interplay with other music software applications; aspects of liveness; and the issue of autonomy for an instrumental performer interacting with live electronics were explored.

In Chapter 8, the totality of the portfolio of compositions is evaluated synoptically. Overarching conclusions are drawn, and scope for further research is defined.

2. Device interaction in analogue studio, early computer and DAW composition

The purpose of this chapter is to clarify 1) how some key aspects of device interaction in compositional practices based in the analogue studio, and in early computer music, have impacted on today's DAW-based practices; and 2) how aspects of device interaction and user interface issues impact on DAW composition. First, device interaction in analogue studio composition is discussed. Then interaction aspects in early computer composition are explored. This is followed by a discussion on how the MIDI protocol, introduced in 1983, enabled the development of the DAW, leading to DAW-specific interaction aspects, and their implications for compositional practices.

The impact of device interaction on technology-based practices is widely recognised; "technologies always mediate human practices and experiences" (Verbeek, 2015, p. 31). This is also true for technology-based compositional practices, since "the design of a music interaction system may support some conceptual activities and prevent or limit others" (McDermott et al., 2013, p. 35). Of course, many other factors influence composers' approaches, since technology-aided composition takes place in a balance between "the creativity of the individuals who [engage] in the composition and performance of new works, and the functional characteristics of the resources used in the course of their production" (Manning, 2013, p. 245). Compositional concepts and cultural and aesthetic values "as much as the design or possibilities of a particular machine [...] can determine how users interact with technology" (Katz, 2010, p. 131). While acknowledging this balance in which technology-aided composition takes places, the section below focuses specifically on aspects of device interaction impacting on composition.

2.1. Device interaction in analogue studio composition

From the 1940s and throughout the 1950s, an increasing number of composers began to work in the environment of the analogue studio. An early example is the Egyptian composer Halim El Dabh, who created an acousmatic work, the fixed media composition *The Expression of Zaar*, as early as 1944. He made field recordings at various locations in Cairo with a wire recorder, a predecessor of the tape recorder, employing magnetic steel wire. These field recordings he took to the studio of Radio Cairo, where he "edited and re-recorded the music onto magnetic tape, [...] manipulated the playback voltage, speed and direction and constantly shifted the moveable walls of the recording studio" (Bradley, 2015). He also applied extensive filtering, aiming to obscure fundamentals and emphasise higher partials of the recorded pitch material. Thus, Al Dabh applied two overarching categories of device-based intervention: manipulating the playback, through tape editing and changing playback speed and direction; and changing the sonic identity of the recordings, through the application of filtering and acoustic manipulation. Both categories of intervention would become leading principles in the ensuing development of studio-based compositional practices.

Importantly, both categories of intervention involved the composer's direct interaction with the devices. From this viewpoint, El Dabh's practice meant a break with the past. When composing for musical instruments, one can choose whether or not to physically interact with the instrument in the compositional process; but for El Dabh, composing with wire and tape recorders, device interaction was a requirement. His practice thus created an "equivalent to putting a performer in the position of a composer" (Battier, 2009, p. 113). This physical involvement of the composer, as well as the fact that the devices "were not originally developed as musical instruments" (Smyrek, 2013, p. 92), would arguably result in novel compositional practices.

El Dabh's novel practice was soon followed by Pierre Schaeffer's studio-based *musique concrète* practice, which made available "everything in the world as materials for music, each item as valid as any other" (Sinker, 2002, p. 189). Recording provided him

with sounds "without having to produce them"; in order to work with them "all we have to do is push the button on a tape recorder" (Schaeffer, 2007, p. 81). Schaeffer worked with field recordings, as well as with sounds recorded in the studio. The resulting hands-on experimentation introduced Schaeffer as a performer within the compositional process, interacting with the recording devices, sounding objects, as well as with proper musical instruments.

Starting to develop his practice from 1948 in the Radiodiffusion-Télévision Française studio in Paris, Schaeffer initially used record players and disc cutters, a mixing desk, reverberation unit, filters and microphones. In 1951, when RTF provided Schaeffer with a new studio, and particularly with the more versatile tape recorder, despite the arduousness of the record players and disc cutters as compositional tools, the "initial reaction was singularly unenthusiastic, for the long and close association with the old equipment had fostered a methodology such that its limited facilities had become a major part of the musical process" (Manning, 2013, p. 25). This may well illustrate device interaction being tightly connected with compositional practice.

Schaeffer soon set out to perform his work for audiences. Attempting to bring liveness to performances, Schaeffer (2012, p. 65) experimented with the distribution of sound through space: "We had to give a little flick of the thumb to the potentiometers and create some interpretative space". The potential of loudspeakers toward liveness in the performance of acousmatic music was recognised by other composers as well. The landmark performances of Edgard Varèse's *Poème Électronique* and Iannis Xenakis' *Concrete PH* in the Philips pavillion at the 1958 World Exhibition in Brussels are an example of such liveness apparently having been achieved successfully, through "the site-specific nature of the music and the necessity of the 300 speakers and real-time sound manipulation" (Laudadio, 2016, p. 6). According to a critic present at the Philips pavillion "[o]ne does not listen to sound, one lives it" (Trieb and Feliciano, 1996, p. 210). Such practices brought the sound engineer into play as an "acousmatic performer" (Stansbie, 2013, p. 147). In some cases, as in Schaeffer's practice, composers themselves might serve as acoustic performer. In other cases, as in the 1958 Philips pavillion, such tasks were delegated to dedicated sound engineers.

Two other examples of works in which a composer consigns technological device interaction to performers deserve mentioning here. John Cage, following his landmark tape composition *Williams Mix* (1953), composed a number of works for radios, such as *Radio Music* (1956). In these works, performers turn the radio's dials according to precise instructions in the musical score, leading to fully indeterminate sounding outcomes - precisely as desired by the composer. In these compositions, the device's user interface was leading in the conceptualisation of the work. Similarly, in *Acustica* (1968-70) by Mauricio Kagel, a number of devices are operated by performers, according to Kagel's precise indications. While in *Radio Music* the radio is operated according to its basic functionality, in *Acustica* the interaction with the devices, most notably a gramophone, is subjected to a range of "extended techniques", expanding the devices' sonic scope, and making the interaction topical within the work.

Karlheinz Stockhausen started working in the electronic studio of the Westdeutsche Rundfunk in Cologne in 1953. In 1963 he was appointed director, and from 1971 until 1990 he was the studio's artistic consultant. From the viewpoint of device interaction Stockhausen's *elektronische Musik* practice required great operational virtuosity. As Manning (2013, p. 66) states, other composers "have rarely approached such a thorough mastery of the techniques of sound synthesis". While in *musique concrète* pre-recorded sound formed the compositional material, Stockhausen's initial focus was on sound synthesis. He aimed "to bring forth what no instrumentalist could ever be capable of playing" (Stockhausen, 2007, p. 379). In a work like *Kontakte* from 1958-60, each sound was painstakingly created by means of oscillators, noise generators, filters, tape recorders, reverberation units, mixing desks, and through extensive tape editing. In such a practice, unlike in *musique concrète*, musical outcomes could only be auditioned at the end of the synthesis process; advance planning was thus required. For this purpose, Stockhausen worked with visual sketches and realisation scores, directing the studio creation process. In the practice of Stockhausen, and of other electronic music composers, notation, albeit in highly individualised forms, and to various degrees of precision and detail, preceded in-studio composition.

Beside Stockhausen's electronic music practice according to precise planning and execution, and the *musique concrète* practice of "sound crafting", often following just "the most general concept of a structural plan" (Holmes, 2020, p. 27), another approach to in-studio composition were automated device-based processes, developed in the 1960s and 1970s. In such practices, the analogue device, in particular "the tape recorder itself becomes an integral cog in the process" (Holmes, 2020, p. 46). Multiple tape recorders synchronously recording and playing back in continually repeating and evolving loops and/or delays allowed, in Eno's words, to "set things in motion that would produce far more than I had predicted" (McDermott et al., 2013, p. 226). Examples are Pauline Oliveros' *I of IV* (1966), for two recorders with live sound input and additional reverberation (Holmes, 2020, p. 46), and Terry Riley's *A Rainbow in Curved Air* (1969), originally recorded with tape delays and overdubbing in a studio setting, subsequently often performed live. Such analogue automated processes were paralleled by computer-based automated practices, to be discussed below.

As the examples above demonstrate, analogue studio-based compositional practices required the composer's interaction with the devices, unlike earlier practices in which composers did not necessarily have to interact with instruments. Aspects of the devices' interfaces, such as the playback and recording functionality of the tape recorder, the dials on the radio, or the playback of sound through loudspeakers, afforded and stimulated novel approaches. The following section looks into aspects of interaction in early computer music, and related compositional approaches.

2.2. Early computer music and aspects of interaction

While in the course of the 1950s the analogue studio gradually came within reach of composers aiming to involve themselves with electronic or electroacoustic music, the computer took longer to establish itself widely as a compositional tool. Early mainframe computers were ordinarily only available to composers within institutional settings. Since they were shared resources, even then computer access was limited. Also, "[m]ost facilities could not synthesize sounds directly from computers" (Holmes,

2020, p. 397), and if they could, composers "invariably encountered significant delays, perhaps extending to many hours, between submitting synthesis tasks to the computer operators and collecting the resulting data" (Manning, 2013, p. 192). Two minutes of music for J.K. Randall's *Lyric Variations for Violin and Computer* (1965-68) "took 9 hours to process on one of the fastest computers of the day" (Holmes, 2020, p. 395). Such limiting circumstances "left no opportunity for any interactive experimentation" (Manning, 2013, pp. 192-3), and the actual compositional work needed to be completed before interacting with the computer - in stark contrast with analogue studio composition practices at the time.

However, using the computer to conduct calculations toward the composition of works for instrumental performance "proved to be a fruitful line of exploration that provided composers with a powerful tool to more fully realize their visions of complex, mathematically rendered compositions" (Holmes, 2020, p. 397). In 1957, Leonard Isaacson and Lejaren Hiller conducted the earliest full-fledged computer-aided compositional process, utilising University of Illinois' *ILLIAC* computer. The project was well documented in their book "Experimental music; composition with an electronic computer" (1959). The resulting *Illiac Suite for String Quartet* proved that the computer could indeed "provide a novel means for studying and exploiting certain techniques of musical composition which can be utilized to produce both conventional and unconventional musical structures" (Hiller and Isaacson, 1959, p. 177). After the Illiac project, Hiller went on to develop, together with Robert A. Baker, the computer programme *Musicomp* (MUsic SImulator-Interpreter for COMpositional Procedures), designed to "automate parts of the composing process" (Holmes, 2020, pp. 398-9), and resulting in, amongst others, Hiller's *Computer Cantata* for soprano, ensemble and computer-generated sounds from 1963 (Hiller and Baker, 1964, pp. 62-90).

Also Iannis Xenakis, when obtaining access to a computer, started using it to generate musical material, freeing himself from the "tedious calculations" (Xenakis, 1971, p. 144) he had been making manually so far, and allowing him to "devote himself to the general problems the new musical form poses". His aim was not to refrain from musical control over the music material; "uncertainties introduced in the programs"

still enabled the composer to "instill his own personality in the sonic results he obtains". Following the initial computer-based generative process, decisions on material and form were made by the composer. Xenakis' approach would inspire a range of practices of other composers, using algorithms to generate "a population of designs" and to "[evaluate] them according to aesthetic or other critera", thus making "certain compositional tasks easier or more pleasant" (McDermott et al., 2013, p. 223) - or even feasible: according to Dutch composer Danny de Graan (interviewed 15 May 2018, Appendix 2), who uses algorithms extensively in composing concert music, "to do this completely manually [...] it's not possible. Too many choices are made".

For computer-based composition involving sound synthesis, it was necessary to "specify all aspects of the synthesis process in advance" (Manning, 2013, pp. 192-3), by means of commands "at the level of software coding whether in terms of textual or object-oriented programming languages" (Marrington, 2016, pp. 52-63), thus bringing the composer "closer to the computer-as-calculator". Consequently, in early computer composition, programming skills were indispensable. In fact, most early computer music composers were also active as programmers. Max Mathews pioneered programming languages for computer-based sound synthesis with his *Music I*, written in 1957. In 1960, his *Music III* introduced the groundbreaking concept of so-called Unit Generators. These were pre-built discreet functions within the programme such as oscillators, filters and envelope shapers, allowing composers to "flexibly connect multiple UGs together to generate a specific sound". *Music III* also introduced a "'score' stage [...] where sounds could be arranged in a musical chronological fashion" (Crab, 2021). *Music IV*, developed with Joan Miller, followed in 1963, and Mathews' final version *Music V* a few years later. Mathews' pioneering work on the *Music* programmes formed the basis for subsequent music software, and for the development of new methods of sound synthesis, by John Chowning, Barry Vercoe, Curtis Roads, Jean-Claude Risset, Miller Puckette, and others. In 1988, Puckette released the first version of *Max*, a programme initially enabling sound synthesis in connection with external devices, later also internal sound synthesis real-time signal processing. It was, and is, predicated on "the notion of a patchwork of devices and connections, represented graphically as a matrix of boxes and connecting

lines" (Manning, 2013, p. 375). Each box, or object, has a particular functionality - reminiscent of Max Mathews' Unit Generators from 1960. *Max*, followed by James McCartney's *SuperCollider* and Puckette's open source programme *Pure Data*, both released in 1996, became some of the major tools for sound synthesis and signal processing. Today, they continue to enable composers and musicians building their own virtual devices, to interact deeply with the underlying processes through coding, and particularly, to achieve such processing in real-time. And in their provision of discreet functional units, the chronological organisation of musical data, and the interaction through text coding, they "can be traced back to early computer music programming" (Young, 2016, pp. 80-1).

While text coding in early computer composition allowed for conducting calculations toward concert music, as well as for sound synthesis, "it is clear that graphical, rather than textual interfaces offer the most immediacy of interaction" (Marrington, 2016, pp. 52-63). It was again Mathews, together with Lawrence Rosler, who pioneered such graphical interaction in 1968 with the programme *Graphic 1*. This programme "could translate images drawn with a light-pen on a display terminal into synthesized sound" (Holmes, 2020, p. 397). Holmes states that Mathews and Rosler were thus "responsible for introducing the concept of interactive, real-time composition on a computer screen with cut-and-paste capabilities, years before personal computers would make this functionality commonplace". Iannis Xenakis, in his turn, "conceived of a mechanical device that would convert visual images directly into musical notation" (Demers, 2010, p. 133). This resulted in the *UPIC* (*Unité Polyagogique Informatique CEMAMu*) system in 1977. The author was fortunate enough to be able to try his hands on the *UPIC* system in the early 1980s, when Xenakis brought it to the Festival Nieuwe Muziek in his hometown of Middelburg, The Netherlands. It would take until 1985 before graphical systems such as *Graphic 1* and *UPIC* would be succeeded by the graphical user interfaces of the first MIDI-based DAWs such as MOTU's *Performer* and Steinberg's *Pro-16*, as will be discussed in more detail below.

After the arrival of the microprocessor in the late 1970s, the era of the mainframe computer came to a close, and computer technology became much more affordable,

and thus accessible. In particular the availability of microcomputer components allowed "those interested in tinkering with handmade electronic music instruments to continue on a path begun earlier with analog technology" (Holmes, 2020, p. 420). As David Behrmann states in Nicolas Collins's book *Handmade Electronic Music; The Art of Hardware Hacking* (2020, p. xiv), the instinct of such soldering composers told them "to rebel against this “obedient” mode in which artists [...] are pushed into continually buying, from ever-growing corporations, the latest computers and software packages". Instead, they used "trickle-down technology of the computer industry, the cheapest chips, and mass-produced kits and circuits", and operated "very close to the level of the machinery itself" (Holmes, 2020, p. 420). At the crossroad of programming, composing and performance they created unique and idiosyncratic electronic instruments and controllers, as alternatives to the computer keyboard, which "reduces performing to a pretty indirect activity, like trying to hug a baby in an incubator" (Collins, 2020, p. xv). In 1984, Dutch composer-performer Michel Waisvisz developed *The Hands*, consisting of "a pair of metal devices strapped to his hands", with keys and movement sensors allowing him to send "control signals to sound modules to generate sound in real-time", utilising "a small computer worn by the performer" (Holmes, 2020, p. 136). Practices might involve soldering, and/or coding. In 1986 Laurie Spiegel developed her *Music Mouse*, operated with the computer mouse as the controlling device, and denoted by Spiegel as an "intelligent instrument" (Holmes, 2020, p. 414). It is described by Holmes as an "enabler of music making rather than a programming environment". It provided a graphical interface with pre-defined controls, "that were all played using a [...] cursor that was moved with the mouse on a visual grid". Practices have continued until today, "adding analog spice to the increasingly digital musical meal" (Collins, 2020, p. xv). The British composer, performer and instrument builder John Richards (2008, pp. 25-31) speaks of "[d]irty electronics" as "a notion of the postdigital, the self-made and do-it-yourself in contrast to the mass-produced".

Analogue automated processes, such as Brian Eno's works involving tape loops and delays, were discussed above in the context of the analogue studio. Similar processes were applied in early computer music, oftentimes by using algorithms to generate music. Once a process was initiated, the algorithms would create "the musical

outcome unattended or with some managed degree of human interaction" (Holmes, 2020, p. 38). An early example is Peter Zinovieff's *Partita for Unattended Computer* from 1968, which showed that "the computer could be programmed to store and randomize sequences of tones, which could then be recalled and played back " (Holmes, 2020, pp. 403-4). Paul DeMarinis also pioneered automated processes, initially applying electronic circuits, as in *The Pygmy Gamelan* (1973), in which the circuits "respond to electrical fluctuations in the galaxy by improvising around five-note phrases" (DeMarinis, 2021). In 1980, five years before the *Music Mouse*, Laurie Spiegel wrote a programme that "embodies a procedure for composing, except that instead of humans playing from that score, a machine does" (Spiegel, 2021), resulting in her work *A Harmonic Algorithm*, which would run as long as the programme was allowed to. Since 1984, the American composer and scientist David Cope has generated music emulating a wide range of historical styles with his *EMI* (*Experiments in music intelligence*) programme (Cope, 1987), since 2009 under the pseudonym Emily Howell. These and other fully or semi-automated compositional practices, generally based on algorithmic programming, demonstrate how "[c]omputers are embedded into the act of music creation so profoundly they become not just facilitators but quasi-creators" (Young, 2016, p. 80).

Ultimately, the increasing accessibility of the computer brought the personal computer "on the desktop of the composer" (Holmes, 2020, p. 416). Composers who had grown up with the "immediacy of response provided by the analogue studio" (Manning, 2013, p. 192) could now "undertake the advanced synthesis and audio manipulations that previously were possible only in the composition studio" (Young, 2016, pp. 91-2). In other words, the computer enabled composers to emulate analogue studio techniques. But beyond that, it allowed them to extend and enrich their practices with "applications of other disciplines" such as "mathematics (chaos and fractals), acoustics (physical modelling), linguistics (generative grammars), psychology and psychoacoustics (timbral and spatial manipulations) and information science (including internet applications)" (Emmerson, 2007, p. 70). The computer thus became a comprehensive working environment toward realising musical work, enabling composers "to explore, more deeply, the very conceptual frames in which

musical ideas might be imagined and realized" (Hamman, 2015, p. 2). Next to its increasing affordability and affordances, a key factor in this coming of age of the computer was the introduction of the MIDI communications protocol.

2.3. MIDI and the DAW

Throughout the development of electronic instruments such as synthesizers and samplers, the lack of connectivity between devices had provided concerns. As Peter Howell of the former BBC Radiophonic Workshop states, such devices were "standalone and not connected to anything else". In the early 1980s, when "the long line of analogue development [...] was to end, and be replaced by digital technology" (Howell, 2021, p. 215), such issues became increasingly pressing.

In 1980 a consortium of American and Japanese music technology companies took up the task of developing a protocol that could serve as a "'universal' digital communication system" (Anderton, 2021) for musical devices. The resulting MIDI protocol first featured on the *Sequential Prophet-600* synthesizer in December 1982; it was widely introduced in 1983. MIDI not only allowed one master keyboard to control other devices, but more importantly, it provided a universal language for musical devices. MIDI data could be entered in real-time through performance on a music keyboard or other controller, or be programmed for automated playback, so-called sequencing. While primarily developed as a Universal Synthesizer Interface, MIDI enabled transfer not only of note information (such as note on-off, key pressure and velocity), but of any other data, programmed to utilise the MIDI number range of 0-127, its 16 channels, and other basic MIDI parameters. This made it a versatile and effective protocol, potentially applicable beyond controlling synthesizers and samplers. Particularly MIDI's timecoding functionality would prove important for subsequent developments.

MIDI was soon applied in the context of the MIDI studio, involving "a computer controlling a host of synthesizers, samplers, and processors" (Lehrmann, 1989, p. 60).

MOTU's *Performer* and Steinberg's *Pro-16*, both introduced in 1985, were among the earliest programmes enabling such computer-controlled MIDI recording, playback and editing. Early MIDI programmes often required user interaction through scrollable lists from which data had to be cut, copied and pasted (Howell, 2021, p. 221). Such lists are in fact still integral to present-day DAWs, as a layer underneath the graphical user interface.

Also in 1985, Digidesign introduced *Sound Designer*, a programme enabling the editing and triggering of samples (snippets of recorded audio) through MIDI communication with a standalone sampler. This programme featured a graphical user interface displaying audio waveforms (Mellor, 1988, p. 24). In 1989, Digidesign released *Sound Tools*, now providing computer-based digital stereo audio recording and editing rather than controlling an external sampler, and displaying the audio waveforms on a timeline, based on MIDI timecoding (Lehrmann, 1989, p. 60).

In 1984, MOTU released its *Professional Composer* programme, a MIDI sequencer offering musical notation. In 1987 and 1988 respectively, C-Lab released *Creator* and *Notator*, also featuring musical notation (Waugh, 1988, p. 22). Such programmes enabled composers to notate their music within the MIDI sequencing environment.

In 1988, Miller Puckette's application *Max,* developed at the Institut de Recherche et de Coordination Acoustique/Musique (IRCAM) in Paris, was first used in composition. As explained above, it was, and is, predicated on "the notion of a patchwork of devices and connections, represented graphically as a matrix of boxes and connecting lines" (Manning, 2013, p. 375). Initially it was only able to send control message to external hardware devices, through MIDI or other communication protocols. Subsequently, internal signal processing (MSP) was achieved with the IRCAM Signal Processing Workstation (ISPW), utilising the NeXT computer. In 1990, the Opcode company released a first commercial version of *Max*.

Opcode's MIDI sequencing programme *Vision*, introduced in 1989, was followed in 1990 by *Studio Vision*, allowing the recording and editing of both MIDI and audio, by

enabling a MIDI sequencer "to also handle digital audio recording, editing, and playback" (Lehrmann, 1991, p. 30). All main functionalities of the DAW were now united, and accessible through a graphical user interface (Levine, 2019), through the agency of MIDI - only seven years after the introduction of the protocol.

In 1991 Digidesign introduced *Sound Tools*' multitrack successor *Pro Tools*, which would develop to become one of the leading DAWs. Digidesign's own DSP (Digital Sound Processor), which handled the sound processing, played a major role in this rise to prominence. It relieved the computer processor and greatly improved the resulting sound quality. DAWs such as *Cubase* and *Logic* followed, the latter also continuing the legacy of C-Lab's musical notation functionality. *Logic* was also one of the first to include virtual instruments within the programme, so that composers didn't have to rely on external (virtual) instruments.

A bias integral to MIDI sequencing was the placement of notes 'on a grid', and consequently a tendency toward regularity of pulse. This made sequencing applications a natural match especially with a pulse-based genre as pop music. In other genres, regularity of pulse was not as common. Functionalities such as quantising (placing notes on the grid) and its reverse, humanising (removing notes from the grid through controlled randomness), did allow for averting the grid bias. Also pitch was standardised in MIDI, although affordances for master tuning adjustment, glissandi, and a choice of modes allowed for nuances in pitch. However, these biases required additional efforts unknown to composers working in the analogue studio, in early computer composition, or with manual musical notation.

DAWs such as *Studio Vision*, *Pro Tools*, *Cubase* and *Logic*, combining audio and MIDI functionality, and *Max/MSP*, focused on live processing, removed or diminished the impact of such biases. Although audio recording, playback and editing were handled by MIDI timecoding, DAWs could now be operated free from the pitch or time grid, with the notable exception of music notation; this continued to "slavishly embody the worst excesses of the definitive and prescriptive aspects of notation within the western tradition" (Emmerson, 2000, p. 121). With the inclusion of effects and mixing

functionality, such programmes provided a true replacement of the analogue studio. Built-in sound synthesis, signal processing, MIDI sequencing, the use of virtual instruments, and the inclusion of musical notation, extended the range of possibilities.

Importantly, the graphical user interface bypassed text coding, obviating the need for programming skills. The DAW thus made computer-based composition accessible to those who were, from a technological viewpoint, not necessarily expert users. It provided a viable computer-based compositional environment for an increasing number of composers.

Thus the modern DAW serves as a comprehensive, integrated and continuously developing working environment - so comprehensive that users might perceive it as a Digital Audio World, rather than Digital Audio Workstation. MIDI has proved to be instrumental in this.

2.4. The impact of the DAW's affordances and user interface on composition

The MIDI-based DAW, with its graphical user interface, brought computer technology's "most detailed control of the internal parameters of sounds" (Wishart, 1996, p. 5) within comparatively easy reach of those wanting to involve themselves with computer-based composition. In comparison with analogue technology, the level of control and access to details in digital media is so extensive that John Cousins states: "I have no excuses: if it doesn't work, it's my problem" (Hoskins and Meehan, 2019, pp. 94-5). But, as the time and pitch grid issue demonstrated, the DAW does not provide a neutral working environment. Programme and interface design have "particular consequences for creative decision-making and workflow" (Marrington, 2016, pp. 52-63). Some biases may be unintentional, some difficult to avoid due to limitations in hard- or software, still others purposely built into the software, since "designers can integrate affordances into their interfaces so users will gravitate to desired interactions" (Wallis et al., 2013, p. 56). Biases apart, many composers have learnt to work within the steadily evolving DAW environment, developed ever new

compositional practices, and created novel and idiosyncratic works, proving that "[using] technologies in a different way than predicted by designers" (Scipio, 1997 1997) is common practice in computer-based composition.

Below, a number of characteristics and affordances of the DAW and its user interface, and their potential impact on composition, are described. Some aspects may be considered unique to the DAW environment; they feed in the discussion of the five portfolio compositions.

In the first place, the DAW enables "the organization of material on a timeline" (Marrington, 2016, pp. 52-63). This timeline is a powerful tool for creating and controlling large form. Material can be placed on, and shifted across, the timeline, and, as John Cousins states, "[t]he form emerges as the work progresses" (Hoskins and Meehan, 2019, p. 103). Users can zoom in and out, viewing detail or larger form, and scroll, moving swiftly between sections. This affordance of "virtually instantaneous addressing of data at any point" (Waters, 2000, p. 58) forms a fundamental difference with analogue storage, which "allowed only linear access". Composer John Psathas speaks about being able "to jump back in time, to something you were thinking about [...] to be able to go back and look at that and just compare it" (Interview with Psathas, 22 March 2018, Appendix 1). Musical material can also be displayed in different formats, such as waveforms, so-called piano roll view (graphical display of MIDI note data according to the piano keyboard), and music notation in some DAWs.

Secondly, audio editing is much more convenient in the DAW environment than it had been in the analogue studio. Musical material can be treated according to "operating principles known from film and video editing applications, as well as from text processing software, the main ones of which are *copy* and *paste*, as well as *freeze*, *frame* and *loop*" (Waters, 2000, pp. 59-60). Such principles "have encouraged composers to work in a modular fashion" (Zagorski-Thomas, 2014, pp. 147-8). They build up their work "by the addition of smaller formal units until the piece appears as a completed jigsaw puzzle" (Marrington, 2016, pp. 52-63). Danny de Graan (interviewed 15 May 2018, Appendix 2) explains how he composes a fragment, "and

what I can do is place it further away along the timeline so that I don't occupy myself with it anymore. […] This way I can take and place hundreds of short fragments, and shift them around, put them in a specific order, and this can be done really fast". Generating and developing musical material, and constructing large form, thus often does not take place in an integrated process, but the composer's focus may shift from one to the other, throughout the compositional process.

Playback is a functionality that the DAW shares with the early analogue studio. It may assist in making compositional decisions, because "in the DAW you always hear a performance. When you press play, you just hear a performance" (Interview with De Graan, 15 May 2018, Appendix 2). In the words of Iannis Kyriakides (interviewed 22 March 2018, Appendix 3), "I do really appreciate that in a composition process I can step back and listen to what I've done". In a sense echoeing Pierre Schaeffer, Trevor Wishart (1996, pp. 123-5) states that playback allows for "the ultimate validation of any musical procedure through the unmediated and unprejudiced listening experience". Consequently, according to Wishart, "gestural structure can be finely tuned by the experience of aural feedback and *need* not involve any separate process of conceptualisation". How the use of playback interferes with the application of mental imaging on the side of the composer, commonly considered a key aspect of the composer's craft, is a point of consideration. In the words of John Psathas (interviewed 22 March 2018, Appendix 1), who composes exclusively in the DAW environment, "I can really only compose in a feedback situation, which is to hear what it is I'm writing, as I'm writing it".

Specific approaches may also be influenced, or even stimulated, by the composer's limited operational skills. Early analogue studio composers were often assisted by engineers; early computer composers tended to be accomplished programmers. Many DAW-based composers, however, are "not necessarily professionally trained engineers", and "'dabbling' with the tools" is often part of their practice. This may lead to "the discovery of new creative possibilities" (Marrington, 2016, pp. 52-63) - not unlike Brian Eno's in-studio approach of " fiddling around with all this stuff" (Eno, 2007, p. 95). At the same time, the "[e]ase of learning in interfaces" that designers

tend to strive for may result in "being locked-down, inflexible, inexpressive, or non-amenable to creative, unexpected use" (McDermott et al., 2013, p. 38). It is in this space between experimentation and control, between ease of use and operational virtuosity, that DAW composition tends to take place.

Another parallel with analogue studio composition lies in the DAW's affordance of capturing real-time performance. This may bring the composer into play as a performer during the compositional process; it thus allows for the experience of liveness in composition. Performership can be realised through audio recording, or by means of MIDI inputting devices such as a music keyboard or other controllers. It may be soloistic or collaborative. In pop music performership in composition is the rule; for composers creating concert music it might be more exceptional. By means of the DAW's "ability to recall multiple past states of creativity" (Marrington, 2016, pp. 52-63), compositional decisions can be made after the initial phase of generating musical material, be it soloistic or collaborative. An interesting question is how music resulting from such real-time compositional processes may be influenced by the performing idiosyncrasies of the composer, and possible contributors, and how this may translate to live performance of the resulting works.

The DAW's playback functionality, its ability to capture real-time performance, and the ordinary prevalence of display formats such as waveform or piano roll, enable DAW composers to *forgo* musical notation, particularly in the creation of acousmatic output. In the creation of concert music, DAW composition tends to *postpone* musical notation. It allows for a creation process without notational interruptions. Decisions regarding parameters to be captured in notation may be shifted to a subsequent notational phase. Such compositional practices based on "listening to and working with acoustic material", rather than "notational *logos"* (Wishart, 1996, pp. 123-5), may lead to subsequent notational challenges - as in the notation of any music of aural origins. At the same time, such postponed notation may serve as "a fine toothcomb [...] it makes you consider everything all over again" (Interview with Psathas, 22 March 2018, Appendix 1).

A final essential DAW functionality lies in its tools for (post-)production. They include editing, the application of effects, mixing, and mastering. For many composers, also those creating primarily concert music, DAW production has become an integral part of their compositional practice. As a result, what composers experience in their home studio, in the "composer's space" (Gibbs and Dack, 2009, pp. 182-3), may increasingly be perceived as a performance in its own right: an emulation of a performance in the case of concert music; or an end product in the case of fixed media. Key aspects in the former case are the computer's "note-perfect performances" (Katz, 2010, p. 212), and the composer's ultimate control of the sonic output. Danny de Graan (interviewed 15 May 2018, Appendix 2) states that "I have to admit that I sometimes prefer the MIDI version above the performed version [laughs]". Such a stance may place high expectations on performers, thus impacting on the practice of live performance. In the latter case, acousmatic composer John Cousins speaks about his appreciation of listening through loudspeakers, in his home studio. It provides him with "a visceral, emotionally and psychologically powerful aesthetic experience" (Hoskins and Meehan, 2019, pp. 77-8), as relevant to him as public performance. Such experiences in the composer's space may place high demands on the realisation of compositions in a performance setting, away from the ideal listening circumstances of the home studio.

2.5. The impact of the DAW on De Graan, Kyriakides, Psathas and Westerkamp

In the context of this research, four composers were interviewed about their work, to a large extent created within the DAW. Their approaches partly informed the conceptualisation of the five portfolio compositions, and partly fed into the contextualisation and evaluation of the portfolio.

John Psathas (interviewed 22 March 2018, Appendix 1) is a New Zeleand composer who composes exclusively within the DAW environment. Though in the first place an instrumental composer, he has created many works with fixed media. Psathas fully relies on the DAW in his compositional approach, since he "can really only compose in

a feedback situation, which is to hear what it is I'm writing, as I'm writing it." Through such aural feedback, "it's like there's another person and you're responding to what you're hearing", and "myself and the software were performing the music together at that point, to each other". In this setting, composing for Psathas becomes "always a very intense experience". He notes that with the increasing quality of sound libraries, "the MIDI demo version that I would create became more and more, I suppose, acceptable as a final result". In his interaction with performers this may create high expectations, so that "it's never quite good enough. Because I have this kind of perfect, pristine vision". In his workflow nowadays, a work is entirely finished in the DAW before notation: "I forget completely about the score and I just write the whole piece". In his use of electronics, Psathas states that he prefers fixed media above live electronics, since "there is security in there, because it will always be the same, it will always be perfect". Yet, in performance of his many works for performer(s) and fixed media, he does "put the performer in the foreground of the storytelling all the time". In all of Psathas music involving electronics, "the performers are really working hard [...] because they have to sell the work, not the electronics". Psathas' reliance on sound libraries, and on auditive feedback during the compositional process, have provided important considerations during the research process, and the compositional process of the portfolio works *Variances*, *Rapprochement* and *Transits*.

Composer Danny de Graan (interviewed 15 May 2018, Appendix 2) composes in a software environment, utisiling the DAW as a central tool, but also applying a range of other applications, each for its specific affordances. His output consists of concert music, acousmatic and electroacoustic work. De Graan states that as a composer and musician, the computer is his instrument. He frequently works with algorithms, since he is "very good at programming things. I can make a pattern, turn it around, make an algorithm that can do that for me. And very complex", much more so than if he would compose in notation or with a piano keyboard. Whereas he uses many different software applications, he increasingly focuses on the DAW, since in realising the required transformations and processing, "I've now got plugins that do it, all in real-time, so I don't need to programme it. [...] It saves me a lot of time, and I can try a lot of things immediately in *Logic*". In his use of the DAW, he particularly appreciates the

DAW's timeline, allowing him to "compose a fragment [...] and what I can do is place it further away along the timeline so that I don't occupy myself with it anymore. [...] This way I can take and place hundreds of short fragments, and shift them around, put them in a specific order, and this can be done really fast". Just as Psathas, De Graan sees the reliance on sound libraries in DAW composing as a potential risk, since "you become dependent on the samples you use, and you expect that these samples are a translation of reality. And oftentimes that isn't the case". Yet, through the MIDI versions of his works he knows "exactly how my pieces should sound! I know exactly when someone makes a mistake, during a rehearsal or performance". This may result in a situation in which "in your mind there's a certain strictness, and in rehearsal that imagination will loosen up a bit. In the past I found that hard; now I can let go a bit more". De Graan's use of a variety of applications, with the DAW as the central tool, has impacted especially on the creation of the portfolio composition *Fossils I-VII*.

Like De Graan, composer Yannis Kyriakides (interviewed 22 March 2018, Appendix 3) creates concert music, acousmatic and electroacoustic work; he is also active as a performer utilising live electronics. Kyriakides uses many different software applications, each for its specific affordances. Yet, the DAW is for him the central tool: "I use primarily *Logic*, actually, really for the creative process, for putting ideas down, and seeing how they work together". He sees advantages but also risks in reliance on the DAW's timeline: "Probably you could say with a DAW, sometimes it fixes you too much to a fixed timeline". Kyriakides appreciates the perception of a work in the composer's space, and aims to emulate this in a concert setting: "In general, you want the experience of the studio to be transferred to the concert hall". He finds the acoustic characteristics of concert venues, the listener's space, often problematic, since "these buildings are often made with a specific idea about sound". In the realisation of his works in concert, Kyriakides is "always sensitive to [...] giving space for the musicians". In his use of electronics, they serve as "this kind of malleable element, this other ensemble player". The interplay between live performance and electronics is important for him: "when the electronics do take over, that it is only temporarily, to remind the presence of this other thing. This constant chance of perspective is important". While Kyriakides appreciates freedom of interpretation of

his works in concert, he does aim for a precise result in produced recordings of his work, which may serve as a reference: "in the final stage that has to be perfectly done". At the same time, "it doesn't mean that it's the definitive version". Finally, about the role of notation, he states that "for some composers the logic of their work really comes from the score". For him it is the other way around: "I have an idea what I want, and the score is somehow the sketching out of this". Kyriakides' aim for a wide interpretational scope for his instrumental works contrasts with the approaches of Psathas and De Graan, and has been inspirational in the creation of the portfolio compositions *Shutterspeed* and *Fossils I-VII*.

Unlike De Graan, Kyriakides and Psathas, for whom the computer was the central compositional tool from very early on, Hildegard Westerkamp (personal communication, 9 January 2021, Appendix 4) has a background in analogue studio composition, and in particular the use of field recordings. Such recordings inform the compositional process: "I never have a preconceived structure for my pieces, precisely because in my experience the recorded materials will allow for a structure to emerge". As in the practice of the early *musique concrète* composers such as Pierre Schaeffer, in Westerkamp's compositional practice listening plays a key role: "From that careful listening then comes a creative process that acknowledges the inherent quality of a recorded sound or soundscape and may inspire a change in the compositional process". Such an approach " requires flexibility and a love for improvisation", since "new discoveries are made that may lead the piece in a different direction than originally thought". Westerkamp often works with the recorded human voice. Like Heiner Goebbels, in working with the untrained rather than the vocally trained voice, people can "access their natural voice, their expressiveness and feelings". This approach in working with the voice "[opens] up interesting possibilities and ways of vocal expressiveness".

In this chapter, some key characteristics of the analogue studio, early computers, and the DAW were defined, and the role of MIDI in the development and functionalities of the latter. Aspects of device interaction and characteristics of user interfaces were discussed, and their potential impact on compositional practices, including those of

the interviewed composers Danny de Graan, Yannis Kyriakides, John Psathas and Hildegard Westerkamp. They now feed into the discussion of each of the five portfolio compositions.

3. *Variances*; jamming across time and place

The aim for the first portfolio composition *Variances* (2017-21) was to research how a quasi-collaborative improvisational experience could be realised in a DAW-based compositional setting, with the composer as a DAW performer. How might the resulting work maintain a sense of the liveness and improvisational character from the compositional phase, captured in music notation, and transported to live performance?

The work was composed in a DAW configuration involving:

- *Logic X* as the creation environment;
- the placement of recordings of pre-existing music on the DAW timeline;
- manipulations of the metronome speed across the timeline, following the tempo nuances of the pre-existing music;
- spectral analysis of the pre-existing music in a separate application, *Transcribe!*;
- and composition of the various instrumental parts through MIDI keyboard performance along with playback of the pre-existing music, on the basis of the spectral analysis.

Variances was commissioned by the French Ensemble Variances. The work has a duration of 17 minutes. It features fixed parts for jazz guitar, percussion and piano, as well as an indeterminate ensemble, in the spirit of Terry Riley's *In C*, in which "[a]ny number of any kind of instruments can play" (Riley, 1964), and which offers flexibility in the interpretation of a given material.

3.1. Improvisation in compositional practices

Saxophonist and composer Steve Lacy once stated that "the difference between composition and improvisation is that in composition you have all the time you want

to think about what to say in fifteen seconds, while in improvisation you have fifteen seconds" (Rzewski, 2007, p. 267). In other words, "[w]hereas a composer might painstakingly score musical events over the course of hours or days, a practised improviser might create music of the same complexity with little effort, taking only the requisite time to produce the notes on the instrument" (Wallis et al., 2013, p. 59). Within the tradition of western art music, musical works "exist as repeatable entities" (Britannica, 2020); composing can be defined as "the act of conceiving a piece of music [...] or the finished product", and is "necessarily distinct from improvisation". Improvisation, then, pertains "a performance that is not practiced and that is invented by the performers" (Cambridge, 2020). It can be argued that this pronounced rupture between the two practices, and thus between composers and performers, points at a state of affairs in the past couple of centuries, specifically in western art music. Christopher Small (1998, p. 115) explains how notation has played a major role in the rupture; as soon as musicians start writing down instructions for performance, "the single process begins to split apart, separating composer from performers, composition from performance, and performers from listeners, centralizing powers in the hands of the composer". Simon Emmerson (2000, p. 123) argues that "one of western art music's increasing obsessions has been that of the 'fixity of the work'". Outside this tradition, musical authorship and degrees of fixity of material often function quite differently, again quoting Emmerson, relying "not on notes written but on notes performed in an interactive ensemble".

In the western tradition, many composers continue to notate their music, envisaging realisation in full detail by performers - although "[t]here's a lot more to music than what's on the page, in *any* music of *any* kind" (Zorn, 2007, pp. 197-8), and interpreters logically "assume something of an editorial role" (Gould, 2007, p. 118). The situation is certainly in flux, and has been so in the past half century. Improvisation, or flexibility in the interpretation of notated material, has been embedded in many compositions, in a variety of ways. But improvisation is also present in 'the composer's space'. John Psathas (interviewed 22 March 2018, Appendix 1) describes composition as "slowed down improvisation". And Jonathan Harvey (1999, p. 27) explains how "composers have started with nothing, but have found their way into a piece by a process of

improvisation". Steve Reich developed many of his earlier works, such as *Drumming* (1970-71), together with his own ensemble, through hands-on experimentation. Terry Riley used tape recorders in works such as *A Rainbow in Curved Air* (1969) making his music "emerge from a combination of composed [...] elements, improvisation and sonic manipulation through technology" (Toop, 1995, p. 194). Trevor Wishart (1996, p. 37) speaks of how "[e]xperience from the free-improvisation forum [can] be extended into the electro-acoustic studio".

How can improvisation serve compositional practices in a DAW-based setting? How may DAW-based composition incorporate a sense of liveness? As became clear in the previous chapter, the analogue studio allowed for circumventing notation in the compositional process, and brought the composer into play as a performer. In fact, recording technology "terminally threatens the deepest roots of the inherited art music paradigm, replacing notation with the direct transcription of performances and rendering the clear distinction between performance and composition null" (Cutler, 2007, p. 140). Brian Eno (2007, p. 129) describes studio composition as "[putting] the composer in the identical position of the painter [...] working directly with a material, working directly onto a substance". Mark Katz (2010, p. 212) states that technology allows composers to "act like performers, working directly with sound and forgoing notation". As in analogue studio practices, DAW-based composition may enable the composer to step forward as a performer, generating material through improvisation, forgoing notation, and achieving a sense of liveness in the compositional process, unavailable to the composer working directly with music notation. Whether resulting in acousmatic or concert music, such DAW-based compositional practices are rarely collaborative.

3.2. Jamming in the DAW

Jamming, encountered in many musical genres and cultures but not as often in western art music, indicates a practice of *musicking* as a "collaborative, improvisational experience" (Swift, 2013, p. 88). Improvisation, forgoing notation, and

liveness, are inherent to it. In his discussion of jamming in the context of improvisational computer-music, Swift (2013, p. 89) defines three goals of jamming: groove; flow; and connection. How can these phenomena be related to DAW-based composition?

Groove denotes here "an understanding of rhythmic patterning that underlies its role in producing the characteristic rhythmic 'feel' of a piece" (Middleton, 1999, p. 143). Although the term tends to be applied to live performance, commonly outside the context of western art music, it can be argued that music technology has stimulated, also in art music, compositional approaches with a major role for pulse or groove: "[c]omputer control [...] makes it possible to formulate new pulse-based lines, polyphonies and resulting forms, reopening the chapter of pulse, rhythm and repetition which Europeans had declared obsolete in the modernist 1950s" (Viñao, 1989). From a contrasting viewpoint, and demonstrated above in the discussion of biases of time and pitch grid in MIDI sequencing, David Toop (1995, p. 73) explains how "the drive of modernism has been harnessed to the dance and songs of machines". How pulse, rhythm and repetition might be approached in novel ways in DAW composition is a topic for investigation.

Flow, a term introduced by psychologist Mihaly Csikszentmihalyi, denoting "a state of mind in which a person becomes fully immersed in an activity" (Kerry, 2021), seems harder to achieve in DAW-based composition. In the one-take practice of the early days of recording, "the activities of a single musical exhalation" (Trezise, 2009, p. 284) were still dominant. However, in current practices "most music is recorded piecemeal" (Gracyk, 2009, p. 69). Similarly, as discussed in Chapter 1, DAW-based compositional practices tend to be modular, with smaller formal units arranged as in a jigsaw puzzle. How can a sense of flow be achieved in such compositional circumstances; "how can there be any question of inspiration, freedom, swing or poetry" (Chanan, 1995, p. 52)?

Achieving a sense of *connection* in a computer-based compositional environment poses perhaps the biggest challenge to the DAW composer. In genres such as pop music, studio-based collaboration is common practice: musicians, composer,

producer, sound engineers, may become co-creators in the studio, oftentimes "authorship [becoming] confused" (Chanan, 1995, pp. 144-5). But "the majority of music software is designed for single user operation" (Fencott and Bryan-Kinns, 2013, pp. 189-90), and composers of concert music tend to work autonomously. How can collaboration be attained, or emulated?

3.3. Virtual collaboration

R. Murray Schafer (1977, p. 162) stated that while "sounds are pronounced in time, they are also erased by time". Yet, François J. Bonnet (2016, p. 7) points out how recording can "reactualize [sound] on demand". Chris Cutler (2000, p. 105) explains how recording sounds in fact "will be their immortality", and adds that recorded music is "placed inevitably in the public domain". In other words, once recorded, music becomes 'up for grabs'. This phenomenon lies at the basis of a wide variety of compositional practices since the birth of *musique concrète*, Cutler's plunderphonics, as "direct importation and plunder" (Cutler, 2000, p. 96), being among the more radical examples.

The elevation of such practices to the digital realm has triggered new approaches. David Toop (1995, p. 88) dreamt of impossible virtual collaborations such as "Charlie Parker recording with Edgard Varèse [...] or the "lost" tracks of Prince with Miles Davies, Miles with Jimi Hendrix and other vaunted but vaulted collaborations". Pop singer Robbie Williams posthumously sang with Frank Sinatra in *It was a very good year* (2001) - a virtual musical collaboration. Can such virtual collaborations, through the use of pre-recorded music, and through "the microphone becom[ing] a time machine" (Amelides, 2016, p. 213), be embedded in the DAW-based creation of concert music? Also this question was dealt with in the compositional process of *Variances* for ensemble.

3.4. The concept of *Variances*

In the compositional process of *Variances*, jamming was deployed in generating compositional output, followed by more formal interventions with the material. To realise a jamming experience, musical partnership was required. Since the partnership was virtual, a suitable pre-recorded source music was selected and utilised. An important selection criterium was the unfamiliarity of the composer with the selected source music, allowing for an open-minded start of the compositional process, and an optimum jamming experience. Eventually, two historic recordings of Chilean-Hispanic folk music were chosen.

The first recording opens with a section of around three minutes, featuring a large group of panpipes (audio sample 1). These are not tuned to a collective pitch or scale, but perform in wide and dense clusters, accompanied by drums. There is a collective pulse, but it is very flexible, and the synchronisation within the ensemble is approximate. The panpipes perform in hocket: the group is split in two, and the two groups play alternatingly. The resulting material is rich in pitch content, timbre, timing, and tempo. The panpipe material was selected for the opening section of *Variances*. It will be further referred to as *Section I a*.

In the historic recording, this material is followed by a call-and-response section of slightly over eleven minutes, with a solo voice calling, and a group of voices and drums responding, continuously alternating between chorus and refrain material (audio sample 2). The material is constantly subtly varied in pitch and rhythm; these variations are at least partly triggered by the sung text. The tempo fluctuates extensively throughout the section. The material for solo voice is phrased and lyrical; the responses by the vocal group and drums are more accentuated and agitated. This rich and playful material was selected for the subsequent section *Section II*.

After *Section II*, there is a brief recapitulation of the first section; this is further referred to as *Section I b*.

The second historic recording, lasting five and half minutes, involves two Chilean guitars and a drum, playing a steadily repeating harmonic and rhythmic sequence, with continuous subtle motivic variations (audio sample 3). Unlike the material of the previous sections, the tempo is quite steady throughout. This material formed the input for the final section of *Variances*, referred to as *Section III*.

The selected source music informed and inspired the compositional process on many levels: form and structure; tempo, rhythm and timing; melodic and harmonic aspects. At the same time it provided ample freedom, serving as a 'canvas to paint on' rather than as a musical straitjacket. Also, the instrumentation of the new work was not meant to correspond necessarily with the timbres of the source music, but to develop its own timbral logic and identity.

Importantly, the source music is not present in the final composition, and consequently not in performance. A similar approach was used by The Residents on their *Opus 1970* album, on which they played along with well-known pop songs, subsequently erasing most of the source material (Cutler, 2000, p. 100). Gavin Bryars's work *1, 2, 1-2-3-4* from 1975 applies a similar strategy involving live jamming. All performers "listen to the same music on individual cassette tapes through headphones, playing along with what they hear rather than responding to each other" (McGraith, 2010, p. 122). The audience perceives only the live performance, not the cassette tapes.

On the basis of the partly flexible instrumentation of the commissioning ensemble, *Variances* was conceptualised for a core trio of jazz guitar, piano and percussion (drumset and marimba), plus a set of parts that can be freely scored for any combination and number of additional musicians. Such indeterminate instrumentation reflects one of the key aspects of jamming: allowing anyone to join in for a performance. At the same time it accommodates the key players of the commissioning ensemble.

Regarding Swift's three goals in jamming; groove was an important factor in all of the source music: its rhythmic patterning was essential in producing the characteristic 'feel' of the music. A sense of pulse, though flexible throughout, was dominant in the source music for *Sections I a* and *I b*. *Section II* was pulse-based, but with intricate text-based rhythm, and extensive tempo fluctuations. *Section III* was light and dance-like, more stable but not fully metronomically strict, with a peculiar quintuplet-like 'afterbeat' feel. Pulse and rhythm thus presented interest and variety throughout, and provided the compositional process with liveliness and playfulness. The source music consisted of live un-edited musical performances in one breath, bringing a sense of flow to the compositional process. And although connectivity would necessarily be one-directional, the nature of the source music provided the composer with at least a sense of musical collaboration.

3.5. Composing *Variances*

The selected source music was first imported into the DAW project, and placed on the timeline. Next, a functionality unique to the DAW environment was applied: the tempo along the entire timeline was adjusted exactly to the source music, through detailed tempo curves, and the adding of time signatures corresponding with the source music. This would assist in the editing process, and facilitate the notation. Also, a clicktrack was now available, precisely following the source music (Figure 1).

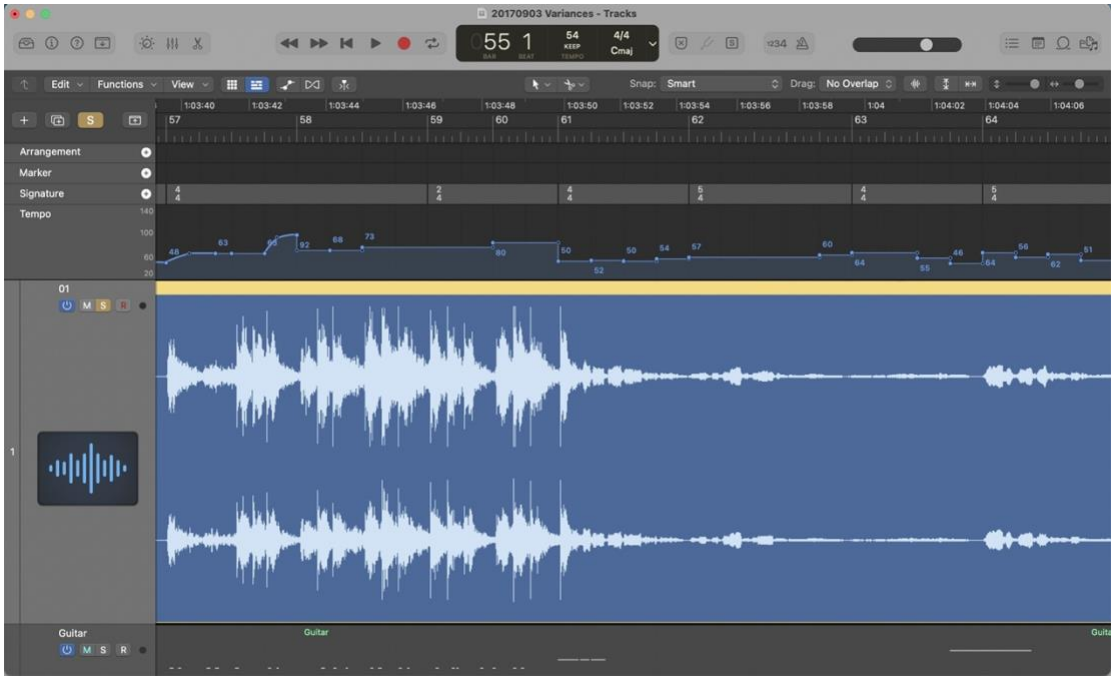

Figure 1: DAW timeline with meter and tempo adjusted to the source music

With the tempo curves and time signatures in place, another digital audio functionality was applied: all the source music was spectrally analysed, meaning that for the entire source music all distinct partials in the recorded audio were specified. A separate application, *Transcribe!,* was used for this spectral analysis (Figure 2). The resulting pitch reservoir, specified for each moment along the DAW timeline, served as the basis for jamming with the source music. It was also applied in further melodic and harmonic development of the generated musical material, during subsequent editing.

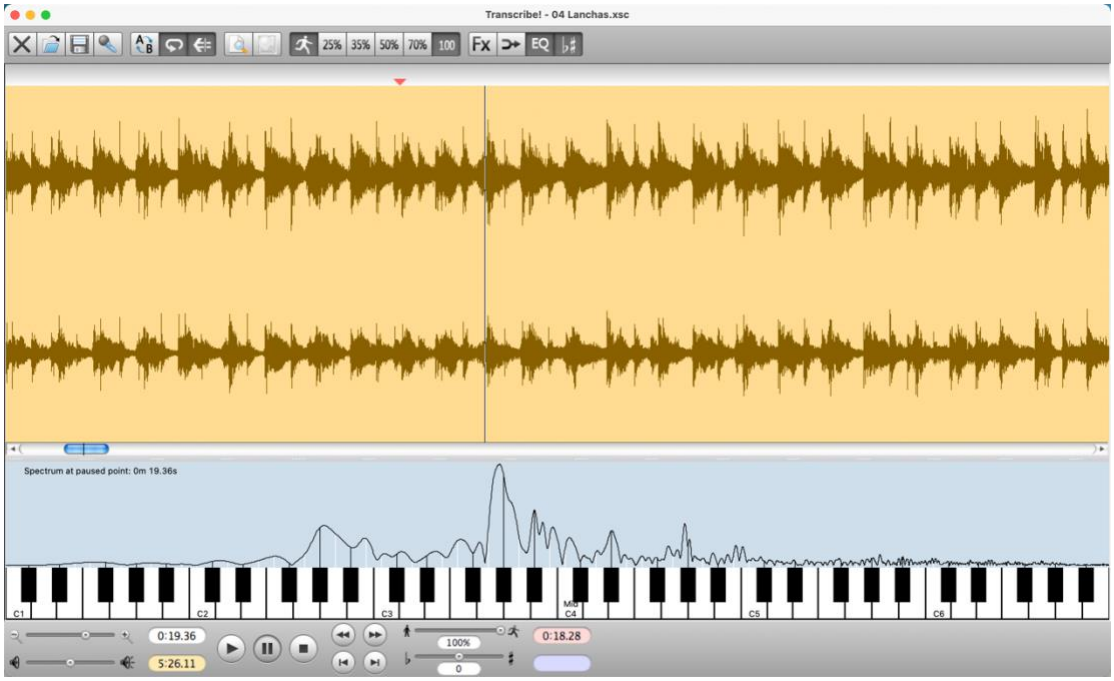

Figure 2: *Transcribe!* used for spectral analysis of the source music

The parts for jazz guitar, piano and percussion (drumset and marimba) were now created, first for *Section I* (audio sample 4, with source music and Virtual Instruments) then *II* (audio sample 5, with source music and Virtual Instruments) then *III* (audio sample 6, with source music and Virtual Instruments) through jamming with the source music, by means of a MIDI keyboard and respective Virtual Instruments, and following the tempo, rhythm, pitch material, structure, and musical flow of the source music (Figure 3). The DAW-based generative phase was performance-based, and to a large degree improvisatory. The source music created a sense of connectivity and flow, throughout the compositional process. The characteristic rhythmic feel of the various sections, or groove, played a major role in the shaping of the parts. The outcomes of the spectral analysis always directed the pitch choice. Since the commissioning ensemble does not have a microtonal practice, the pitch choices were limited to equal temperament intonation. This initial compositional phase resulted in MIDI tracks for each of the three instruments, covering each of the sections on the timeline.

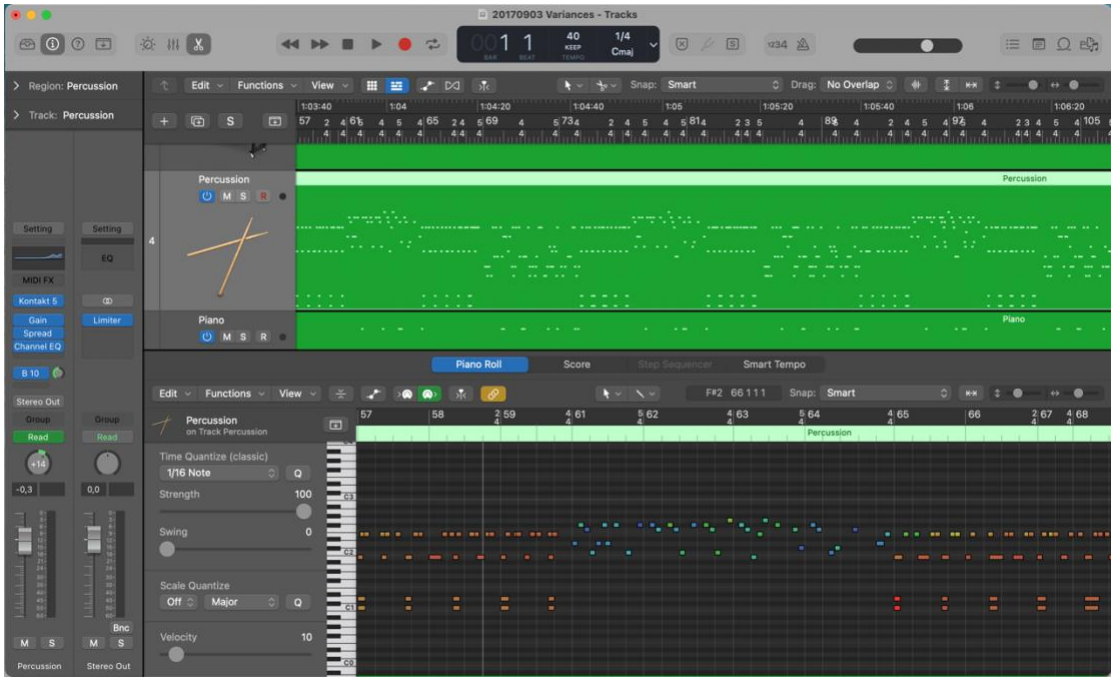

Figure 3: drum part created through jamming with the source music

This phase was followed by extensive editing of the material, now available as MIDI data, through refinements in timing, rhythm, pitch, and dynamics. However, in order to maintain the improvisational essence of the parts, care was taken to leave the material as much as possible intact, not to edit out "the interruptions of real life", essential to improvisation (Rzewski, 2007, p. 269). DAW playback of the three parts proved essential throughout the editing phase; it informed and motivated many of the compositional choices. The source music, which had served as a musical companion during the generative phase, was mostly muted while editing, although it was sometimes used as a reference. The editing phase was followed by the mixing and mastering of the trio parts. This concluded the main compositional stage. Apart from possible corrections, the trio version of *Variances* was now ready within the DAW.

Tempo flexibility in combination with rhythmic complexity was a major tool in achieving this, particularly in *Section II*. Furthermore, coordination within the ensemble was to take place aurally, rather than through visual gesturing. For this purpose, aural cues were provided throughout the composition.

The next step in the compositional process was the notation of the trio music. A chief consideration in translating the liveness from the DAW-based improvisatory phase to notation, and subsequently to performance, was to maintain "the spontaneity, the "danger", of live performance" (Katz, 2010, pp. 151-2), and some of the essence of the underlying oral tradition the trio parts were based on. Such elements might "escape notation because of their subtlety and their spontaneous and elusive nature" (Chanan, 1995, p. 11). The three parts were first exported as MIDI files from the DAW to the notation software.

These files then provided merely a starting point for notation, due to the customary inaccuracy of such MIDI export (Figure 4), but more importantly since many notational decisions were to be made during this phase, especially regarding rhythmic nuances 'outside the grid'. The notational phase was also used for further refinements and corrections to the composed material, as in Psathas' "fine toothcomb checking" (Interview with Psathas, 22 March 2018, Appendix 1). In this phase the aim was to base the detailed compositional decisions on 'the composer's craft', on expertise and experience, not on playback (Figure 5).

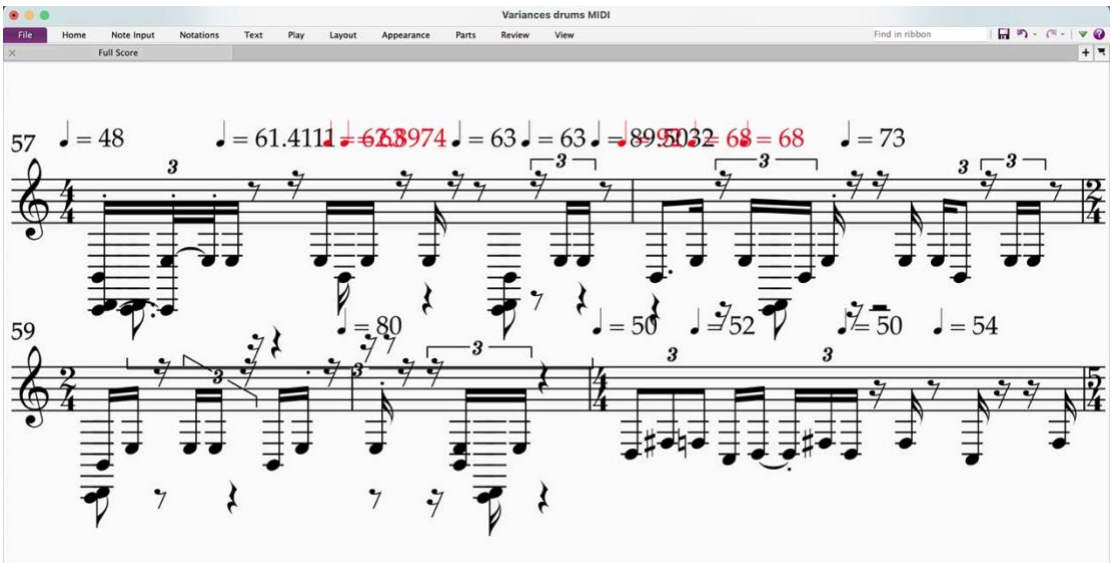

Figure 4: drum part imported as raw MIDI data into *Sibelius*

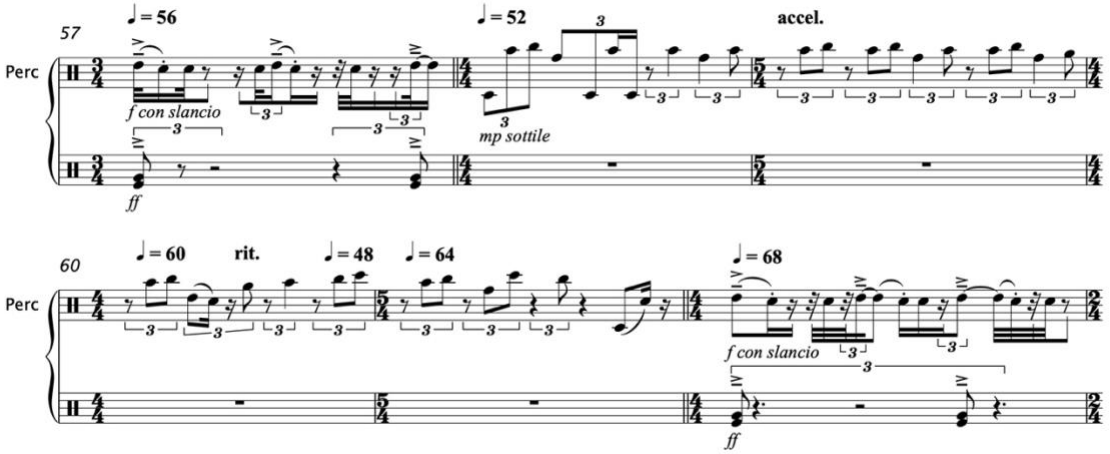

Figure 5: drum part final notation in *Sibelius*

Once the three core parts were notated, this material was used to create so-called 'shadow parts', for an indeterminate ensemble of additional musicians. These follow the core trio, aurally synchronising with them, and providing the work with a flexible instrumentation (audio sample 7, with live core trio and shadow music). The shadow parts were notated directly in the notation software; the DAW did not play a role in their composition. The instrumentation of the shadow music is left up to the performers, and variable for each performance. For each section, shadow players can pick any part suiting their instrument, and they can move freely between parts. Shadow parts can be played by more than one performer, allowing for larger numbers of players to join in. If notes are out of the range of any of the instruments, they can be passed on to another player, or left out. The instrumentation of the shadow parts can be fixed during rehearsals, or (partly) left open for performance. For this purpose, the shadow players play from a 'shadow particel', encompassing all the shadow parts, and available in various standard transpositions (Figure 6). The freedom offered to performers in choosing and shaping their shadow parts makes the shadow music perhaps the most flexible component of *Variances*, even though it was created outside the DAW context, directly in musical notation software. It is aimed at assuring a lively performance practice of *Variances*. This links up with works like Terry Riley's *In C*, mentioned above, and Gavin Bryars' *Jesus' Blood Never Failed Me Yet* (1971), both for indeterminate or flexible ensemble.

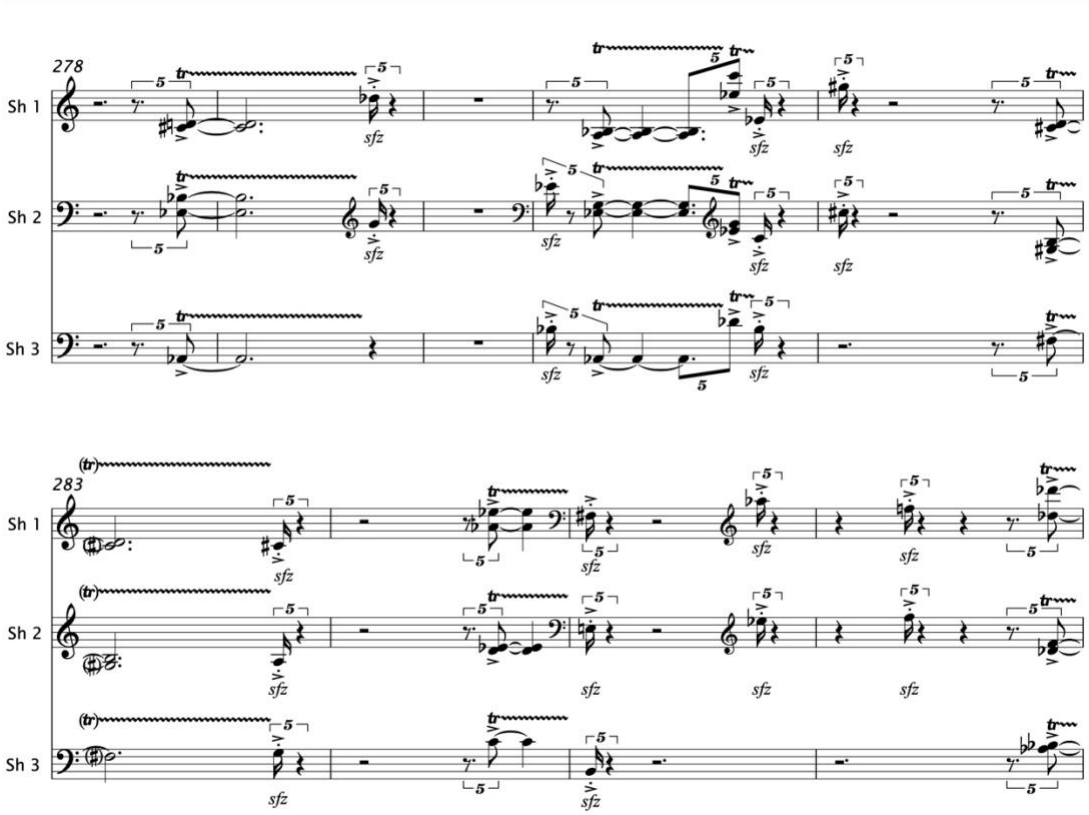

Figure 6: *Variances* shadow particel

3.6. The three sections of *Variances*

The source music for *Section I a* features panflute clusters which are very rich in pitches and partials. These informed a chord sequence in guitar and marimba, and ascending chains of fast notes in the piano (audio sample 8, live core trio and shadow music). For the chords, played on the first and third beat of each bar, notation was straightforward. The guitar part is played *legato*, connecting all the notes, thus making it stand out from the more pointed marimba chords, and providing it with a melodic profile. The ascending chains of fast notes in the piano are performed freely. They are notated graphically within the space of the bar; their exact points of entrance and exit are not fixed in time. Within the chains however, accentuated notes are specified, to be lined up precisely with the second and fourth beat of each bar. To signify their importance, they are notated with larger note heads. These accentuated timed piano notes maintain, together with the guitar and marimba chords, maintain the *hocket* character of the source music. Through their accentuation, they also build a counter-

melody to the guitar line. The tempo of *Section I* is specified as *sempre flessibile*. This allows the pianist to freely shape the fast note chains, and stimulates liveliness, rather than strictness, in performance. The hocketing serves as a synchronisation tool within the trio.

Section II (audio sample 9, live core trio and shadow music) is based on the source music of a solo voice calling, and a group of voices and drums responding, continuously alternating between chorus and refrain material, with constant subtle variations, and extensive tempo fluctuations. The guitar part, with its disrupted yet lyrical material, is based on the solo singer's chorus material. It is characterised by a lilting quintuplet feel. The source music's refrain is reflected by the rhythmically straightforward piano part. The extreme tempo variability of the source music is recreated by a playful pushing and pulling in tempo between guitar and piano. This playful exchange, and striving to stay together, prevails over achieving exact rhythm. Strategically placed lower and upper tempo markings, connected by gradual speeding up and slowing down, and sudden tempo changes, provide tempo information, at the same time offering flexibility in performance. A sense of liveliness within the section, bordering on improvisatory disorder, is provided by the complex and pulse-evading drumset part. The drumset part was conceived very freely, and required some moulding to a rhythmical grid, to capture it in notation. It ws important to make the drumset part consistent enough to enable auditive synchronisation within the core trio.

Section II is followed by *Section I b*, a brief return to the material of *Section I a*. The guitar plays a sequence of chords on the first and third beats, each chord increasing in volume, and steadily alternating with the piano, which now plays a calm melody on the second and fourth beats. The fast ascending note chains are now placed in the marimba part, this time notated as steady quintuplets. They provide the section with rhythmic stability, allowing the players to calm down after the hectic *Section II*.

This brief section is followed by *Section III* (audio sample 10, live core trio and shadow music), derived from the source music of two Chilean guitars and a drum. This final

section is written in a constant hocket between guitar and marimba on the beats, and piano on the off-beats, in a limping quintuplet feel. The note choices are based again on the spectral analysis of the source music. Since choices from the pitch reservoir are continuously varied within the core trio, the pitch material is rich and kaleidoscopic. The music is pulse-driven, relatively stable in tempo, and lacks the rhythmic complexity of *Section II*. The guitar utilises a delay pedal set at the prescribed tempo for *Section III*, assisting in tempo stability, and adding to the pulse feeling throughout the section. As a result, the final section has perhaps the strongest sense of flow. The piece resolves in a brief *coda* with long resonant chords, with some brief recurrences of the hocket material; it finishes hesitatingly.

3.7. Realising *Variances*

In the rehearsals leading up to the first performance, the trio material of *Variances* proved individually demanding, and required intense chamber music practice. The shadow music provided no issues in individual performance. Overall, the synchronisation and coordination between the core trio and the shadow players worked well. As anticipated, the realisation of the shadow music triggered a lively rehearsal process. In *Section I*, the guitar and marimba chords served well as time keepers in the pianist's placing of the accented notes within the ascending chains of fast notes. In *Section II*, the intended pushing and pulling of the tempo required full control of the core players' parts, awareness of each other's parts and the provided cues, and agreement on issues of leading and following. Especially the drumset part appeared to be demanding, due to its rhythmic nuance and complexity. This section required the biggest time investment in rehearsal. Some visual cues were put in place to assist in synchronising. The brief recapitulation of *Section I*, with the ascending chains of fast notes now in the marimba, provided no difficulties in ensemble performance. Also *Section III* provided no major issues. Focus points in this section were maintaining the light and dancelike character, and keeping a fine internal balance within the ensemble, allowing the shadow parts sufficient presence within the dense texture.

During the rehearsal process, some corrections were made to the score. In *Section I*, the ascending chains of fast notes in the piano part were shortened at some points to increase comfort within the piano part. In *Section II*, three repeats from the chorus and refrain material were removed, to improve the proportions between the three sections. No adjustments were made to *Section III,* apart from some notational corrections.

The realisation of the work in performance was overall satisfying. Repeated performance will be advantageous in furthering the ensemble interaction, and finetuning the musical results. A main consideration was that the visual cues in *Section II*, while assisting in synchronising, hampered some of the musical interaction and liveliness in timing, and removed some of the desired 'danger'. The piece was conceived as chamber music; conducting, even in rudimentary form, removed some of the essence of '*musicking* on equal footing'.

A separate rehearsing and recording process was foreseen. In preparation for the recording, some additional editing was done to the musical notation, primarily comprising note corrections. More extensive changes were made to *Section II*. To increase liveliness within this section, the refrain material was varied in duration, the full refrain only appearing in the last repeat.

Due to COVID-19, and the related travel and group size restrictions, recording could not take place with the full ensemble. Therefore it was decided to record the three core parts one by one, and the shadow music collectively in a fourth and final session. The use of the initial DAW clicktrack in the final audio production of *Variances* made the work come full circle: by emulating the nuanced tempo curves of the source music, the clicktrack initiated an interpretation rich in tempo nuance and flexibility. It was used in its entirety during the guitar recording session; while recording the piano and percussion parts it was partly switched off. In the final recording session of the shadow music, performed by saxophone quartet, the clicktrack was not used at all. Coordination was now entirely aural. This helped creating the sense of spontaneity and 'danger' which the conducting had circumvented in the first performance. It

ensured a lively and flexible performance; and last but not least, it emulated the tempo idiosyncracies, and thus some of the essence, of the original source music.

4. *Rapprochement*; the DAW enhancing microtonal composition and performance

Rapprochement, the second portfolio composition, is a microtonal work with a duration of 10 minutes, commissioned by the Amsterdam-based Ensemble SCALA. It was written in the autumn of 2017, and premiered on Sunday 14 January 2018 in the chamber hall of the Muziekgebouw aan 't IJ in Amsterdam, in the concert series of the Huygens-Fokker Foundation.

Ensemble SCALA specialises in microtonal music, and employs some unique microtonal instruments, with distinctly different tunings. In *Rapprochement*, the role of the DAW was explored in composing a work involving different tunings, and in advancing accurate intonation throughout the process, from the conceptualisation and composition to rehearsing, performance and recording.

Rapprochement was composed in a DAW configuration involving:

- *Logic X* as the creation environment;
- tailormade Virtual Instruments, emulating the exact intonation and timbre of various microtonal instruments;
- and a multi-keyboard lay-out for realising highly specific microtonal performance requirements during composition.

Following composition and live performance of *Rapprochement*, in a DAW-based multi-track recording process, the work was recorded part by part allowing for maximum microtonal precision.

4.1. Some examples of microtonality in western art music

The term microtonality is utilised in the context of western art music to indicate pitches or scales outside "twelve available pitches neatly formatted between one octave of the piano" (Adriaansz, 2009). The term thus takes equal temperament, in

which the octave is divided in 12 equal (semitone) steps, as the norm, and defines different sizes of steps, normative in other musical contexts, as 'micro'. A more neutral and adequate term is wanting; therefore microtonality will be used throughout this chapter.

Microtonality is often considered demanding for composers, musicians and listeners, due to the 'classical ear' not necessarily being trained to deal with different intonations. Such "unfortunate connotations of "otherness" and "strangeness"" seem to provide microtonality with a sense of "an outsider activity" (Gilmore, 2005). In truth, *musicking* more often than not involves intonation outside equal temperament. Different temperaments such as 'just' or 'meantone', based on the intervals of the harmonic series, play a role in early music practice, in folk music traditions, but they are also common in classical music practices, in the latter case often in parallel with equal temperament. While not always addressed explicitly, this may lead to intonational issues between, for example, singers, wind, string players, and keyboard instruments, the latter tuned in equal temperament. Also vibrato and glissandi are instances of deviation from equal temperament in common musical practice, as are modes from other musical cultures which may play a role in compositional and performance practices, such as the *pelog* and *slendro* tuning of the Indonesian gamelan, the 24-tone Arab scale, the heptatonic tunings of the West African kora, and the *blue note* in blues and jazz.

However, in certain practices, microtonality is treated as a central compositional element. Some composers and performers may be attracted to microtonality because of the unfamiliarity of different tunings, providing novelty and surprise. Dutch composer Sander Germanus (Germanus, 2020) applies "[h]allucinatory and disorienting harmonic progressions" so that the "expectations of the listener can be optimally put to the test by the dizzy fluctuations of the 'quarter-tone double tuning'". Microtonality may also serve as "a way of increasing the general level of complexity of the pitch domain" (Gilmore, 2005), as in the work of a composer such as Brian Ferneyhough. Composers such as La Monte Young and Terry Riley apply microtonality, in particular just intonation, for its consonant qualities and timbral opportunities. The

American composer Ben Johnston takes as a starting point harmonies "that have been used in music for hundreds of years" (Gann, 2011) developing these "outward into more exotic harmonies". The involvement with microtonality of Dutch composer Peter Adriaansz (Adriaansz, 2009), who often combines electronic sine waves with instrumental performance, results from his focus on sound, and "everything to do with pulsation, resonance, vibration and speed, each of which was already imbedded in the DNA of any small interval". Also for spectral composers such as Gérard Grisey, Tristan Murail, and Horatio Radulescu, it is the materiality of sound, and its parameters, which motivated their involvement with microtonality (Drott, 2016).

The American composer Harry Partch, who considered the dominant use of equal temperament unsatisfying, extensively researched principles of tuning and intonation, presented in his book *Genesis of a Music* (1949), "not offered as a basis for a substitute tyranny", but "to stimulate creative work" and "to encourage investigation of basic factors" (Partch, 1949, p. 5). He devised a tuning system with 43 pitches within the octave, built a large set of instruments according to this tuning system, and composed his music especially for these instruments. While tuning and intonation are a central element in Partch's music, they may be considered "only one aspect of his work, and not the most important aspect" (Gilmore, 2005). Other important aspects are the timbral qualities of the instruments; their visual and functional design; the specific playing techniques; and Partch's idiosyncratic and eclectic musical language. His large scale music theatre work *Delusion of the Fury* (1964) demonstrates how all these elements, in combination with text, movement and costume, give Partch's music an interest beyond microtonality.

During the author's involvement with the realisation of *Delusion of the Fury* by Heiner Goebbels and Ensemble Musikfabrik, in the Ruhrtriënnale in Germany in 2013, the ensemble had the opportunity to familiarise themselves for more than a year with Partch's instruments, musical work, and microtonal language. The project demonstrated that, with intensive involvement, performances of microtonal music can transcend intonational complexity, and that microtonal music can be whistled and

sung by musicians and audience members alike - perhaps fulfilling Charles Ives' fantasy of a century ago, of school children whistling quarter-tone melodies (Gann, 2011).

Partch's practice of microtonal instrument building, and composing for these instruments, is mirrored in current practices of composers such as Benedict Mason, Godfried-Willem Raes, Gijsbrecht Royé, and James Wood. Ensemble Musikfabrik, having performed *Delusion of the Fury* on a number of occasions since 2013, subsequently commissioned various composers to write new works for the set of Partch instruments that had been built especially for the project, thus giving a strong impetus to the further development of microtonal repertoire.

Another organisation that plays an important role in the development of new microtonal repertoire is the Amsterdam-based Huygens-Fokker Foundation, to which Ensemble SCALA is connected. The microtonal Fokker organ, tuned in the 31-tone scale as formulated by 17th century Dutch physician Christiaan Huygens, plays a central role in the activities of the foundation. The Fokker organ was designed by physician and composer Adriaan Daniël Fokker, built between 1948 and 1950 by the Pels organ building company, and is currently located in the chamber hall of the Muziekgebouw aan 't IJ, Amsterdam. The organ can be played manually, or controlled by a computer. The latter setting enables composers to write beyond the limits of the organist's craft. Dutch electroacoustic composer Danny de Graan wrote various works for the Fokker organ. In the earliest of these, *Forma*, he explores parameters other than pitches and organ registration, enabled by computer control. In particular the control of the amount of air sent through the pipes results in glissandi, and in timbres ranging from noise to pitch. The work was created entirely within the DAW, resulting in MIDI-controlled acoustic concert music (Interview with De Graan, 15 May 2018, Appendix 2). It demonstrates how computer control can extend the possibilities of instrumental performance.

In the examples above, it is the combination of microtonality, a focus on the materiality of sound, the expansion of timbral possibilities, instrument design, playing technique, and the application of music technology in some cases, which may lead to

novel and idiosyncratic practices. In all cases, as soon as intonation extends beyond twelve notes within the octave, pitch becomes a topic of research, and the "impulse for innovation will go inward to its own materials rather than outward" (Gann, 2011). Whether for standard instruments, tailormade microtonal instruments, and/or for electronics, the complexity of writing in different tunings and temperaments provides challenges within the compositional process. These become aggravated in a setting where a plurality of microtonal tunings is combined within a composition. In the performance of such works, highly specialised craftmanship is often required.

Can music technology, in particular the DAW, help enhancing the control of microtonality in composition? How can musical notation, designed for semitone steps, support the interpretation of microtonal music? How can musicians be assisted in realising microtonal work, and how can a sense of musical logic, and precision and control be obtained?

4.2. Precision and the unique moment

Christopher Small (1998, p. 140) states that the meaning of art lies "not in created objects but in the act of creating, displaying and perceiving". It is the unique moment in which *musicking* takes place, "its presence in time and space, its unique existence" (Benjamin, 2018, p. 9), which provides meaning to the musician and the listener. This unique moment of musical performance is, naturally, liable to human imprecision. This may be the cause of mistakes in performance, but also, and perhaps more importantly, it results in "micro-variations in tuning and timing [producing] authenticity in the performed sound" (Klein, 2016, p. 30). This perspective on authenticity in musical performance is in opposition with "an aesthetic of performance which excludes error, hesitation" (Chanan, 1995, p. 18), or "the barbarism of perfection" (Adorno, 1991, p. 44). A practice of "flawlessly functioning, metallically brilliant apparatus" may lead to performances in which, according to Adorno, "not the slightest hole remains open for the meaning of the whole".

In other words, while musicians constantly strive for craftmanship, control and perfection, precisely the limits of control and perfection may provide *musicking* with authenticity, and meaning. How do the attainment, or lack, of control and precision in the realisation of microtonal music, in all its potential complexity and unfamiliarity, influence the unique moment of performance? And how do control and precision come into play in the recording of microtonal work?

4.3. Recordings as a reference in performance practice

In the recording studio, musicans might be expected to take more risks than in concert, where there's only one chance to get it right. Yet, "most [musicians] reported taking fewer risks in the studio, in spite of the potential for correction" (Fabian, 2009, p. 242). Fabian adresses here an issue that has often been discussed, since the beginnings of the era of recording: recording tends to demand "clean, legitimate execution and beautiful tone" (Chanan, 1995, pp. 127-8), and has set "new standards of professional competence, of technical efficiency combined with quality of tone". It seems to be "less about immediate entertainment, more about long-term quality" (Fabian, 2009, p. 244). Consequently, recordings may be considered "[far] from being documentations of performances", but "musical works in their own right" (Gracyk, 2009, p. 63).

Whether considered representations of musical works, or art works in their own right, premiere recordings of new works, especially when supervised by the composer, tend to set standards in performance practice. While compositions allow for a multitude of interpretations, and while "[every] performance explains the composition, but does not exhaust it" (Eco, 2007, p. 171), a recording converts a performance, "however fluid or improvisatory, into a fixed entity, which then acts as a template to guide further interpretations and performances" (Echard, 2009, p. 24).

Recordings indeed enable performers to "study, emulate, or imitate performances in a way never before possible" (Katz, 2010, p. 32). This is especially apparent at music

conservatoires where, perhaps more than ever, students benefit from the accessibility of recordings, particularly in the online environment, to develop a broad knowledge of repertoire and performance practice, and easily familiarise themselves with works and practices.

However, the risk of a performance taking a recording as a point of reference is that it may sound "like its own phonographic record" (Chanan, 1995, p. 118). When audiences "attend to all music with expectations that are only appropriate to works of phonography" (Gracyk, 2009, p. 63), they may come to expect musicians to deliver on stage performances equaling their recordings, rather than appreciate the individuality of interpretation. The risk involved in such expectations is made clear by Chanan (1995, p. 18): "little by little, the very nature of music changes: the unforeseen and the risks [...] disappear in repetition". Or in the words of Adorno (1991, p. 72): "the performance of a symphony in which nothing can go wrong is also one in which nothing happens any more either".

Especially in microtonal music, in which intonational precision is often hard to achieve - as some of the early recordings of Partch's works demonstrate - benchmark recordings may place unrealistic demands on performers in a live setting. They may make microtonal performances unsatifying for composer, musicians and audience, potentially stifling a lively performance practice. Recordings may thus inform, inspire, or inhibit the interpretation of microtonal works - in interplay with music notation, as the primary intermediate between the microtonal composer and the performer.

4.4. Notational issues in microtonal music

In standard western music notation, the basic pitch unit is the semitone. Thus, composers working with microtonality need to apply, or develop, notation which can capture smaller, or different, pitch nuances. For some instances of microtonal intonation, standard notation has been developed. Quarter-tones can be notated with adjusted accidental symbols. Accidentals may be also used to express enharmonic

differences, although this is not common practice. In the case of eight-tones and sixteenth-tones, and many other intonations, modes and temperaments, there are notational solutions, but these are not standardised. Microtonal music specialists such as Ere Lievonen have done extensive work surveying and developing microtonal notational strategies (Lievonen, 2021).

Notation can incorporate only a limited number of parameters, identifying "definite values and unambiguous elements, otherwise there is confusion over what they denote" (Chanan, 1995, p. 11). Musical material needs to be "[reduced] to simple units" (Cutler, 2000, p. 89), and can encompass "only a very limited degree of complexity within those units". Flexible deviations from equal temperament in common musical practice, such as vibrato, portamento and glissando, can be notated only approximately. Fixed pitch intonation may be captured in notation more precisely, but may require specialised knowledge for deciphering and interpreting. Biases of notation software applications create an extra layer of difficulty, as noted in Chapter 3. Such applications are based on semitone notation, underlying pulse, and common rhythmic values. Support of extended notation, including microtones, graphic or free notation, is very limited. Manual notation, or notation through graphic software, is applied by some composers. Yet, this does not solve the issue of the standardisation of extended notation, and thus the facilitating of interpreting music which extends beyond standard western music notation, including microtonality.

The notation of works which combine various microtonal intonations aggravates such issues. This is the case in the second portfolio composition, *Rapprochement*.

4.5. The concept of *Rapprochement*

Rapprochement: (especially in international affairs) an establishment or resumption of harmonious relations (Lexico, 2020)

In the first portfolio composition *Variances*, despite the microtonal implications of the spectral analysis, intonation was limited to equal temperament, due to the nature of the commissioning ensemble. Since the second portfolio composition *Rapprochement* was written for a microtonal ensemble, "avenues for intonational intrigue [...] exciting in prospects, appalling in number, and unpredictable in direction" (Partch, 1949, p. 5) could be explored. The work deals with pitch relationships between instruments that speak diverse intonational languages.

Ensemble SCALA consists of seven musicians; all were included in the instrumentation of the new work. Three of the instruments have fixed pitch: the Carrillo piano, with sixteenth-tone tuning, resulting in 96 notes within the octave; the Fokker organ, with 31 notes within the octave; and the meantone guitar, with additonal frets allowing for just intonation and enharmonic differentiation in a number of keys. In *Rapprochement*, these three instruments form the core group, with an additional core role for percussion: an octave of crotales, small brass discs, tuned in equal temperament and fixed in pitch, but rich in harmonics and commonly slightly out of tune; a large shundersheet, a suspended large thin metal sheet, providing either noise, or inderminate pitches through bowing; and a pair of castanets, providing pulse in some sections. The remaining three instruments of Ensemble SCALA, flute, viola and (bass) clarinet, have flexible pitch.

Rapprochement can be performed by the full ensemble, or by the core quartet only, without the flexible pitch instruments. This instrumentation allows the core material of the piece to be rehearsed intensively by a small group. It also provides the ensemble with a work that can be performed more widely, the core players being involved in most Ensemble SCALA concerts.

In the existing repertoire for Ensemble SCALA, the Carrillo piano is utilised comparitively rarely. To provide the ensemble with a work with a prominent role for the Carrillo piano, this instrument occupies a central position in *Rapprochement*.

Comparing the tunings of the core instruments of Ensemble Variances, only one note is shared by all: the C natural. Many other notes are so close together that it may be hard to perceive pitch differences. However, nuances in intonation form the essence of Ensemble SCALA's practice, so it seemed essential to take even the smallest pitch nuance into account. Therefore, instead of striving for, or suggesting, melodic and harmonic correspondences between the microtonal instruments, each is allowed to speak its own intonational language. This leads to relative motivic autonomy within the composition, for each of the core instruments.

The decision to allow the core instruments to speak their own intonational and motivic language was supported by individual sessions with each of the core players, in which register, timbre, articulation, dynamics, and specific playing techniques of their microtonal instrument were explored. In composing *Rapprochement*, these idiosyncracies of the core instruments were taken into account as much as the tuning.

One parameter was identified to hold the instrumental parts together: a collective and steady tempo throughout the piece. Thus, as in *Variances*, tempo and pulse served both as a key compositional parameter, and as a support in the coordination within the ensemble in performance.

The other three instruments of Ensemble SCALA, flute, viola and (bass) clarinet, are not microtonal by nature. However, each of them can intonate freely: flute and clarinet can achieve any pitch played by the core instruments through alternative fingerings and/or embouchure control, and the violist can move freely across the fingerboard. For flute, clarinet and viola, performing microtonal music is thus possible, but it involves constant aiming and adjusting. This is an essential difference with the core instruments - although intonation on the microtonal guitar can be influenced to a degree through finger pressure and varying positions on the strings.

This intonational aiming and adjusting of the three flexible instruments determines their role in *Rapprochement*. Aurally adjusting intonation, as well as timing, is part of the practice of wind and string players in any repertoire. In *Rapprochement*, the flute,

clarinet and viola don't take the initiative in intonation or timing; they follow in the footsteps of the core players. This allows them a comfortable way of playing. As in *Variances*, the shadow music colours and enhances the core parts, and provides the work with a subtle and flexible instrumentation, a musical shadow.
As in *Variances*, the core group is fixed, but the instrumentation of the shadow music is flexible. Thus, a different light can be shed on the work in each performance, through the variable shadow ensemble. *Rapprochement* can be performed by the core quartet only; with the shadow ensemble of the first performance; or with any other group of shadow players. To cover all the material of the shadow parts, at least three players are required. The ranges of the shadow parts guide the choice and assignment of instruments. No maximum is given; in the case of a large shadow ensemble, the core quartet may need to be amplified in performance.

As in *Variances*, this indeterminate approach also reflects the composer's interest in the socio-musical setting of a work. The work can be performed by the core quartet in collaboration with other professionals musicians, in an educational setting, with amateurs, young players, or in hybrid settings involving both professionals and amateurs. Through its shadow music, the work provides the opportunity for non-specialists to be actively involved in the performance of microtonal music.

4.6. The instruments

The Carrillo piano was designed by the Mexican musician and music theorist Julián Carrillo. After the presentation of the instrument in 1958, piano manufacturer Carl Sauter built a small number Carrillo pianos; one of these is now in the possession of the Huygens-Fokker Foundation (Huygens-Fokker, 2021). It is an upright piano with 97 keys. While a normal piano with this number of keys extends over a range of eight octaves, from C0 to C8, the Carrillo piano covers just one octave, from C4 to C5, in equal temperament, with eight pitches per semitone. There is hardly any sympathetic resonance within the instrument: due to the small number of consonant relationships within the one octave, strings hardly resonate along with the played notes. As a result,

the Carrillo's timbre is thinner than that of a normal piano. Notation is commonly according to the piano keys, rather than sounding pitch. This makes reading easy, but it also decouples the playing from hearing. The instrument doesn't require any special playing techniques. Due to the large distances between intervals (two octaves on the keyboard equal a sounding minor third, and six octaves a major sixth), there may be an inclination toward big jumps across the keyboard, and toward melodic rather than harmonic writing.

As mentioned above, the Fokker organ is tuned in 31 pitches within the octave. The instrument has two manuals, a pedal starting from the 16' sub-bass, and only a small number of stops. It is played with a specially designed keyboard, with several rows of small colour-coded keys, positioned on a vertically extended axis. The keyboard is comparatively compact, and constructed according to microtonal logic. Yet it is puzzling for a novice, and requires a specialised and experienced player. Even then, sightreading is difficult. The tuning combines pitches from various meantone temperaments, allowing just intonation in a number of keys. Notation however follows the principle of the most nearby equal temperament quarter tone, using normal and quarter-tone sharps and flats. A relevant timbral detail is that the operation of the Fokker organ is noisy. In dense organ textures, and especially with short note values, this factor needs to be taken into account.

The meantone guitar is a normal acoustic guitar, with added frets allowing for enharmonic differentation between a number of flats and sharps, based on meantone intonation. Some of the meantone intonation is shared with the Fokker organ, but the latter has a bigger choice of meantone pitches. Apart from the extra frets, notation is as for a standard guitar. Sharps and flats in the notation indicate enharmonic differences, and thus specify the additional frets. A technical challenge concerns the handling of the enharmonic frets: they are close together, leaving not much room for the fingers. The meantone guitar also allows for some pitch manipulation through finger pressure, pushing and pulling of the strings, or through the use of a bottle neck, as will be discussed below. As is often the case with acoustic guitar in ensemble performance, the instrument is generally subtly amplified for improved balance.

The percussion part comprises a pair of castanets, fulfilling a purely rhythmical function; a thundersheet, played with soft beaters for noise, or bowed for indeterminate pitches; and an octave of crotales, tuned C7-C8. These brass discs are spectrally rich, and tuned in equal temperament, though commonly slightly out of tune. The percussion part provides the graduations toward intonational imprecision within the core quartet.

The instruments of Ensemble SCALA offer challenges in playing technique, reading, and intonation for some. These are different for each instrument and player. Expertise in microtonal instrumental performance is built up gradually over time, and each new work presents new difficulties. The performance practice of Ensemble SCALA is thus arguably more taxing than practices of ensembles using standard instrumentation. That microtonal performance requires extensive individual and ensemble practice was demonstrated in Partch' *Delusion of the Fury* project in 2013. The potential role of the DAW in dealing with this issue was a focus throughout the creation process of *Rapprochement*.

4.7. Composing *Rapprochement*

At the beginning of the compositional phase, a DAW project was created within *Logic X*. The role of the DAW in auditively monitoring the intonational relationship between the four core parts was essential for the compositional process. Therefore, both for the Carrillo piano and the meantone guitar, a microtonal Virtual Instrument (VI) was created by the composer. For the Carrillo piano, the original instrument was first recorded, and the samples were used to create an EXS player VI. For the meantone guitar, existing guitar samples were used to create an EXS player VI, transposing the samples to the appropriate microtonal pitches. For the Fokker organ, a VI was available from *Hauptwerk*. However, in order to emulate the Fokker organ keyboard and create a realistic performance setting, a set-up with three MIDI keyboards, laid out in vertical extension, was created by the composer (Figure 7). For percussion, crotales, thundersheet and castanets from the *Vienna Symphonic Library* were used.

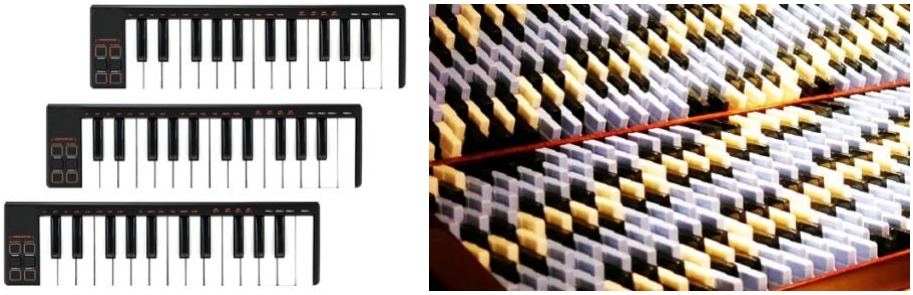

Figure 7: Lay-out of three MIDI keyboards and the Fokker organ keyboard

A constant tempo of 104 beats per minute was set for the entire piece. This calm yet flowing tempo was considered appropriate for a work for large chamber ensemble, to be performed without a conductor. To enhance stability in ensemble performance, tempo and meter were constant. The piece was now composed, part by part, section by section, through performance on the MIDI keyboards, triggering the respective microtonal VI's, utilising a clicktrack in the specified tempo. Real-time performance was chosen as a suitable compositional strategy to achieve musical flow, and to guarantee accomplishable parts for each of the core players. The parts were composed in such a way that the core instruments could lead the work, in particular the Carrillo piano, through auditive coordination, rather than visual cuing or conducting. Each of the core parts was created against the playback of the previously composed part(s).

The music for the Carrillo piano was composed first. In most sections it has the leading role, and it is to be placed within the centre of the ensemble, so that it can be heard well by all players. In writing for the Carrillo piano, care was taken that chords or melodies do not exceed the maximum spread within the hands; focusing on the smallest intervals guaranteed such control (audio sample 11, with Carrillo piano Virtual Instrument). The Carrillo part for *Rapprochement* consists for the most part of 'micro-melodies', bringing out the smallest intonational nuances (Figure 8). The Sauter Carrillo piano is not completely mechanically consistent and reliable. This provided an additional reason to avoid large jumps across the keyboard, and compose a part allowing for fine touch control (Figure 9).

Figure 8: 'micro-melodies' for the Carrillo piano, created with a VI in Logic

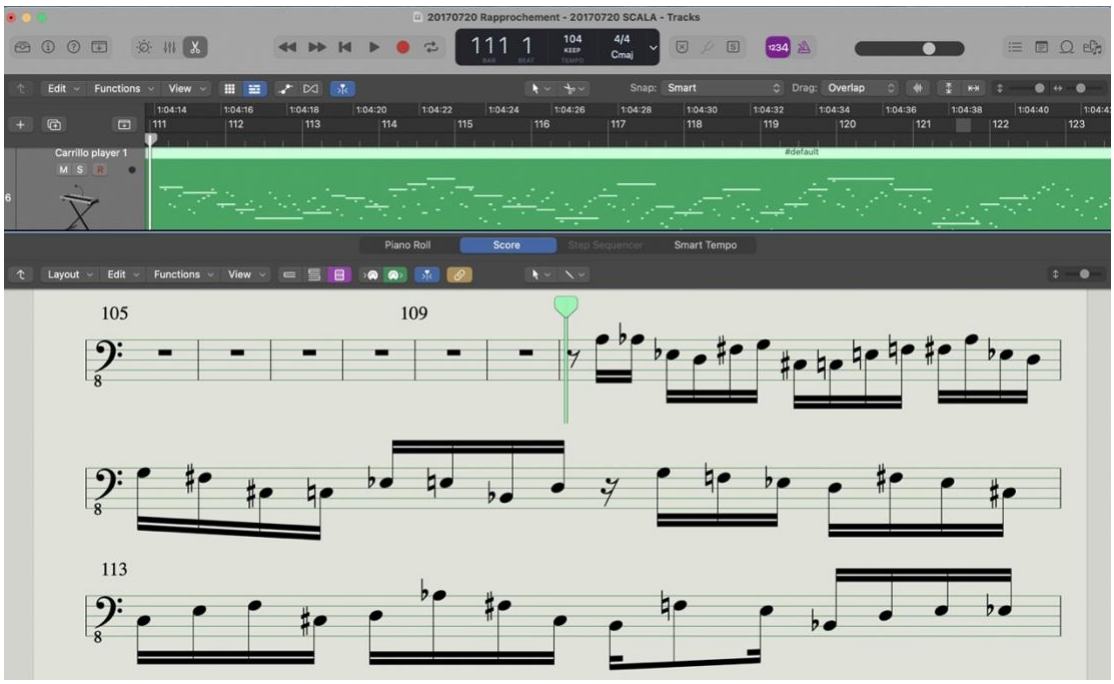

Figure 9: Carrillo piano part created in Logic, avoiding large jumps

The part for Fokker organ was composed next. As noted above, not every seemingly accomplishable part for the Fokker organ can be realised with a reasonable amount of effort, not even by a specialised performer. Some organ parts for Ensemble SCALA are more conveniently performed on a normal MIDI keyboard than on the custom Fokker keyboard. Also, on occasion the organ part had been programmed for automated computer playback. In the latter case, timing flexibility was eliminated within the ensemble. For *Rapprochement* it was essential to write a part that is comfortable in its execution, and allows for smooth ensemble performance. To

guarantee a good balance with the soloistic Carrillo piano, and to provide sufficient low registers within the ensemble spectrum, the Fokker organ part is written mostly in the pedal register (audio sample 12, with Virtual Instruments).

The meantone guitar part was composed next. Writing for the meantone guitar requires an awareness of the physical implications of the additional frets. A normal acoustic guitar was used to test fingerings. Enharmonic differentiation provided by these frets was used to create intonational nuances in double stops (audio sample 13, with Virtual Instruments). In the final section of the piece, the guitar switches roles and joins the shadow group. It follows the Carrillo piano utilising a bottle neck, a metal or glass cylinder around a finger of the left hand, allowing for sliding tones on the guitar strings. Intonations outside the guitar's meantone scale could thus be achieved, and the meantone guitar bececame a flexible pitch instrument. The guitar was subtly amplified, using a guitar amplifier positioned near the player.

The percussion part was composed last. It occupies the high end of the ensemble spectrum with castanets and crotales (audio sample 14, with Virtual Instruments); the middle range with a bowed thundersheet, providing indeterminate pitch input for the bass clarinet; and the low end with a thundersheet tremolo, supporting the Fokker organ in the final section of the piece (audio sample 15, with Virtual Instruments).

The composition of each of the core parts started with an experimentation phase in which the musical material was developed, always with DAW playback. It was in this phase in particular that the microtonal relationships between the core parts were developed and monitored, in interplay with the playback of the finished parts. The DAW, and the realistic microtonal Virtual Instruments, proved essential in this phase. Each new part, as developed in the experimentation phase, was then recorded in real-time through performance on the MIDI keyboards, utilising playback of the finished parts, and the clicktrack where needed. For each consecutive part, the need for the clicktrack reduced; increasingly often it was switched off. Correction takes were recorded if needed. The VI's allowed for judging not only the intonational, but also the timbral and dynamic relationships between the parts.

Subsequently the resulting parts were further developed by editing the MIDI data within the DAW, involving adjustments in pitch and rhythm. However, to maintain the flow of the original parts, the editing was kept to minimum; no substantial changes were made to the parts. The meantone guitar part was checked for possible technical issues on a standard guitar, taking into account the additional frets. After the composition of the four core parts was finished, the DAW project was mixed and mastered. The core quartet music of *Rapprochement* was now ready for notation.

The four core parts were exported from *Logic X* as a MIDI file, and imported into *Sibelius 6* notation software. The MIDI data were used as the starting point for notation. The meter was fixed at 4/4 throughout. The percussion part was written following standard notation. For the Fokker organ, standard Ensemble SCALA was used, involving sharps, quarter note sharps, flats, and quarter note flats. For the meantone guitar, standard Ensemble SCALA was used, with sharps and flats distinguishing between enharmonically different pitches in meantone temperament. Also for the Carrillo piano, standard Carrillo notation was used, specifying the notes as on the keyboard, rather than according to sounding pitch (Figure 10). Following the notation of pitch and rhythm, dynamics, articulations and character indications were specified for each of the core quartet parts, thus completing the quartet score.

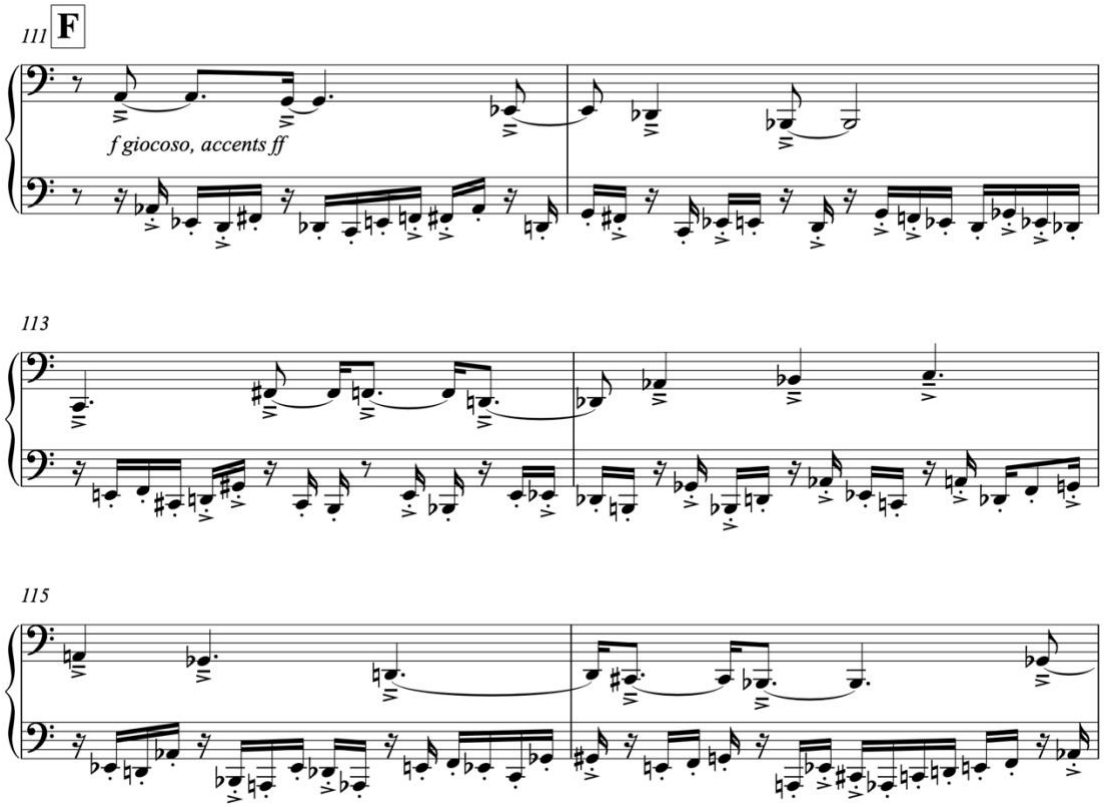

Figure 9: microtonal Carrillo piano notation according to the keyboard

The shadow parts were derived from the core quartet parts. They were not created in the DAW, but notated directly in *Sibelius 6*. The shadow parts utilise standard Fokker organ and meantone guitar notation. Their notation represents sounding pitch, and thus facilitates the shadow players' intonational efforts. However, the notation of the Carrillo piano is based on the standard piano keyboard, while the tuning of each of the strings is not. The notation thus provides no sounding pitch information to the shadow players. Therefore a notational approach was designed especially for the shadow players: the Carrillo part was re-notated in semitones at sounding pitch, with small numbers ranging from 0 to 7 above each note, specifying the exact sixteenth-tone intonation. A note with a 0 above it indicates exactly a semi-tone in equal temperament. With each subsequent number, the pitch is raised by a sixteenth-tone. After the 7, the next semi-tone is reached, again notated with a 0 (Figure 11). The shadow parts can be prepared by the shadow players with fingerings, embouchure and string positions, established individually, and rehearsed with the core quartet. In

a process of aural aiming and correcting, the intonation of the shadow players can then be finetuned to the core instruments.

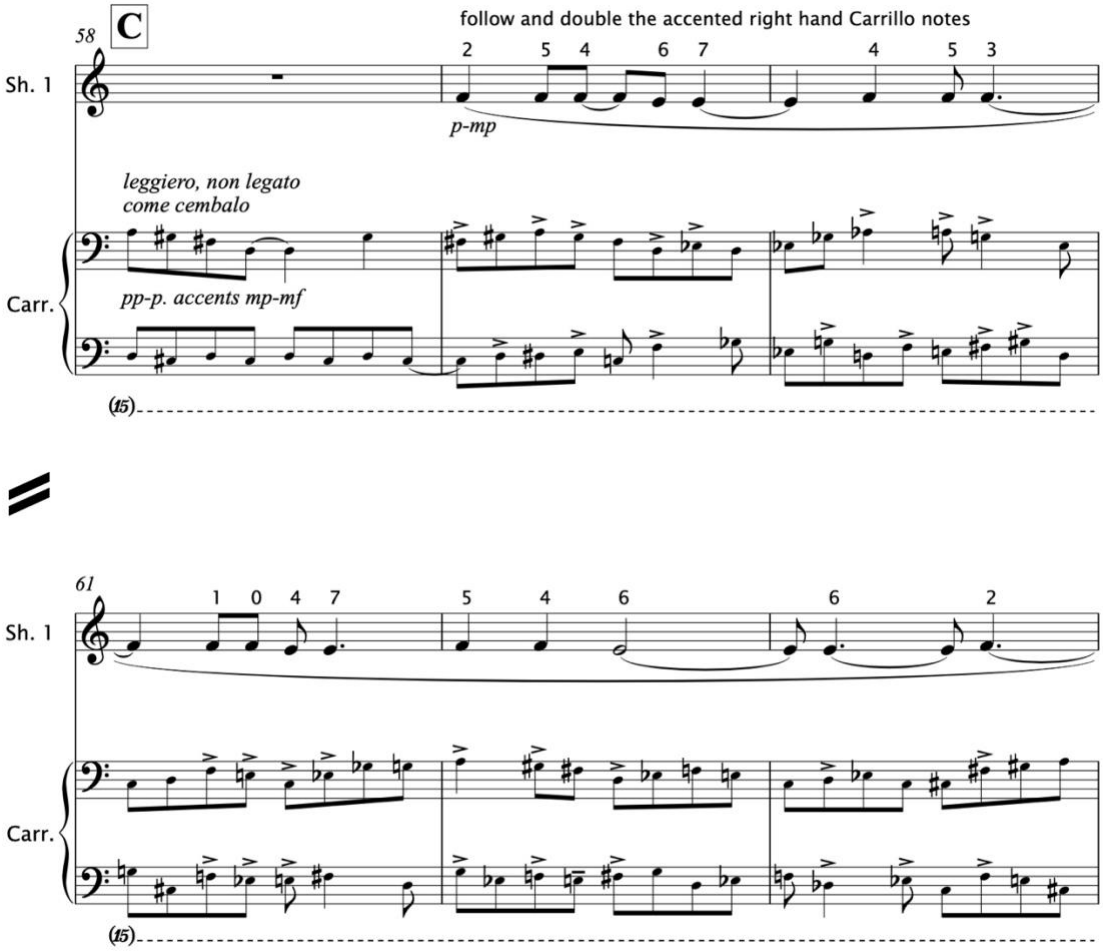

Figure 11: Shadow part providing sounding pitch of Carrillo piano

The shadow music score provides all the shadow parts, but does not specify instrumentation; instrumentational choices are made by the ensemble. Essential material from the parts of the four core players is included in shadow music score, in most cases from the Carrillo piano. This assists the shadow players in aurally following the core quartet while performing their parts.

4.8. Realising *Rapprochement*

Since *Rapprochement* was composed with Virtual Instruments, a virtual DAW recording of the music for the core parts could easily be made after the completion of

the work. This recording gives an adequate impression of the piece; in particular, it provides precise intonation. The audio samples above are all taken from this virtual recording. It was provided to the performers of Ensemble SCALA, enabling them to familiarise themselves with the work in advance, and especially giving the shadow players the opportunity to practise the intonation of the shadow parts. The recording was handed out with the awareness that it might impact on the interpretation, through its 'authoritative status'. However, at the start of the rehearsal process, the virtual recording appeared not to have been used much in individual preparation.

The attainment of control and precision in the microtonal intonation was a main consideration in composing *Rapprochement*. Since the core instruments, in particular the Carrillo piano, convey the intonation, their audibility within the full ensemble is essential. This commanded the intended ensemble layout, with the Carrillo piano positioned in the centre of the ensemble, facing backwards, and the Fokker organ keyboard behind it, facing forwards. These two core players thus face each other, and are surrounded by the other musicians. In the first rehearsal it was decided to place the Fokker organ keyboard in the centre instead, and the Carrillo on the side, without a direct sightline between the two players. Due to this altered layout, the Carrillo piano was not well audible for some of the ensemble members, and thus the Carrillo player could not fulfill its leading role. Instead, the music was visually coordinated from the organ keyboard position. Although visual coordination can be effective in 'staying together', it is not as effective in tight rhythmic coordination in chamber music practice. This partial shift from auditive to visual coordination and focus thus impacted on the rehearsal process toward the first performance.

The individual parts provided no major issues. Throughout the rehearsal process, the shadow players had the opportunity to calibrate their microtonal intonation to the core trio. The intonational precision, and the ensemble performance, developed well throughout the rehearsals. Considering the compact timeframe available for the preparation and rehearsing of *Rapprochement*, and the altered ensemble layout, the results achieved in the first performance were satisfying.

Following the first performance, a DAW recording of *Rapprochement* was made by Ensemble SCALA and the composer. The seven parts were recorded individually, first the Carrillo piano, followed by the Fokker organ, meantone guitar, percussion, and each of the three shadow players. The recording process provided the opportunity for further refinements of each of the parts, and their interpretation. The recorded parts were edited between each individual recording session. The Carrillo piano was recorded with a clicktrack, providing steady tempo. When recording each of the core players, the previously recorded parts were played back through headphones, allowing to perform against the background of the previously recorded parts - a growing ensemble. With each subsequent part, the clicktrack was increasingly switched off. The shadow parts were recorded without clicktrack. Unlike in performance, the recording of the shadow music was thus done exclusively through aural feedback.

After recording and editing the final shadow part, the multitrack recording was mixed and mastered within the DAW. The resulting recording of *Rapprochement* provides a fine rendering of the work, with excellent individual and ensemble performance, and with precise intonation. It realistically emulates a live performance; recording the individual parts against the playback of the growing ensemble was a significant factor in this (audio sample 16, recording with core trio and shadow instruments).

After the completion of the recording, a second performance of *Rapprochement* was planned. In preparation, the produced recording was handed to the ensemble players, as the virtual recording in preparation of the initial rehearsals. During the rehearsals for the second performance, the comfort and precision in individual and ensemble performance proved to have grown considerably. The performance practice of any work develops over time, and through repeated rehearsing and performing. Yet, it seemed that both the recording process and the subsequent availability of the recording had increased the ensemble's grip on the work; this impression was confirmed by some of the players. The ensemble recording was also consulted much more than the virtual recording had been. The second performance of *Rapprochement* was fully satisfying, both in ensemble coordination and in intonational precision.

5. *Transits*; voice and human presence within the DAW

Transits (2018-19) is scored for eight voices (two sopranos, two altos, two tenors, two basses), bass flute and four channel electronics. The work has a duration of 20 minutes and was commissioned by the Dutch vocal company Silbersee. It was first performed by Silbersee in the Muziekgebouw aan 't IJ, Amsterdam, on 28 March 2019.

Recordings of shortwave radio and of spoken word in many languages form the sonic basis of the composition. The use of the voice was explored as the primary vehicle of human presence in the DAW environment. The work is inspired by some specific compositional practices from the analogue studio.

Transits was composed in a DAW configuration involving:

- *Logic X* as the creation environment;
- the use of various field recordings, placed and organised on the DAW timeline, thus providing a basic structure for the vocal and instrumental music;
- the use of Virtual Instruments as well as Virtual Singing Instruments during composition;
- and the creation of four-channel fixed media, for spatialised playback in live performance of the work.

5.1. The acousmatic human voice

Recording permits the inclusion of "aspects of human life in music" (Harvey, 1999, p. 50). Harvey states that "not only ideas, but sound itself [...] can be drawn from the world of human activity". The use of (field) recordings, in particular when involving the human voice and other human body sounds, enables composers to create output which is personal, not only in a musical, but also in a literal sense: the listener may be introduced to an actual person. As Simon Emmerson (2007, p. 62) states, "[s]ince the inception of *musique concrète* in 1948, human presence in general and human body

sounds specifically have haunted the soundworld". The "representation of personal and psychological spaces" may create "anxiety and tension" in the listener, who is used to being more distanced.

A genre preceding *musique concrète*, taking full advantage of human presence and its impact on the listener, was the *Hörspiel*, or radio play. "Ideas about using radio in an artistic way are as old as the medium itself" (Glandien, 2016, p. 167), and already in the early days of radio broadcasting, the radio play combined human presence with sound effects and music. Orson Welles' 1938 quasi-realistic radio drama *The War of the Worlds*, based on H.G. Wells' eponymous novel (1898), famously demonstrated the potency of the genre, and of the acousmatic use of the voice.

While composers might ordinarily employ the voices of others in their electroacoustic works, "[t]he very medium [...] allows the composer as presence to re-emerge into their own piece" (Emmerson, 2007, p. 79). It supports "[the] idea of the author being an integral part of the substance of the work, as well as being present in it" (Amelides, 2016, p. 217). The New Zealand acousmatic composer John Cousins, whose works "explore intimate human relationships" (Hoskins and Meehan, 2019, pp. 76-7), uses his own voice in many of his works. As a result, his compositions and sound installations are highly personal, sometimes biographical. For him, the human body "is represented by the human voice, or sounds that carry inferences of vocalisation, including the breath (a necessary initiator of the voice)" (Hoskins and Meehan, 2019, p. 79). He considers spoken word "a way of insinuating data into the sound stream, because you don't hear the voice as a noise; you hear it as data, information [...] it has the same role as dialogue in the cinema" (Cousins, 2018).

Acousmatic human presence may help composers achieving communication with the listener. However, it can also be frustrating: "It represents a displaced 'other' - the other side of an impenetrable curtain. We hear (and hence observe) but we cannot communicate back" (Emmerson, 2007, p. 80). Of course, this inability to communicate back applies to all genres of *musicking* in which the listener is not an active participant. But the close human presence that voice and human body recordings bring to

electroacoustic music may make one more aware of this unidirectionality of communication.

5.2. Unique voices

The primary vehicle of human presence in DAW composition is arguably the voice. It is specifically the voice that, in Chanan's words (1995, p. 128), may "[bring] an intimate, personal relationship with the [listener]". And especially in practices not involving "a notation-based system of theory", vocal music "is the most sensitive carrier of gestural information" (Zagorski-Thomas, 2014, pp. 147-8).

Heiner Goebbels (2015, pp. 33-4), in whose compositional work the human voice plays a major role, explains that he has "primarily worked with unmistakable, unique voices, which cannot be replaced or recast by other voices". Professionally trained classical voices affect him much less; he considers these to a certain extent trained to eliminate personality and individual qualities from the vocal production. In this context Goebbels speaks of "normalisation" of the voice, making a comparison with the adjustment of an audio signal to a pre-defined amplitude level in audio production. Many of Goebbels' works feature unique and highly recognisable voices, in live performance, or through the use of recordings. An example from his *Sampler Suite* (1994), combining live performance with samples and (historical) recordings, is *Chaconne/Kantorloops,* "[preserving] the memory of the Jewish cantorial tradition, a vocal culture that has long ceased to be accessible in this form" (Goebbels, 2000).

This interest in voices from outside the scope of European classical singing was shared by Luigi Nono: "when I started to work in the electronic studio I began to distance myself from [the European view on singing, on art song]" (Pauli, 1971, p. 123). Nono researched music, particularly vocal, outside the influence of European traditions. Comparing western vocal composition with Japanese, Indian, Chinese, African, Spanish and Jewish musical practices, he states that "[t]his is far removed from what prima donnas do, and much more related to the artlessness with which children use

their voice". Nono's research strongly influenced his writing for voice, and fed into his electroacoustic work, as is demonstrated in a work such as *Das Atmende Klarsein* (1980-83), for eight voices, bass flute and live electronics.

Hildegard Westerkamp combines recordings of the speaking voice with environmental sounds in many of her works. In *Für Dich - For You* (2005), she chose to work partly with non-professionals in the recitation of a poem by Rainer Maria Rilke, which forms the core material of the piece. Working with the participants in the studio, her aim was to "make them feel comfortable, give them a chance to access their natural voice, their expressiveness and feelings", thus opening up "interesting possibilities and ways of vocal expressiveness" (personal communication, 9 January 2021, Appendix 4).

Two key examples of works involving children's singing voices are Karlheinz Stockhausen's *Gesang der Jünglinge* (1955-56) and Jonathan Harvey's *Mortuos Plango, Vivos Voco* (1980). In both works, the children's voices are interwoven with sound synthesis, as well as with church bell recordings in the latter case. Both works "[blend] acoustic and electronic sounds as equivocal raw materials" (Holmes, 2020, pp. 245-6). The "physical impossibility" of the union between these disparate sound sources is realised through sound processing (Kendall, 2016, p. 44) - analogue in the former, digital in the latter case.

These compositional practices and works direct the attention to a point which appears to be essential for many electroacoustic and acousmatic composers working with the human voice: the opportunity to work with specific individual voices, not (necessarily) classically trained; and benefitting from their idiosyncratic characters and qualities. To be sure, the individual voice fascinated composers long before the age of electroacoustic music. Leoš Janáček (Harvey, 1999, p. 49) already stated that “[f]or me, music emanating from instruments [...] contains little real truth. [My notebooks with speech melodies] are my window through which I look into the soul". And popular music tends to "[project] the idiosyncratic features of the individual singer’s voice" (Wishart, 1996, p. 258). However, analogue and digital technology have enabled composers to develop new approaches in pursuing such fascinations.

5.3. Human presence in the virtual DAW environment

Before discussing aspects of human presence, and the unique voice, in the third portfolio composition *Transits*, human presence in the virtual DAW environment is addressed. They are an intriguing match - the proverbial human and machine.

Demers (2010, pp. 113-4) states that "recordings excel at suggesting acoustical situations that do not or cannot exist in real life". Yet, "human nature likes the idea that whatever it is that we hear was created at a particular time and in a particular place" (Gibbs and Dack, 2009, p. 184). The acoustic environment, or its spatial and temporal suggestion, is thus one of the key elements that may provide psychological access to an electroacoustic composition.

This may apply especially to human voice and body sounds, which, arguably more than instrumental or non-human sounds, create a relationship with the listener. Even when speech is "fragmented so that words become meaningless, spoken in a language we don't understand", it is "still speech and part of our world" (Norman, 2000, p. 240). And "[o]nce we begin to consider two or more utterances occurring in the same acoustic space, we enter into the realm of human interaction" (Wishart, 1996, p. 315). An awareness of the spatial and temporal context in which the musical narrative is positioned, and a consciousness of "how locating sounds can result in complex interactions", can help electroacoustic composers "enhance meaning and clarify intention" (Gibbs and Dack, 2009, p. 173). A virtual space may thus become, according to Gibbs and Dack, "no longer just an undefined space with certain qualities: it has become a place, somewhere that we can go to".

5.4. Composing *Transits*

Transit: the passage of goods or people; a change or transition; a route (TheFreeDictionary, 2020)

These different meanings of the word transit have informed the subject matter of *Transits*: 1) change versus permanence, interpreted in an (inter)personal context, through the use of recorded spoken text; 2) traveling across borders, translated to shortwave radio recordings; and 3) the traveling of sound through space, by means of the spatialisation of amplified sound in performance. The phenomenon of transit has thus inspired the composition on a thematic, sonic and spatial level. Recordings of speech in many languages, obtained through online crowdsourcing, and gradual scannings through shortwave radio frequency ranges, form the sonic basis of *Transits*. The aspects of the unique voice, and human presence in the virtual DAW environment, discussed above, are explored in the work. *Logic X* served as the compositional environment.

In the first two portfolio compositions *Variances* and *Rapprochement*, the impact of the DAW on the creation of instrumental concert music was explored; with *Transits*, the voice and fixed media were introduced into the research project.

Three existing electroacoustic works provided inspiration in the creation process of *Transits.*

Transits was written as a companion piece to Luigi Nono's *Das Atmende Klarsein* (1980-83); it follows its instrumentation of vocal octet, bass flute and electronics. *Das Atmende Klarsein* was inspired by the possibilities of the Freiburg Experimental Studio in Germany. Nono's discovery of the analogue studio changed his compositional practice. His studio-based electroacoustic experimentation with performers came to trigger his musical material. Flautist Roberto Fabbriciani described Nono's approach as "necessarily collaborative and continually dedicated to a freedom that saw possibility in uncertainty" (Edwards, 2008).

Das Atmende Klarsein is structured in alternating sections for vocal ensemble and bass flute. Apart from overlaps between sections, "the flute and choir never perform together" (Edwards, 2008). Both the bass flute and the vocal ensemble are subjected to live electronics processes such as harmonisation, transposition, and spatialisation.

As Edwards states, through this spatialision, Nono and Hans Peter Haller, of the Freiburg Experimental Studio, created "a new instrument in an imagined space within the concert hall".

While the bass flute part utilises playing techniques such as air sound, whistle tones, multiphonics, vibrato and tremolo, the vocal parts are performed without extended techniques, non-vibrato throughout, utilising only the aspect of register. A unifying element between the bass flute and the vocal ensemble is breath. Throughout the work, breath dictates phrasing and form.

The text of *Das Atmende Klarsein* was set by Massimo Cacciari, and consists of snippets from Rainer Maria Rilke's *Duineser Elegien* (1912-22), and the golden tablets from Orphic graves. In the initial section the text is set in such a way that maximum clarity of meaning is achieved. In later sections, a blurring of diction and meaning is created, through the use of multiple languages, collage techniques, and the superimposition of text.

Transits was also inspired by Karlheinz Stockhausen's tape work *Hymnen* (1966-67), particularly in its use of shortwave radio recordings. This acousmatic composition features "broadcast sounds, miscellaneous noises, shortwave interference, crowd sounds, and Stockhausen's breathing" (Holmes, 2020, p. 248). Within the work's context of "international gibberish of shortwave transmissions" (Toop, 1995, p. 101), the breathing provides a sense of close human presence, evoking associations with the prominent role of breathing in the bass flute part of Nono's work.

A third inspiration was found in Trevor Wishart's acousmatic work *Globalalia* (2004), a piece "using syllables taken from 26 different languages, to create a series of elaborate variations on the sounds of language itself" (Wishart, 2012). As the shortwave recordings in *Hymnen*, the voice recordings were collected "from the airwaves". With these voice recordings, Wishart created a database consisting of around 8300 syllables, organised phonetically, to create *Globaliala*. The human voices,

"initially intended for a non-musical context", are "redeployed into a musical context" (Gould, 2014), raising issues of context and meaning as discussed above.

As in the works by Nono, Stockhausen and Wishart, the texts for *Transits* stem from multiple sources, and utilise a variety of languages. *Continuity II* (2016), a short poem by the American poet and music publicist Daniel Albertson, was chosen as a pre-existing text. The six lines of the poem, sung by the vocal octet in four *refrein* sections, form the core of the libretto.

The second text source consists of a large number of anonymous recorded responses to two questions, collected by the composer through an online request (audio sample 17: some recorded responses). The questions related to continuity and change in the life of one's best friend. A large number of respondents recorded their answers to the two questions, in their native language, in up to six words per response. In the libretto, one line is one response. One contributor interpreted the instruction of up to six words per response differently, and recorded a larger number of lines of up to six words each, thus making a more prominent contribution, and unintentionally obtaining a quasi soloistic role within the libretto.

In the spirit of Goebbels and Nono, the speech recordings yielded a large collection of unique voices, and a variety of distinct vocal colours, speech characters, and content matter. The recordings appear in the fixed media; a number of them are also transcribed for the vocal octet, and sometimes for bass flute. This approach can be compared with Steve Reich's *Different Trains* (1988), in which material for string quartet is derived from speech and field recordings. The notation of the speech snippets is necessarily an approximation; however, since the snippets also appear in the fixed media, the musicians can auditively emulate the recorded speech. They thus become 'shadow musicians' in the respective sections, as the shadow ensemble in the portfolio compositions *Rapprochement* and *Variances*.

The contributors made their voice recordings under different acoustic circumstances, and with a variety of devices: smartphones, tablets and computers; portable recording

devices; and DAWs. The resulting differing sound quality adds to the voice timbres and characters of each of the recordings. What all recordings share, as was hoped for, is a sense of intimacy, and naturalness of speech, providing the work with rich human presence. Although many of the recordings may be "spoken in a language we don't understand [...] it is still speech and part of our world" (Norman, 2000, p. 240). Yet, to enhance meaning, and clarify intention, the responses rendered in transcription by the vocal octet are in the original respondents' languages, as well as in English translation.

The shortwave radio recordings were made by performing slow continuous scannings through the various bands of a shortwave radio. Each shortwave band was recorded just once, within a total timespan of around 60 minutes, thus capturing 'a moment in time'. Within the shortwave recordings, occasional voices appear in various languages; because of the continuous scanning, only isolated words are captured, and rarely a snippet of music. The shortwave material consists for the most part of noise in gradually changing colours, and occasional pulses and beeps - a barren environment for the human voice recordings (audio sample 18).

In order to create sufficient scope for the diverse and rich audio and text material, the relatively large vocal and instrumental forces, and the electronics in performance, a work with a substantial duration was foreseen. A DAW project with a 20 minutes timeline was thus created. In line with the multi-channel electronics of Nono's work *Das Atmende Klarsein*, performed in the same concert programme, four tracks were created, anticipating four channel playback in performance. The compositional process was initiated by structuring the DAW timeline in pre-defined sections for the shortwave and speech recordings, bass flute, and vocal octet, in various combinations. The shortwave recordings, and the speech recordings, were placed within this structure. Subsequently, through a process of positioning and editing along the DAW timeline, the material was shaped into a fixed media part (Figure 12). Many of the speech recordings appear more than once, thus increasing the intelligibility of the spoken text within the work, and enhancing the creation of meaning. To maintain the colour and character of the original recordings, both the shortwave and the text

recordings were left largely unmodified. In one section, the shortwave and text recordings were subjected to extensive editing, resulting in rhythmical patterns, serving as a fundament for a bass flute solo (Figure 13, audio sample 19).

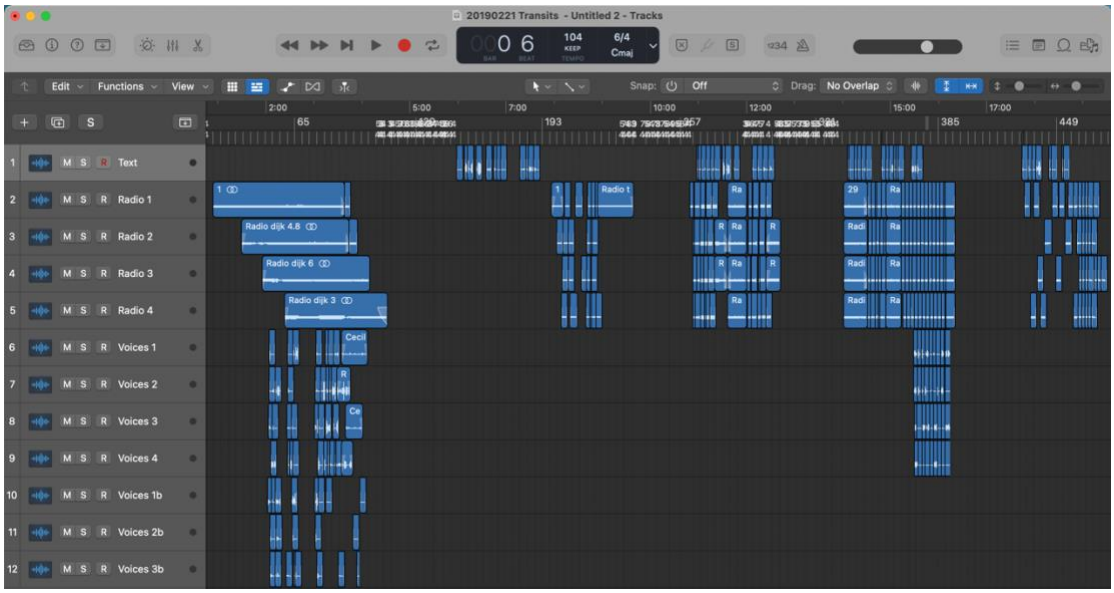

Figure 12: shortwave and speech recordings structured along the DAW timeline

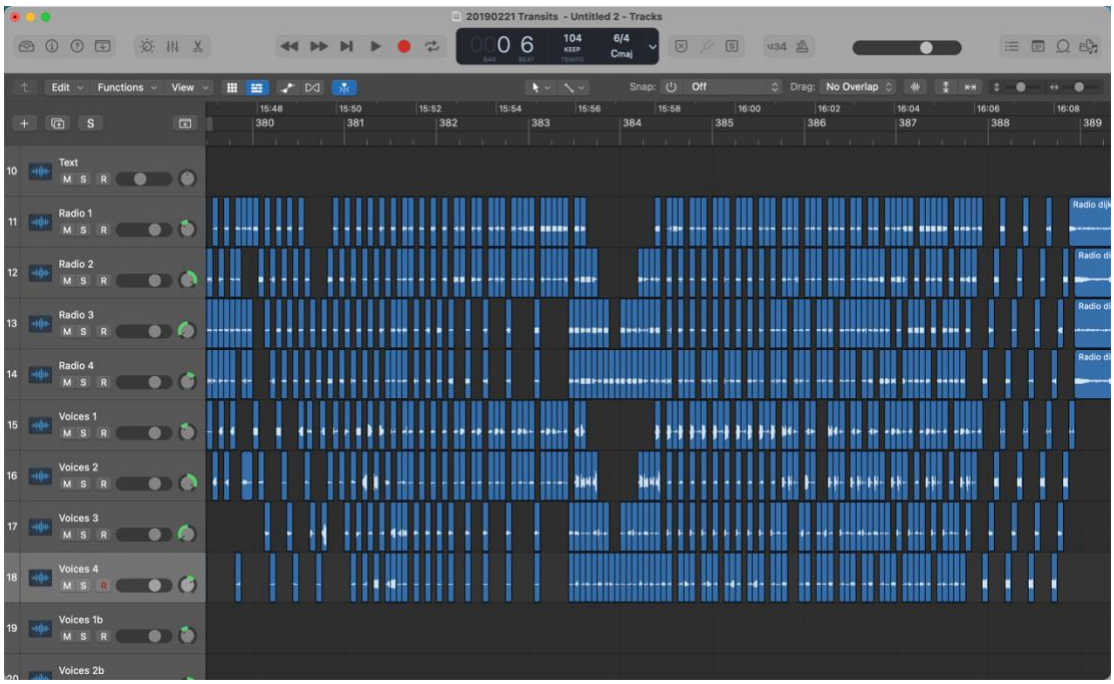

Figure 13: shortwave and text recordings edited into rhythmical patterns

Following the composition of the fixed media, the parts for voices and bass flute were composed within the DAW, using a MIDI keyboard, a Virtual Instrument for the bass flute, and several different Virtual Singing Instruments for the eight voices.

Three main types of basic vocal material were developed for *Transits*:

1) slow chord progressions, on the basis of Daniel Albertson's brief poem *Continuity II*. Each section of *Continuity II* utilises only a few words; the poem is thus 'stretched out' through the piece, as a *refrain*. Its long lines are comparable with the vocal writing in *Das Atmende Klarsein* (audio sample 20 with Virtual Singing Instruments; audio sample 21 concert recording);
2) rhythmicised harmonic material, utilising selected words from the text recordings;
3) doublings of the spoken text recordings, emulating the text rhythm and melody (audio sample 22 with Virtual Instruments; audio sample 23 concert recording).

The DAW renderings with Virtual Singing Instruments and bass flute Virtual Instrument present full precision in intonation and rhythm, but lack text, and appear 'robotic'. The concert recording demonstrates some intonational difficulty in the writing, but exemplify vocal nuance and natural phrasing.

The bass flute has three distinct roles. As a soloist, its material is elaborate and quasi-improvisatory; when interacting with the text, it follows the melody and rhythm of the text; and in some sections the bass flute joins the vocal ensemble's chord progressions. While in Nono's work the flute and voices never play together, apart from brief overlaps, *Transits* features sections for choir alone, solo bass flute, and full ensemble.

After the completion of the fixed media and the vocal and instrumental parts within the DAW, the audio was mixed and mastered. Also in this final compositional phase, the sonic character of the original recordings was as much as possible left intact. A stereo mock-up DAW recording of the full work was made for reference; audio samples 20 and 22 above are taken from his mock-up recording.

Subsequently the vocal and bass flute parts were exported as MIDI files, and imported into *Sibelius 6*. During the process of notation, corrections and adjustments were made to the parts. If these impacted on the timeline structure, corresponding adjustments were made to the soundtrack within the DAW, to maintain the correspondence between the soundtrack and the live parts. Special care was taken in transcribing the text snippets for the singing voices (Figure 14), to ensure easy rhythmical synchronisation between the soundtrack and the voices.

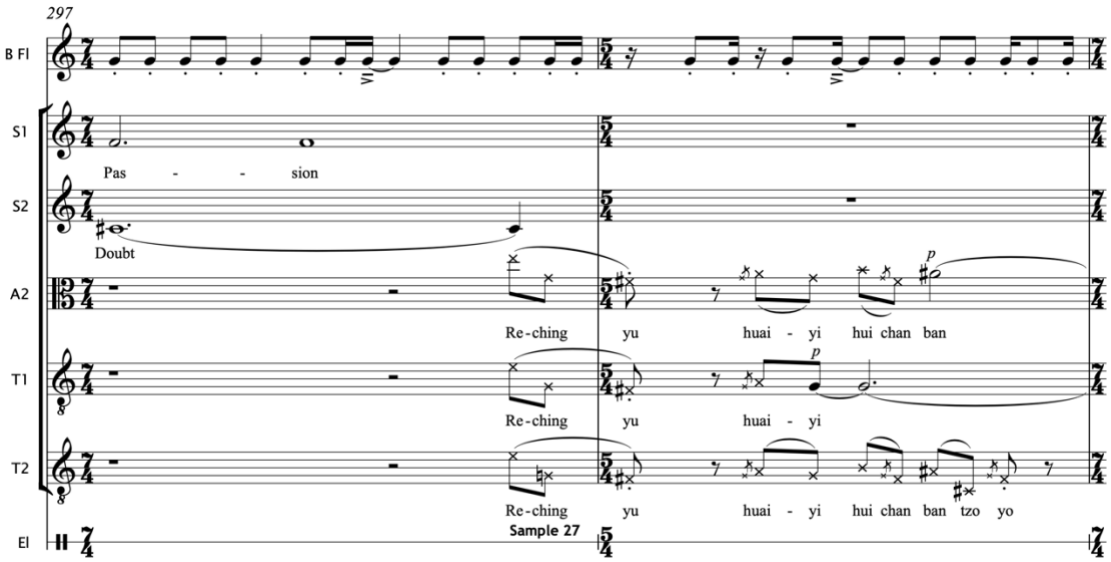

Figure 14: transcription of text snippets for singing voices

As a last step in the compositional process, the four channel performance audio was finalised within the DAW. The soundtrack was divided into a number of short sections. These were numbered, and the numbers were marked in the score. This enables rehearsing in sections, and facilitates the synchronisation between the conductor, musicians and fixed media. The performance audio, so far panned in stereo, was routed between four channels, in a variety of movements and patterns, partly fixed, and partly to be operated live through randomised spatialisation software. Random spatialisation is also applied to the voices and the bassflute. This spatialisation forms a live electronics aspect of *Transits*.

5.5. Realising *Transits*

During the compositional phase of *Transits*, the acousmatic speaking voice was explored within the DAW environment, as the primary vehicle of human presence in the context of the work. DAW playback through studio monitors or headphones strongly supports the intimacy of spoken word. DAW production also allows for an intricate acoustic interplay between the intimate space created by the human voice, the spaces of vocal and instrumental performance, and the undefined space of the shortwave radio. The sense of intimacy resulting from the sonic human presence, the signification of the spoken text, the musical substance, the plurality of acoustic spaces, and the interplay between these elements, together were responsible for the creation of meaning in *Transits*. The DAW environment allowed a nuanced interplay between, and fine control of, all these elements. A sense of intimacy, control, nuance and note perfection were omnipresent in the composer's space, throughout the compositional process.

Such intimacy, control, nuance, and note perfection are much harder to achieve in a live performance, particularly in a reverberant performance space, in which the acoustics of the fixed media and the room acoustics are superimposed - in the words of Denis Smalley (1997, p. 122), the "composed space" and the "listening space". Audio samples 24 and 25, taken from the DAW mock-up recording, respectively from the concert recording, demonstrate differences in clarity, precision, balance, phrasing and timbre between the composed space and the listening space (audio sample 24, audio sample 25).

In the performances of *Transits*, the fixed media were played back through four sets of loudspeakers, positioned around the audience, which was situated in the center of the auditorium, for an optimum perception of the spatialisation of sound. The voices and bass flute, positioned on the stage, were amplified for balance, acoustic adjustment to the space, and spatialisation. *Transits* was performed with a conductor, assuring synchronisation with the fixed media. A sound designer/engineer controlled

the amplification levels of the four channel audio, eight voices and bass flute, and the spatialisation. The composer controlled the audio cues.

The first performance of *Transits* took place in a reverberant concert hall, which suited the vocal and instrumental performance, but obscured some of the fixed media's nuances of composed space. The second performance took place in a much less reverberant space, which afforded more control in the interplay between the fixed media, the bass flute and the vocal ensemble, through "the art of diffusion" (Smalley, 1997, p. 122). Consequently, the realisation of *Transits* in the second performance was much closer to the identity of the work as perceived in the composed space of the DAW, resulting in a more intimate experience. The two different realisations of *Transits* thus demonstrated that "both the qualities of space as evidenced by acoustic dimensions and the way in which these feed into the creation of a sense of a real actual physical place or location are highly significant in how we respond to composed, performed and realised works" (Gibbs and Dack, 2009, p. 184).

The second performance was separated from the first by a couple of months, and it was preceded by a second rehearsal period. It manifested an improved grip on the work. Since the recording of this second performance appeared to have failed, the earlier recording is included in the portfolio.

6. *Shutterspeed*; transformed in transfer

Shutterspeed, for clarinet and fixed media, was commissioned by the Dutch clarinetist Michel Marang. The work was premiered by Marang on 6 June 2020 at the Dag in de Branding festival in Theater Korzo, The Hague, The Netherlands. Due to COVID-19, the performance was live-streamed and took place without a physical audience.

Marang's double profession as a clarinetist and photographer has impacted on the concept and aim of the work: utilising the DAW to explore the dichotomy of the 'blink of an eye' of photography's exposure time and music's unfolding in time. The basis of the piece is formed by recordings of the shutter sound, as well as other sounds, of historical photo cameras, and 'snapshots' from the existing clarinet repertoire. Issues of appropriation, and the realisation of meaning and identity of recorded and performed material in a new context, feed into the discussion.

Shutterspeed was composed in a DAW configuration involving:

- *Logic X* as the creation environment;
- the use of pre-existing recordings and field recordings, edited, placed and organised on the DAW timeline, to create a basic structure for a live clarinet part;
- the use of a MIDI keyboard and a Virtual Instrument for the composition of a clarinet part;
- and the creation of stereo fixed media for live playback, in the electronic music tradition of works for performer and soundtrack.

6.1. Recording and the transfer of gifts

The creative process of composers is often informed and inspired by other artwork. In the words of Jonathan Harvey (1999, p. 54), "[e]ngagement with other works of art, at whatever level it takes place, has always been among the most fertile sources of

inspiration for composers". Such engagement may impact on motivic material, form, instrumentation, style, musical character, and so on. If the other artwork comprises musical work, quoting and reappropration are common implements, from "the simple borrowing of a musical motif in the form of a citation or homage, all the way to 'plunderphonics'" (Bonnet, 2016, p. 312). The latter term, introduced by John Oswald in his paper *Plunderphonics, or Audio Piracy as a Compositional Prerogative* (1987), denotes music created exclusively with samples of pre-existing music. Such practices are certainly not a recent phenomenon: "[m]usicians have always stolen, borrowed, exchanged or imposed influences" (Toop, 1995, p. 12). But, as Toop adds, in the past century or so "music has become voracious in its openness - vampiric [...] asking to be informed and enriched by new input and the transfer of gifts."

Recording has arguably played a major role in this voraciousness; it has launched "everything in the world as materials for music, each item as valid as any other" (Sinker, 2002, p. 189). This availability of material for reappropriation thus "creates a freedom of choice unprecedented in traditional music" (Manning, 2013, p. 489). Composer John Zorn, whose compositions often rely on extensive stylistic quoting, relates his eclectic approach to growing up with a diverse record collection. At the same time he questions the appropriateness of such a practice: "I'm basically a thief. There's no hierarchy" (Toop, 1995, p. 261).

Since the days of the Edison phonograph, recordings were essential in the compositional approach of Béla Bartók. Bartók traveled extensively through Hungary, Bulgaria, Romania, Serbia and Slovakia, often together with fellow composer Zoltán Kodály, recording local *musicking*. This strongly impacted on his work: "recording played a seminal role in reawakening his hearing to the presence and significance of these various subtle powers of expression" (Chanan, 1995, p. 11). It gave Bartók access to details that can only be perceived through "the recording process [that] fixes everything for inspection" (Gracyk, 2009, p. 79).

Recording has played a major role in compositional practices of many composers ever since. It has provided them with a "ruthlessly objective memory, affording us a view

of reality which is simultaneously heightened in that we can review and shift the focus of our attention as we replay events" (Young, 2009, p. 322). Approaches include a wide range of "techniques of citation, reappropriation, and rereading of existing works" (Bonnet, 2016, p. 312); *musique concrète* practices "based on the simple manipulation of microphone recordings" (Manning, 2013, p. 25); post-modern practices of "music that jump[s] across stylistic boundaries with little regard for synchronicity or "good taste"" (Toop, 1995, p. 261); popular genres such as "House and Rap [using] samples to reinforce what is familiar" (Cutler, 2007, p. 154); turntablism as "a complete triumph of style over substance" (Shapiro, 2002, p. 164); Heiner Goebbels' use of samples and historic recordings, again in Cutler's words, "to make the familiar strange, dislocated, more like debris"; and plagiarism, committed by "the forger, the unknown maker of unauthenticated goods, [who] is emblematic of electronic culture" (Gould, 2007, p. 121).

Many of these practices, based on the compositional use of recordings of pre-existing material, renounce the familiar idea that "[a]ll musical knowing originates in the embodied act of performance making, when the hand makes contact with the musical material, and begins to mould it." (Doğantan-Dack, 2009, p. 308). Instead, composers may position themselves as an intermediate, receiving 'musical gifts', disassembling them, utilising such material to create new gifts, and passing these on to the listener.

6.2. Identity and meaning of recorded sound in a new context

In familiar instrumental and vocal practices of borrowing motivic material from pre-existing musical works, note sequences inserted into a new context may easily change their identity. Admittedly, some note sequences appear to be motivically robust. If this were not the case, if specific note sequences would not be able to carry identity from one musical context to another, motivic quoting would lose much of its appeal. But the large majority of potential note sequences made available by western music's twelve notes within the octave appears to conform easily to a new context.

But how does recorded sound, "the literal re-presentation of the sound of something – not just its mimicry through instrumental performance" (Emmerson, 2007, p. 67), obtain identity in a new context? David Hirst (2008, p. 56) states that "[e]stablishing identity in acousmatic music is not as clear cut as it is the case with instrumental music". How identity and meaning coded into recorded sound respond to reappropriation is an essential question for composers, since "[t]he great distribution of experience, the great community of listening, comes about via its coding" (Bonnet, 2016, p. 242).

When a recorded sound is imported into the DAW, it is isolated from its original acoustic environment and context. It "loses, along with its address, its destination, and its origin" (Bonnet, 2016). Recording renders it "an intact reflection of experience as well as an object that can be taken apart and reassembled" (Young, 2009, p. 320). Traces of its origins are carried into the virtual environment: "samples necessarily bring to new works associations from their original environments" (Demers, 2010, p. 61). Yet, a new context needs to be created, since "a reproduced sound can accede to authenticity only on condition that one considers it for itself, and not as a phantom of the original sound" (Bonnet, 2016, p. 43). In this new context, new meaning needs to be created, since "[t]he power of transcontextual techniques lies in the formation of new meanings, and not in the borrowing process for its own sake" (Field, 2000, p. 53). Such formation of new meaning takes place in interplay between all the reappropriated sounds; once grouped within a new context, sonic objects "forget themselves as objects, and each bear a value only in relation to the whole" (Schaeffer, 2017, p. 33).

Thus, in composing with recorded sound, sounds may, partly of fully, lose their original identity and meaning, and obtain a new identity and meaning, in relationship with the totality of the recorded sounds, grouped within a new context. How can "a product" be manufactured "out of a certain type of raw material" (Chanan, 1995, p. 69)? And in doing so, how can "[t]he expressive mark [of the material] be rewritten, reinterpreted", so that the "sound can be projected into another regime of discourse

and can take on other values, tell another story" (Bonnet, 2016, p. 258)? These questions come into play in composing with recorded sound.

6.3. Material, form and discourse

While recording has made every possible sound available as material for music, creating form, "the lever that propels the sonorous toward recognition, hence toward permanence, and finally toward audibility" (Bonnet, 2016, p. 121), is as much as ever the composer's concern. Schaeffer (2012, p. 79) formulates some essential questions around composing with recorded sound:

> "We wanted to create a work. How shall we go about it? First, provide ourselves with material, then trust to instinct? And how shall we establish the score? How are we to imagine a priori the thousand unexpected transformations of concrete sound? How can we choose between hundreds of samples when no system of classification, and no notation, has yet been decided upon?"

At least three overarching approaches can be discerned in creating form with recorded sound.

Composers may "start the creative process by developing a clear concept of the sound structures they wish to achieve [...] leading to a precise set of studio routines, which may then be executed" (Manning, 2013, p. 22). This approach is reflected in early studio works by Karlheinz Stockhausen, such as *Gesang der Jünglinge* (1955-56), created according to precise planning. Also in the realisation of John Cage's acousmatic work *Williams Mix* (1958), precisely defined studio routines were executed - albeit according to chance operations, without a predefined concept of the sound structures.

Alternatively, composers may "start with a selection of potential sound sources, offering a range of characteristics with which they may experiment, building up from the results of such investigations the elements for a complete composition" (Manning,

2013, p. 22). As Manning points out, especially in the latter case, in which the auditioning of the material forms the starting point of the compositional process, the characteristics of the recorded sound may strongly influence the creation process, and thus the resulting work, including its form. According to Toop (1995, p. 257), developing structure through such an approach "is the most radical structure of all, since it is hard to envisage a master plan emerging out of such an amorphous, uncontrollable method". Hildegard Westerkamp (personal communication, 9 January 2021, Appendix 4) states that "I never have a preconceived structure for my pieces, [...] because in my experience the recorded materials will allow for a structure to emerge". In the creation process of Trevor Wishart's *Globalalia*, discussed in the previous chapter, the meticulous creation of a database with the selected material was followed by a compositional process directed by the nature of the material. This approach is not unlike early practices in Pierre Schaeffer's studio, in which the creation of an archive of recorded sound formed an important part of the studio work. Although the creation process of *Globalalia* was thus highly structured, the form of the work still results from the investigation of the sonic material.

Whether composed according to precise planning, or resulting from experimentation, works created with recorded sound, according to Pouncey (2002, p. 155), demonstrate a tendency toward "a musical form defined by fragmentation and discontinuity". Fragmented form can be intentional, as in Cage's *Williams Mix*, shaped by indeterminacy: "Form is what interests everyone and fortunately it is wherever you are and there is no place where it isn't" (Cage, 1961). Fragmentation might also be considered inherent to a practice which "allows composers to construct music by constructing recorded sound". A work may "[emerge] gradually, through trial and error" (Gracyk, 2009, p. 69), and sometimes be "lost and helpless in the [electronic] forest" (Toop, 1995, p. 260). To be sure, composing through trial and error has always been an accepted compositional approach: "Composing begins when a performer, liking what he or she has just done, repeats it, perhaps many times, and tries to improve it" (Small, 1998, pp. 113-4).

Many compositional practices involving recorded sound, however, demonstrate a solid grip on form. Some examples are process-based compositions such as Steve Reich's early tape works, in which "repetition is [...] the revelation of *form*" (Bonnet, 2016, p. 115); works in which the recording itself defines structure and form, such as Gavin Bryars' *Jesus' Blood Never Failed Me Yet* (1971); works such as Andrew Lewis's *Penman Point* (2002-03), which utilise "recurrent phenomena" to assist in the understanding of "musical organisation" (Seddon, 2016, p. 246); or works composed according to narrative discourses, such as many of the works by John Cousins, discussed in the previous chapter.

A third overarching approach with recorded sound involves practices in which structure and form are not, or only partly, defined during the compositional phase. In such practices, often involving live electronics, form is achieved in real-time, in live performance, or in an installation setting. An example of such work is Ros Brandt's *Pillars of Memory* (1993), "an interactive sound installation in Austria that combined audio activities and inputs from several regional locations, recorded as loops and fed into a warehouse space where the movement of audience members affected the density of the textures being heard" (Holmes, 2020, p. 385).

Many of these past practices relied on the electronic studio; most current practices are based in the DAW environment. As discussed in Chapter 2, the DAW's timeline, and its playback and editing functionalities, facilitate a variety of approaches in realising form when composing with recorded sound. How snippets of concrete sound, and of pre-existing music, can be appropriated in a DAW setting; how form can be created with such isolated material; and how photography's exposure time may inform a compositional concept, was explored in *Shutterspeed*.

6.4. Photography and sound recording: snatches from space and time

Photography and recorded sound seem to be fully disparate phenomena: in photography the exposure time, or shutter speed, approximates 'the blink of an eye';

for the exposure of sound, it is precisely the passing of time which is needed. The longer the camera's exposure time, the brighter the photo - until the image becomes white, loosing identity and meaning. With the shortening of a recorded sound, it becomes increasingly unrecognisable - until it too loses identity and meaning.
Yet, as Rob Young (2002, p. 47) states, sound objects represent "a measure of lived time scooped out of time, just as the photograph snatches a single instant out of visual, ontological reality". In the words of John Young (2016, p. 70), both "[a] camera or a sound recording device makes a fixed object out of our experience". A photographic image isolates and fixes a segment from a spatial context; a sound recording isolates and fixes a segment from a temporal context. At the same time, a sound recording represents a precise location in space; a photographic image represents a precise moment in time.

Although these two media are fundamentally different, they both isolate and fix snippets from space and time. And while photography carries traces of time, sound recordings carry traces of space. These connections between the two media informed the concept of *Shutterspeed*.

6.5. Composing *Shutterspeed*

Shutterspeed was created on the basis of two sources of recorded sound: recordings of pre-existing music; and recordings of concrete sound made especially for the piece. Sound snippets of quasi photographic duration were isolated from the recordings, so brief that their agency in preserving identifiable traces of their original identity became the subject of musical investigation.

As a primary source, recordings of pre-existing clarinet repertoire provided *Shutterspeed* with rich musical 'documented experience'. Fragments of no more than three consecutive notes were taken from 15 recordings of works for, or involving, the clarinet, by Luciano Berio, Pierre Boulez, Claude Debussy (arranged by Stephan Koncz), Giora Feidman, Ivan Fidele, Béla Kovács, György Kurtág, Olivier Messiaen, W.A.

Mozart, Henri Pousseur, Franz Schubert (arranged by Reinbert de Leeuw), William O. Smith, Carl Stamitz, Karlheinz Stockhausen, and Igor Stravinsky. A list of the works is provided in Appendix 7. Some fragments have a slightly longer duration; these might be compared to a time exposure, an extended camera exposure time in low light circumstances. None of the clarinet snippets contains any developmental material; they are fixed objects, isolated from their origins. Do these brief note sequences prove motivically robust, or do they easily conform to a new context? In either case, their recorded identity made "never-to-be-repeated subtleties and inflections [...] available for infinite re-audition and placements in new contexts" (Young, 2009, p. 314).

The shutter sounds of photo cameras, and some other camera sounds, served as a second source of audio input. At *Foto Koberl*, a camera store in Graz, Austria, with an extensive collection of vintage and present-day cameras, 21 photo cameras and one camera flash were selected, and their sounds recorded. A list of the recorded devices is provided in Appendix 6. Of all cameras, shutter action at various exposure times was recorded, and of some cameras also the film transport, self timer, motor drive, or camera start up sound.

In *Shutterspeed*, the camera sounds create a conceptual and musical connection between the phenomena of recording within the visual and the auditory realm. The briefness of the camera's shutter speed, inherent to the capturing of a visual image, defines the temporal scope of the musical motifs; it dictates their unusual briefness. And while the cameras are not visualised within the work, they are sonified. Their sound is utilised to 'capture' the clarinet music; the recorded camera sounds 'frame' the clarinet snippets. The initial decision was made that the live clarinet serve as a musical partner for the clarinet snippets, but not for the camera sounds. A camera observes, captures, and frames; it is itself neither observed, nor captured, or framed. Both the pre-recorded and the live clarinet thus operate within the auditory 'frames' as defined by the camera sounds.

With the material from the two sources, the opening section of the fixed media was composed (audio sample 26). A DAW project was created in *Logic X*, with a timeline

of yet undefined duration. To initiate the compositional process, all the clarinet snippets were randomly placed within the first 40 seconds of the DAW timeline, close together, with many overlaps. Through a process of positioning and balancing, a playful and chaotic exhibition of clarinet snippets was created. Each clarinet snapshot was subsequently paired with, or framed by, a specific camera sound (Figure 15). To create transparency within the dense section, each clarinet and camera pair was panned, in other words, assigned to a fixed position within the left-to-right range of the stereo image.

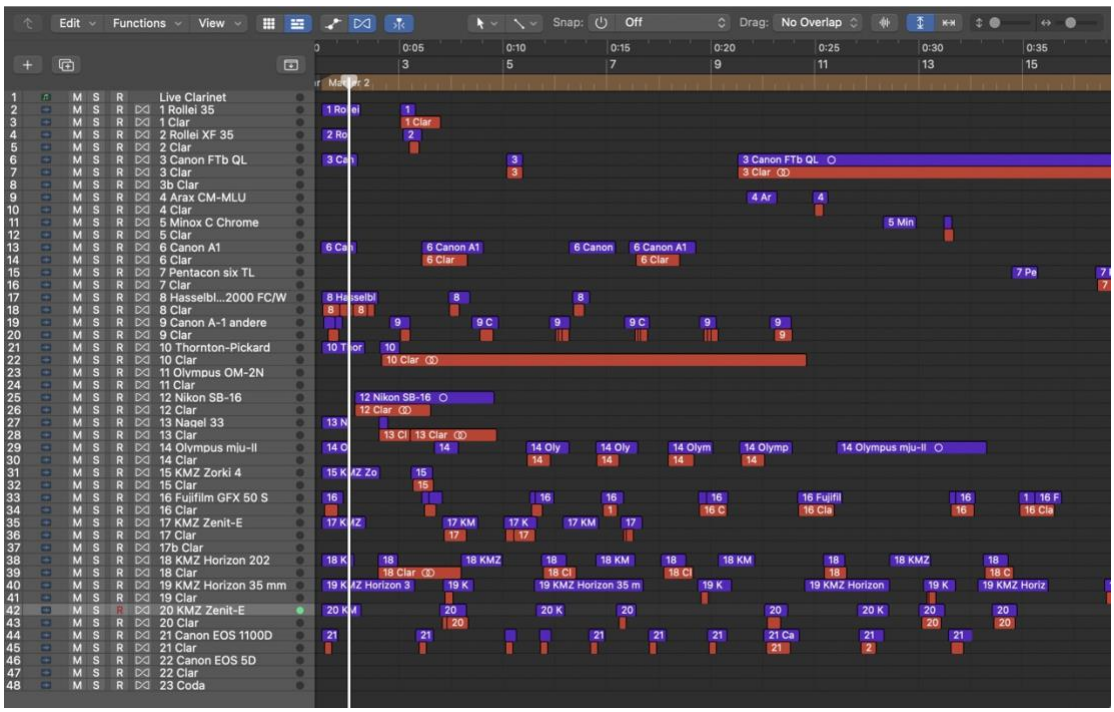

Figure 15: opening section with paired clarinet snippets and camera sounds

Through the "amorphous method" (Toop, 1995, p. 257) of experimentation with the sonic material, the opening section of *Shutterspeed* was thus structured. Subsequently, the global structure of the piece was determined, encompassing four sections:

A) the 40 seconds opening section: a playful, chaotic and brief exposition of all the clarinet and camera snippets, still without the live clarinet;

B) a long section led by the live clarinet, in which all the snippets re-appear, for the most part in the same order in the A section, but now with silences, repeats, inserts, and occasional editing or rhythmicising of the snippets;
C) a brief transitional section, featuring the recorded camera sound of a film rewind;
D) a reprise of the exposition, but with an excessive *accelerando* and upwards *glissando*, followed by an extended final live clarinet note.

All the paired snippets were now copied from the A section, and placed at a corresponding position within the timeline region reserved for the B section. This was however done in a much expanded manner, resulting in a very open texture, providing ample space for the live clarinet.

After all the paired snippets were roughly positioned within the B section, the live clarinet part for the B section was composed, as the soundtrack's musical partner (audio sample 27, with clarinet Virtual Instrument). This was done with a MIDI keyboard and a clarinet Virtual Instrument from the *Vienna Symphonic Library*. Material was first developed and tested, then performed in real-time. The thus created MIDI material was edited as needed. While composing the clarinet part, the positions of the snippets, and the overall structure of the B section, were constantly finetuned, in an interplay between the two layers (Figure 16).

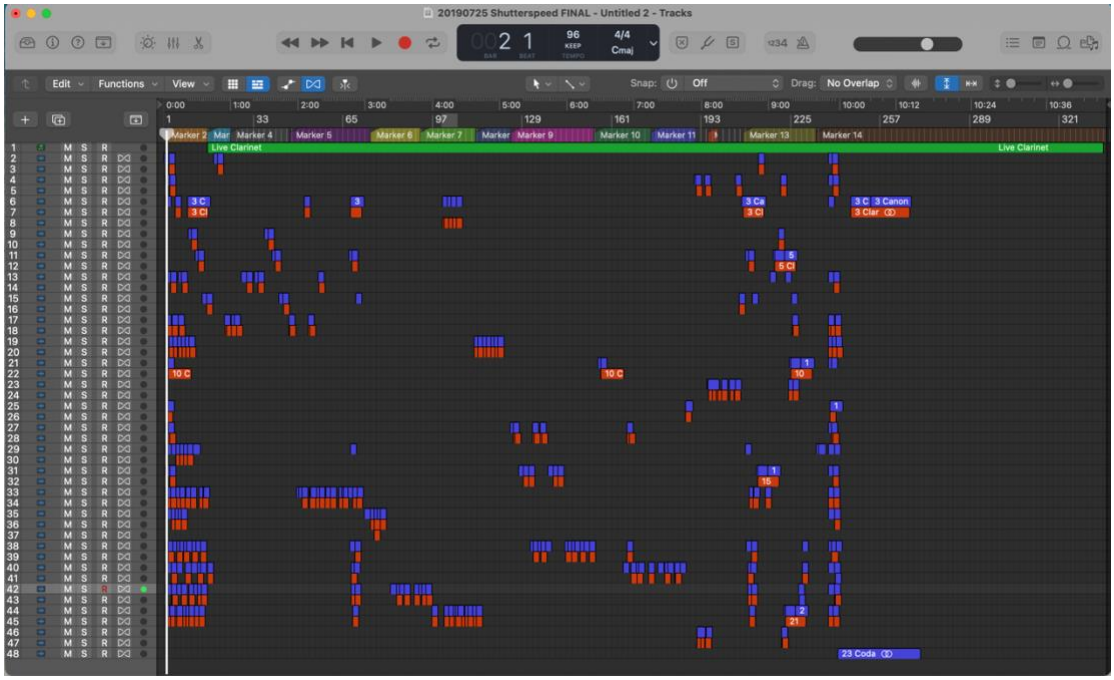

Figure 16: *Shutterspeed* timeline structure, with live clarinet

The live clarinet enters the piece through a long crescendo on a g#, picked up from a a clarinet motif in the A section, and making the transition into the B section. In the B section, the live clarinet draws motivic material from, commentates, connects, accompanies, extends, embellishes, and contrasts the paired clarinet-camera snippets. It provides the snippets with a new identity and meaning, and creates a narrative discourse throughout the B section.

Having reached the end of the B section, with a duration of around 8 minutes, it was decided to add a freer subsection, a *quasi cadenza*, to the pre-defined structure. This provides the clarinetist with an opportunity to perform more freely, and independently from the soundtrack. This subsection was created with material from the fixed media, as well as from the live clarinet part, both 'recycled' in a free manner. An audio sample demonstrates the *quasi cadenza* section with the clarinet Virtual Instrument as performed by the composer (audio sample 28).

The thus extended B section, with a total duration of 9 minutes, is followed by the brief transitional C section. This utilises a 10 seconds recorded film rewind, announcing the *reprise*, the D section (audio sample 29). This final section is an exact

repeat of the opening 40 seconds, but now subjected to an excessive speeding up, or accelerando, and simultaneously an upwards glissando, making the core sonic material of the piece briskly 'take off and vanish', in around twenty seconds (audio sample 30). The live clarinet finishes the piece with its initial g# pitch, in a long and gradual diminuendo, as a *coda*, or 'tail'.

The entire structure of the finished piece is thus made up of an exposition, development, *quasi cadenza*, *reprise* and *coda*.

To conclude the compositional phase, a stereo audio file for live playback was created. Up to this point within the compositional process, pre-existing clarinet recordings had been used within the fixed media. They had all invested their own musical character, instrumental timbre, acoustic trace, and intonational nuances into the new composition. To make a further step in the recontextualisation and re-composition of the clarinet motifs, all the snippets were re-recorded. At the same time, more musical consistency was achieved within the fixed media. However, in the re-recording of the snippets by Michel Marang, care was taken to maintain as much as possible their original timings, and their instrumental, timbral and acoustic idiosyncracies. These had, after all, informed and inspired the live clarinet part. The re-recorded snippets were worked into the fixed media. After mixing and mastering, it was completed.

Finally the live clarinet part was notated. The MIDI data were exported from *Logic X* as a MusicXML file, and imported into *Sibelius 6* (Figure 17). On the DAW timeline, neither the fixed media nor the live clarinet part had been composed according to pulse or meter. While in some sections a sense of pulse and rhythm was present, most sections were largely free in timing. Therefore, decisions about tempo, meter and rhythm needed to be made during the notational process. These decisions were explicitly not based on the origins of the snippets; any awareness of original meter or rhythm was ignored, as it had been during the compositional process. The snippets were treated as mere found objects. The notational phase thus served as a final step in the compositional process (Figure 18). For reasons of exactness in synchronisation between the live clarinet and the fixed media, graphical or free notation were not

considered suitable; standard notation was therefore used throughout. Only the *quasi cadenza* section was notated without defined meter, and without fixed synchronisation with the fixed media.

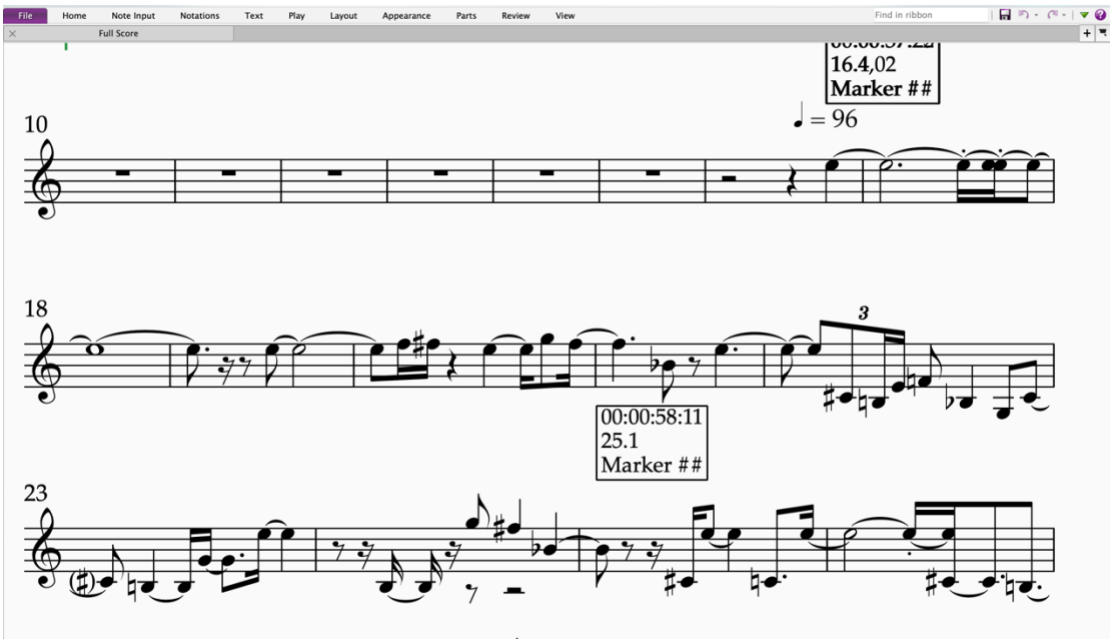

Figure 17: clarinet part imported into *Sibelius* as a MusicXML file

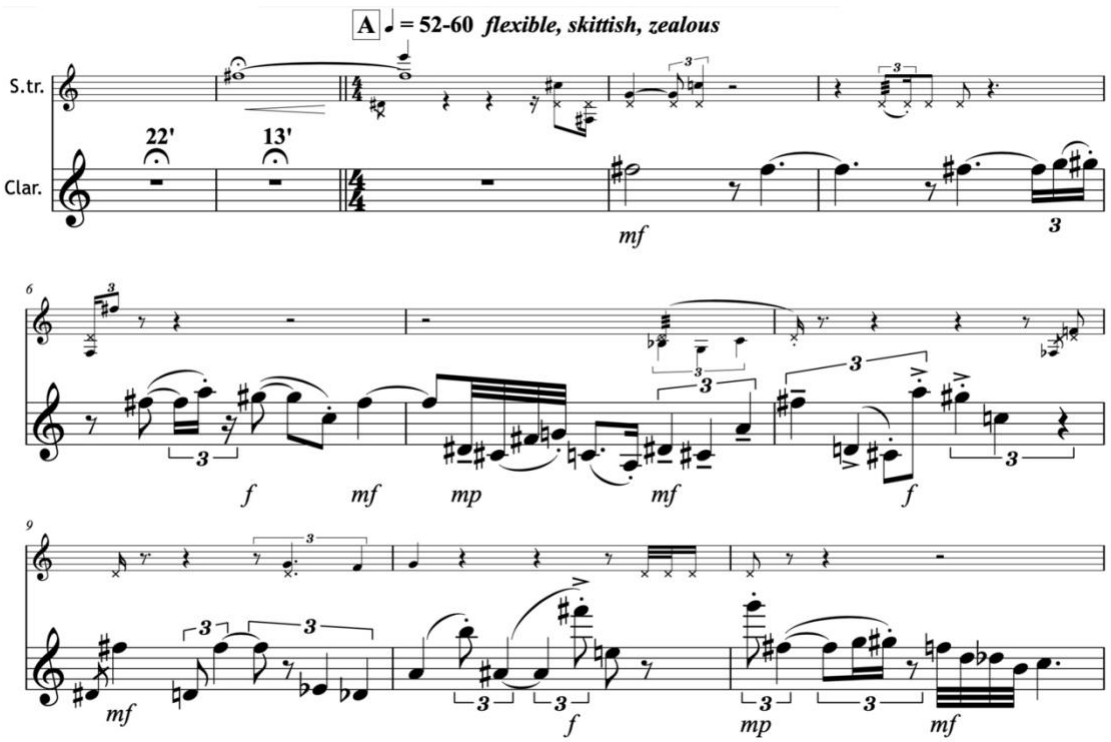

Figure 18: final *Shutterspeed* clarinet part, with fixed media cues

Since neither the fixed media material nor the clarinet part were composed in strict tempo within the DAW project, the musical notation was necessarily an approximation of the DAW material. Therefore, after the notation of the live clarinet part, a large number of cues from the fixed media were notated on an additional staff, allowing for aural synchronisation in performance. Creating a performance clicktrack for synchronisation would have been difficult, due to the tempo flexibility. It was also considered unsuitable for *Shutterspeed*: in the composer's personal experience a clicktrack tends to cause stiffness in interpretation, and hinders the musician's auditive focus on, and interaction with, the soundtrack. Although true interaction with fixed media is not possible, aural synchronisation from the side of the performer may result in the most lively musical experience, both for the performer and the audience.

6.6. Realising *Shutterspeed*

Once the work was completed, the live clarinet part, and the interplay with the fixed media, were examined with the commissioning clarinetist. The live part provided no major issues; only minor corrections were made. The internal balance within the fixed media was improved to enhance the interplay with the live clarinet, and some cue material was brought out dynamically to support aural coordination, and facilitate live performance.

The synchronisation between the fixed media and the live clarinet required detailed knowledge of the fixed media, but proved possible in performance. When all the written tempi are achieved, synchronisation is effortless. To allow the clarinetist room for interpretation, the fixed media provide cues for aural adjustment in case of slight tempo differences.

The live-streamed first performance was satifying, and provided no further issues. The live recording of this performance demonstrates the richer timbres and more natural phrasing of the live clarinet, as well as the impact of the venue's acoustics, the 'listener's space', on the work (audio sample 31).

Following the completion of *Shutterspeed*, and its repeated performance, a few questions arise.

In the first place, has any of the original musical context of the clarinet snippets survived the transfer into the new work? Considering the quasi photographic briefness of the snippets, the fact that none of them contain any developmental material, and their being embedded within an entirely new narrative, there is no doubt that their original context has been fully lost. As in Goebbels' use of samples, the familiar is made "strange, dislocated, more like debris" (Cutler, 2007, p. 154). The clarinet snippets have "[forgotten] themselves as objects" (Schaeffer, 2017, p. 33), and are "projected into another regime of discourse" (Bonnet, 2016, p. 258).

In continuation, how much of the origins of the clarinet material might be recognised by the listener? By a clarinetist who knows the repertoire well, some of it; by a non-clarinetist, almost certainly hardly any of it. At most, some clarinet snippets might give a stylistic hint. A few of the snippets do have, after Denis Smalley, a clear spectromorphological configuration, or "temporal unfolding and shaping of sound spectra" (Hirst, 2008, p. 14); these may prove motivically robust, and maintain some of their original identity.

Finally, does it matter if the origins of the material remain for the most part undisclosed? The playful and chaotic exposition doesn't provide clear clues regarding meaning and form. In this section, the material appears within a dense texture, yet in isolation. In the course of the subsequent B section, the snippets reoccur and gain a new identity, through repetition, and particularly through the agency of the live clarinet, which connects the snippets, and creates a new narrative. In the words of John Psathas, not the fixed media, created within DAW, but "the performer, the person playing live, has to be the storyteller" (Interview with Psathas, 22 March 2018, Appendix 1). The *quasi cadenza* and the *reprise* sections consolidate the listener's familiarity with the material. These final sections, concluding the narrative,
allow the listener a sense of completion.

7. *Fossils I-VII*; a work realised in four settings

Fossils I-VII, the fifth and final portfolio composition, is a work for piano and live electronics. The electronics are optional; the work can also be performed as a piano solo. Following the compositional phase, three different versions of the work were realised: an initial version for piano solo; a version for piano and live electronics (due to the COVID-19 circumstances only partly realised to date); and a full DAW-produced version with piano and electronics. Within these consecutive settings, the role of the DAW in interplay with other music software applications; aspects of liveness; and the issue of autonomy for an instrumental performer interacting with live electronics were explored.

Fossils I-VII was created in a DAW configuration involving:

- *Logic X*, a MIDI keyboard and a Virtual Instrument for composing the initial solo piano version;
- *Max/MSP* for creating live electronics patches;
- *Logic X* as well as *Ableton Live* for experimenting with audio processing to be programmed in *Max/MSP*; *Max/MSP* for the realisation of a live performance involving piano and live electronics;
- *Logic X* as a recording environment for the piano version of the work;
- and *Logic X* in combination with *Max/MSP* for creating a final version of *Fossils I-VII* involving piano and electronics.

The work was composed between 2019 and 2021. The piano score was recorded by Paolo Gorini on 31 May 2021. *Fossils I*, *VI* and *VII* were performed live by Gorini on 21 June 2021 at Splendor, Amsterdam, partly with live electronics. The DAW-produced version with electronics was realised between June and August 2021.

7.1. Leaving the timeline

As discussed in Chapter 2, the timeline is a key functionality of the DAW. By enabling "the organization of material on a timeline" (Marrington, 2016, pp. 52-63) it serves as a powerful tool for creating and controlling form during the compositional process. In combination with the DAW's playback, it allows a realistic impression of material and form. It also enables precise control of parameters along the timeline, through automation. In principle, in each instance of playback of an unamended DAW project, an identical representation of a composition can thus be realised. This makes the DAW a direct descendent of the analogue recording and composition studio.

The organisation of material along a timeline, fixed control of parameters, and identical representations of a composition in playback, may be particularly beneficial in the creation of fixed media works, or concert music with a fixed time structure. Compositional practices involving, in performance, flexible material and/or open form may require different kinds of functionality: "Probably you could say with a DAW, sometimes it fixes you too much to a fixed timeline" (Interview with Kyriakides, 22 March 2018, Appendix 3).

Computer music applications preceding the DAW did not function according to a timeline; also many current music software applications, such as *AudioMulch*, *Impromptu*, *Max/MSP*, *Pure Data*, and *SuperCollider*, are based on a non-linear workflow. Rather than structuring material in time, they permit generating and processing material, either in real-time or 'offline', the latter indicating the processing or generating of material disconnected from audio playback. Such applications may be aimed at live performance, and/or at studio-based compositional practices.

Algorithms, as "procedure[s] that can be written in a programming language as a set of instructions for a computer" (Holmes, 2020, p. 619), play a central role in such non-linear applications. Through adjustments to an algorithm, composers can "influence it, often live" (Interview with De Graan, 15 May 2018, Appendix 2). De Graan states that "what I like about the algorithms is that on each iteration [...] it does it slightly

differently" - just as musicians will realise a unique representation of a work on each iteration. Algorithms allow composers to create "not a single instance of the work, but instructions with the potential to create a family of instances" (McDermott et al., 2013, p. 225). In such practices, "[a] fascination with the idea of diverse outcomes from the same initial conditions is perhaps the strongest motivator" (Young, 2016, p. 96). The use of algorithms thus brings a sense of liveness to computer-based composition, and to electronic or electroacoustic performance.

Working in a timeline-based software environment does not exclude non-linear functionality. Many plugins, software elements enhancing the DAW's basic functionality, operate in a non-linear manner, in real-time, or offline. In addition, some applications combine linear and non-linear environments. *Ableton Live* offers both the 'arrangement view', according to a timeline, and the 'session view', providing "a non-linear workflow that allows music makers to explore ideas without a defined start or end point" (Ableton, 2021). With one keystroke, users can move between a timeline-based environment and an environment in which material can be created and processed in real-time - along with the material under operation. *Ableton Live* thus renounces "the opposition between the studio and the stage, between crafted electronic composition and live electronic improvisation" (Cox, 2002, p. 36). Other examples of such hybrid software applications are *MetaSynth* and *Kyma*.

7.2. The DAW in interplay with non-linear music applications

Composers creating concert music not involving electronics may well limit themselves to the DAW as a compositional environment, with its focus on the organising of material on a timeline. Also creating fixed media, especially with recorded material, as in a variety of *musique concrète*, electronic or electroacoustic practices, may be done entirely within the DAW environment. This may result in acousmatic works, or in electroacoustic accompaniments to live performance. John Psathas (interviewed 22 March 2018, Appendix 1) states that he uses the DAW as his exclusive compositional environment, in all of his works.

However, when working with electronics, particularly in a live context, composers are likely to use applications for signal processing or generating in real-time, in addition to, or instead of, the DAW. Oftentimes they use multiple applications, each for specific compositional or performative purposes. Electroacoustic composers and and performers Danny de Graan, Wouter Snoei, Jorrit Tamminga and Yannis Kyriakides state that they utilise, and partly code, customise or create, a multitude of applications, each fulfilling a specific role within their practice.

Three overarching approaches can be defined in combining the DAW with other software applications in compositional practices: 1) creating material in applications other than the DAW, not based on a timeline, either in real-time or through offline processing, and subsequently using the DAW "as a montage field" (Interview with De Graan, 15 May 2018, Appendix 2); 2) the initial creation of sonic material within the DAW, and/or in other applications, and the subsequent export of the sonic output to applications with live functionality; and 3) the exclusive use of live created and/or processed material.

In the first approach, software applications other than the DAW are selected and employed on the basis on specific affordances, such as sound synthesis, signal processing, and/or generating note material, through real-time procedures, coding, sequencing, the use of algorithms, or other processes. The resulting audio, or note material, is subsequently edited and structured within the DAW. The respective non-linear applications are operated only in the compositional phase; they are not used in performance. In such practices, the composer can 'explore ideas without a defined start and end point'. If the initial creating and processing takes place in real-time, especially when it involves real-time interventions by the composer, the composer may experience liveness within the compositional process. Through the editing and montage phase, the composer maintains control of the material and form of the resulting composition: "there is security in there, because it will always be the same, it will always be perfect" (Interview with Psathas, 22 March 2018, Appendix 1).

When resulting in fixed media, this approach may resemble early analogue studio practices, in which material was first created, then shaped into a composition, to be performed as an acousmatic work, or in combination with live parts. An example of such a work is Michel van der Aa's film opera *Sunken Garden* (2011-12) for vocal soloists, ensemble, fixed media, and film. The material for the work was created in the composer's home studio, utilising a wide variety of hardware and software tools and applications. Using the generated material, the large form of the work, and a four-channel soundtrack, were subsequently composed within the DAW. The work is realised through live performance of the instrumental and vocal parts, in combination with playback of the four-channel soundtrack.

When resulting in concert music, the approach of first generating material in non-linear software applications, and then organising it within the DAW, may resemble Iannis Xenakis' practice of the computer-based generating of note material, followed by a structuring phase.

In the second approach, initial material is created within the DAW environment, and subsequently exported to applications with live functionality. In performance, the DAW-produced material may be subjected to further processing, often in interplay with live created instrumental and/or electronic material. This approach allows for control of the basic material in the compositional phase, simultaneously allowing ample opportunity for "exploration and flexibility" (Green, 2006, p. 4) within the live setting. It is a common approach in live electronics performance. A particularly intricate example of a work in which pre-produced audio is subjected to live processing, in interplay with live performance, is Marko Ciciliani's *Map of Marble* (2004-5) for mezzo soprano, percussion, live electronics and lighting. In this work, pre-recorded and pre-processed audio, as well as instrumental and vocal live performance, are subjected to extensive live digital processing, all three elements in interplay with "the room’s resident frequencies as the basis for all the pitch-structures of the electronics" (Ciciliani, 2021).

A third category of compositional and performative use of diverse music software applications may be considered live electronics in its purest form: all material is created and processed in real-time. In such practices, the DAW generally doesn't have an role in realising the work in performance; it is however well-suited as a tool in the recording and post-production of such works and performances. This realm of digital practices was preceded and influenced by a wide variety of analogue practices. Since the 1960s the application of electronics in performance, increasingly focusing on achieving liveness rather than fixedness, "became a major sphere of activity" (Manning, 2013, p. 157). An analogue example of a work involving exclusively live processing is Jonathan Harvey's *Ricercare Una Melodia* (1984), originally for trumpet, later arranged by the composer for various other instruments. In the work, a tape delay system "creates a variety of textures and colours" and "broadens the trumpet's voice and transposes it far beyond the trumpet's lowest registers" (Barth, 2011, p. 72). Interestingly, a *Max* patch was later created for the work, emulating the tape processing within a digital environment. Although in this composition, and in many other works, sound is created and processed exclusively in real-time in performance, project settings are in almost all cases prepared in advance. In fact, since the musical outcomes rely for a large part on the electronics; the design and realisation of such electronics 'patches' is an essential part of the compositional process.

In such practices involving exclusively live created and/or processed material, the responsibility of the performers may increase, and their role may become more prominent. Consequently, oftentimes "[t]he composer's role, as a governing force, diminishes greatly" (Young, 2016, p. 95). This deeper involvement of the performer, the interactivity between electronics and performers, and the resulting sense of liveness, may in fact motivate electroacoustic composers to involve themselves with live electronics, and to partly or fully abolish the use of fixed media.

7.3. Issues of autonomy in performing with fixed media and live electronics

Live electronics have thus partly evolved from the desire to free electroacoustic performance from the fixedness of fixed media. Such fixedness impacts on composers, performers, and listeners.

As discussed in Chapter 1, for a composer creating fixed media, this output is "the actual intended musical outcome" (Gatt, 2016, p. 150). After the completion of an acousmatic work, the responsibility toward the realisation of the work is placed on the shoulders of the composer, and of the sound engineer as an "acousmatic performer" (Stansbie, 2013, p. 97) in a performance setting.

In fixed media combined with live performance, the composer is confronted with two heterogeneous musical partners, one able, the other inherently unable to interact. This relational fixedness strongly impacts on the performer: although fixed media may "[hint] at being a mere substitute 'accompaniment'" to live performance, they often appear for the performer a "superhuman (and sometimes robotic) force" (Emmerson, 2000, p. 207). Since interaction with fixed media is for the most part one-directional, apart from a possible role of the sound engineer as mentioned above, questions are raised around "the degree of autonomy left to the performer" (Stansbie, 2013, p. 90). When writing for performer(s) and fixed media, how can the composer's primary task of "facilitat[ing] performing" (Small, 1998, pp. 113-4) be fulfilled? Answers to this question are often sought in the exploration of the performer's role in relationship with the fixed media.

Fixed media in performance also impact on the listener. Within the context of repeated listening to a recording, listeners are familiar with identical instances of a musical work. In a concert setting however, audiences are likely to expect and value liveness. They may cherish the uniqueness of the attended performance; desire "commitment and authenticity on the part of the performer" (McDermott et al., 2013, p. 40); and appreciate "the unforeseen and the risks" (Chanan, 1995, p. 18). Also, the "'quality of life' of the performer" in relationship with the electronics "has a chance of

being conveyed to the listener" (Emmerson and Landy, 2016, p. 347). Perception of the performer's 'quality of life', and a potential fixedness in the performer's role in performing with fixed media, doubtlessly impacts of the audience's 'quality of listening'.

In stark contrast with fixed media, live electronics involve musical output which is created, partly or fully, in real-time. Just as in instrumental or vocal performance, live electronics yield unique performances: no identical instances of a work are realised. In other words, liveness is inherent to the medium. If live electronics were to produce identical instances of a work, they would in fact produce fixed media. In such a case "[we] could question an elaborate improvisational or generative method that produces very similar results in every instance. Why has the composer/designer simply not worked out the music fully, to ensure a preferred outcome" (Young, 2016, p. 96)?

This consideration of "why do you need the electronics to be live? If there are electronics, why can you not pre-programme those things?" (Interview with Psathas, 22 March 2018, Appendix 1) appears a watershed between the use of fixed media in performance, and live electronics practices. While fixed media may suit composers who "[want] to retain full control even in a live setting where far more contingency is feasible" (Young, 2016, pp. 91-2), live electronics tend to serve as "this kind of malleable element, this other ensemble player" (Interview with Kyriakides, 22 March 2018, Appendix 3). Live electronics ordinarily do not serve as an accompaniment to live performance; they "aim to be autonomous, creative co-contributors" (Young, 2016, p. 95). And through their being autonomous and creative, and not robotic, live electronics may trigger creativity, and allow for autonomy, on the side of the live performer - making them equal musical partners, as in chamber music practices.

7.4. Composing *Fossils I-VII*

Issues around the musician's autonomy in performing with electronics, and the interplay between the two heterogeneous musical partners, fed into the process of composing and realising *Fossils I-VII*. While fixed media may create a 'robotic' context for live performance, live electronics may allow for more autonomy for the performer. They may also provide the composer with the opportunity to expand a work beyond the timeline as composed within the DAW.

To explore these issues, first an integral solo seven movement piano work was composed within the DAW (audio sample 32: fragment of *Fossil II* for piano alone, as performed by the composer with a piano Virtual Instrument). *Fossils I-VII* thus is an example of a work composed according to the second approach defined above, in which initial material is created within the DAW environment, and subsequently exported to applications with live functionality. Working from a finalised and coherent instrumental composition was intended to provide a good starting point for safeguarding and exploring the autonomy of the pianist, and shaping the interaction with the live electronics.

The piano music was created within the DAW, using *Logic X*, a *Vienna Symphonic Library* virtual grand piano, and a MIDI keyboard. Only basic DAW functionalities were utilised in this initial compositional phase: MIDI performance; editing and structuring the material along the timeline; playback; the application of effects; mixing and mastering. The finalised piano music was exported from *Logic X* as a MusicXML file, and imported into *Sibelius 6*. The work was notated in standard piano notation. The resulting composition for piano solo can be performed as a concert piece, without electronics.

Yet, *Fossils I-VII* was conceptualised primarily to be enhanced and transformed in performance by live electronics. All material is created and/or processed live in performance, in real-time. The application of live electronics, as well as the fact that

the piece can be performed in two different versions, distinguishes *Fossils I-VII* from the other four portfolio compositions: *Variances* and *Rapprochement* represent instrumental concert music, not involving fixed media or live electronics in performance; *Shutterspeed* combines live performance with fixed media; and so does *Transits*, with the addition of live spatilisation of the fixed media, and of the vocal and instrumental parts.

Live electronics serve to transform sonic material in real-time. Such transformation processes may lead to a wide range of sonic outcomes. For *Fossils I-VII*, the idea of fossilisation was chosen as a metaphor in exploring the sonic possibilities of the digital processing of piano sound. This decision was partly inspired by a visit to the Blue Lias cliffs, on the coast near Lyme Regis (UK), which are abundant in fossils from the Jurassic period. Cues were taken from fossil-related phenomena such as erosion, corrosion, substitution, solidification, and encapsulation. Although the sound processing in *Fossils I-VII* is not meant to resemble exact fossilisation processes, and the work does not pretend to suggest respective temporal dimensions, some images involving fossilisation sparked off the musical imagination. They guided the compositional process for each of the seven movements. On the basis of these images, a live electronics patch, or group of settings, was conceptualised for each *Fossil*, to 'fossilise' the piano music in a sonically distinct way. These patches were realised in *Max/MSP*, only after each of the seven movements was completed instrumentally. The autonomous identity of the piano music of each *Fossil* was thus guaranteed to predominate in the realisation of the electronics.

The piano music may be considered to represent an original entity before fossilisation; the electronics may be considered to represent the outcomes of a specific fossilisation process. An obvious difference between fossilisation and live electronics is that in fossilisation, original entities and their fossilised forms can never co-exist, whereas in sound processing, sonic materials and their transformations can. In some movements of *Fossils I-VII*, the 'fossilised' state indeed coincides with the instrumental performance. In other movements the processing is separated from the instrumental music, and extends beyond it. The live electronics thus allow the work to leave the

fixed timeline of the piano music, as constructed within the DAW, in a number of sections.

The following initial images triggered the piano music for the seven *Fossils*, the concepts for the electronics, and their realisation through live electronics patches:

In *Fossil I*, a multitude of fossilised material crumbles from a cliff and is washed into the sea - or picked up by a beachcomber. The richness and variety of fossilised material in *Fossil I* is represented by the piano part itself, and by a double delay in the live electronics, duplicating the piano part at a distance of respectively a dotted semiquaver, and a dotted quaver. The resulting double canon serves as a 'chamber music partner' for the pianist, providing rhythmic support, and creating a 'virtual virtuosity' through the resulting hocketing, or alternating patterning. This is demonstrated in the original DAW-version with piano Virtual Instrument, respectively the recording with live piano and electronics (audio sample 33, audio sample 34). During the instrumental section of *Fossil I*, the piano music is stored in a buffer, or audio storage. After the piano section is concluded, slightly overlapping with it, the buffered material recurs in snippets, in two forms. Within a specific pitch range, the original transient and onset of the snippets are removed. This is done through granulation, the dividing of a sound sample "up into small grains of sound" and "controlling parameters such as grain size, the frequency of individual grains, their density, the way that grains might overlap, and degrees of randomness introduced into the process" (Holmes, 2020, p. 103). These snippets appear randomised with a pre-defined density, through algorithmic programming which "does it slightly differently" on each iteration (Interview with De Graan, 15 May 2018, Appendix 2). They serve as a continuum - as fossils washed into the sea. Another part of the snippets appears with its original articulation. Through another randomisation algorithm, these are randomly scattered, to be 'picked up from the beach'. Toward the end of the movement this second material also looses its articulation, and only its acoustic outlines remain. In *Fossil I*, the pianist actively interacts with the live electronics, through the hocketing with the double delay.

In *Fossil II*, organic material is aggregated, compressed and dessicated over time. The movement forms one of two exceptions to the rule of the exclusive live generating and processing of sound: a pre-recorded spoken text serves as input for a transformation process between the text recording and the piano part denoted as cross-synthesis, or the "transfer [of] certain characteristics [...] of one recognisable sound-source onto another recognisable source" (Wishart, 1996, p. 158) (audio sample 35). The piano music is introduced layer by layer. In each repeat, a new layer is added by the pianist, auditively synchronised with the repeating previously played layers. Throughout four consecutive cycles, the layers of piano material are increasingly transformed and obscured through the gradually intensifying cross-synthesis. The spoken text, though only partly intelligible, describes the transformation of organic material to peat, then gyttja, then coal, then anthracite. Performers may pre-record the text themselves for cross-synthesis. Alternatively, they may use the provided text, spoken and pre-recorded by the composer: for the first time within the portfolio of compositions, the composer appears in his own work, and adds human presence to an otherwise instrumental work. In *Fossil II*, the pianist actively interacts with the live electronics, by auditively adding layer by layer to the piano part. As in the electronically delayed piano music in *Fossil I*, the buffered and repeated piano layers serve as a chamber music partner for the pianist.

In *Fossil III*, an original substance vanishes, while its form remains. The piece opens with a repeated dense chord sequence. In each repeat, notes 'erode' out of the harmonies, until all original piano substance has vanished. However, the overall form and harmonic content remains: the chord sequence gradually appears in the live electronics, flattened and smoothened by means of a granulation process. After the piano part has concluded, this granulated material is increasingly 'corroded' through spectral transformation, distortion and small pitch shifts (audio sample 36). In *Fossil III*, the pianist is not bound to any parameters in the live electronics, but can interpret the piano part autonomously; the live electronics follow the piano music during the overlapping section.

In *Fossil IV*, an object, first exposed in its original form, is then solidified within

transparent matter, as in amber. The piano music of Fossil IV is first played and buffered. During subsequent playback it is subjected to yet another granulation algorithm. In the resulting 'solidifying' process, the instrumental timbre a well as the overall pitch content are preserved, but all detail of articulation is lost (audio sample 37). In *Fossil IV*, the pianist is not bound to any parameters in the live electronics; they appear only after the conclusion of the live piano part.

Fossil V features some 600 enigmatic and eroded traces; ancient footprints of unknown origin. A long chord sequence, continously ascending and descending, speeding up and down, may suggest an unknown animal species, walking uphill and downhill. In the course of the movement, a mountain wind increases in strength; this is the second pre-recorded material in *Fossils I-VII*. Through a process of increasing cross-synthesis with the piano music, the wind gradually degrades the piano chords from pitch to noise; it finally obscures them (audio sample 38). As in *Fossil III*, the pianist is not bound to any parameters in the live electronics, but can interpret the piano part autonomously, auditively interacting with the live electronics.

In the brief *Fossil VI*, a primordial duel is followed by rapid immobilisation, perhaps through volcanic eruption. The piano music is buffered during its performance. Starting on the last live piano note, the buffered audio is played back, rapidly decreasing in speed and pitch, coming to a standstill (audio sample 39). This rapid decrease in speed and pitch mirrors the final section of the fourth portfolio composition *Shutterspeed*, in which the fixed media gradually increase in speed and pitch, not coming to a standstill, but resulting in a 'lifting off'. As in *Fossil IV*, the pianist is not bound to any parameters in the live electronics; they appear only after the conclusion of the live piano part.

In *Fossil VII*, finally, the beachcomber patiently sorts out the scrappy collection of dishevelled findings. The piano music of *Fossil VII* consists of motivic material from all the previous movements, isolated from its origins, and placed, or re-composed, within a new context. This material is elongated in the live electronics, through a granulation process, enhancing the live piano. In the live electronics, the buffered material of all

the previous movements reappears, in snippets of around 100 milliseconds, freely scattered through the live piano music (audio sample 40). Though musically very different, this final *Fossil* again echoes the fourth portfolio composition *Shutterspeed* in its use and recomposition of musical snippets, both in the acousmatic and in instrumental writing. As in *Fossil III and V*, and very different from *Shutterspeed*, the pianist is not bound to any parameters in the electronics, but can interpret the piano part autonomously, auditively interacting with the live electronics.

Although the piano music for each of the seven *Fossils* is very different in musical substance and character, and the live electronics are distinct for each *Fossil*, the seven movements are interconnected through reoccurring pitch material, motifs, and chord sequences.

7.5. Realising *Fossils I-VII*

As described above, the piano music for *Fossils I-VII* was composed within the DAW, and notated in *Sibelius 6*. This was done before, and independently from, the creation of the electronics. Once the piano music was completed within the DAW, a MIDI recording of the work was available (audio sample 41: fragment of virtual rendering). This recording represents the first setting in which the work was realised: the virtual DAW environment, or the composer's space.

An instrumental recording of the work was then made. It was performed by pianist Paolo Gorini, with a fine quality grand piano, in a performance space with a medium degree of reverberance, resulting in a natural sounding rendering of the work. The recording was done in one full take, rarely two, of each movement, to safeguard a sense of liveness, and avoid a studio production approach. The recording of the piano version of the work thus represents the second realisation setting of *Fossils I-VII*: live instrumental performance (audio sample 42).

Subsequently the live electronics were created for each *Fossil*, on the basis of the piano recording, the initial concepts for the electronics, and test patches of some of the movements. The primary, but not exclusive, software application used in this phase of the compositional process was *Max/MSP*. It is also the application used in performance.

The patch for *Fossil I* was realised first, for the purpose of a first public performance of *Fossils I*, *VI* and *VII* by Paolo Gorini. On this occasion, the latter two movements were played in the version for piano alone; *Fossil I* was performed with live electronics. Within the context of the realisation of the portfolio composition, the performance thus represented, at leastly partly, a third setting, instrumental performance with live electronics (audio sample 43).

Within this performance context, the functionality of the *Max* patch could be tested in a live setting, as well as the impact of a phenomenon inherent to live electronics practices involving acoustic instruments, the 'bleeding' of the signal between the microphones and the loudspeakers. To apply electronic processing to the live piano, the piano sound is picked up by microphones. This signal is sent to the *Max* patch, to be processed. The processed signal, in most cases in a mix with the 'dry' signal, is then sent to the loudspeakers. Despite the use of directional microphones, placed close to the instrument, and loudspeakers positioned at a distance from the instrument, a certain amount of the loudspeaker signal is picked up by the microphones. This bleeding potentially creates a loss of control and clarity in the processed and amplified sound. Especially in the musical context of *Fossil I*, with its dense rhythmical interaction between the piano and the live electronics, such bleeding needs to be constrained as much as possible. This requires high quality equipment, fine sound engineering, and preferably an acoustically dry performance space. But even under ideal circumstances, processing will not be as controllable as in a studio setting. Even if a composer might "want the experience of the studio to be transferred to the concert hall" (Interview with Kyriakides, 22 March 2018, Appendix 3), the phenomenon of bleeding is inherent to performance practices involving acoustic instruments and live electronics.

In performance, the *Max* patch for *Fossil I* worked as envisaged, and the bleeding could be kept within reasonable margins. Yet, the opportunity of testing the patch in concert, in particular the double delay in the opening section, provided valuable insights for the live electronics in the other movements. Simultaneity of live and processed signal, dense textures, and desired equality in balance and timbre between the live piano and the electronics, demand a minimum of bleeding. Realising the live electronics for *Fossil I* proved to be challenging but possible. In the creation of the patches for the other *Fossils* these issues could be taken into account.

Following the partial first performance of *Fossils*, a separate *Max* patch was now built for each of the seven movements, utilising the instrumental recordings of the piano music as audio input to trigger the processing. By playing back an entire movement many times within the *Max* patch, meanwhile auditioning, adjusting, and constantly refining the processing settings, the patches were created.

Max/MSP allows for the defining, adjusting and storing of parameter settings; it also allows for storing changes over time, made to these parameters throughout a work or performance. In most *Fossils*, such parameter changes over time were indeed stored within the patch (Figures 19, 20 & 21). In a sense, a timeline was thus introduced to the *Max* patches: some - not all - parameters pass through a pre-defined and temporally fixed sequence of changes, not unlike the use of automation in a DAW project. This provided control of the musical output, both during the compositional phase, and in subsequent performance. In fact, during the compositional phase, on repeated playback of the recording, the *Max* patches could generate similar instances (though never identical, due to the use of randomisation of some parameters), allowing for precise finetuning of the processing, the various parameters, and the changes made to them. Unlike DAW playback, which allows for jumping back and forth in time, the *Max* patch "allowed only linear access" (Waters, 2000, p. 58), and the monitoring of the processing could thus only take place for an entire movement, in real-time. This may well have resulted in an increased focus on the large form of the electronics for each of the *Fossils*.

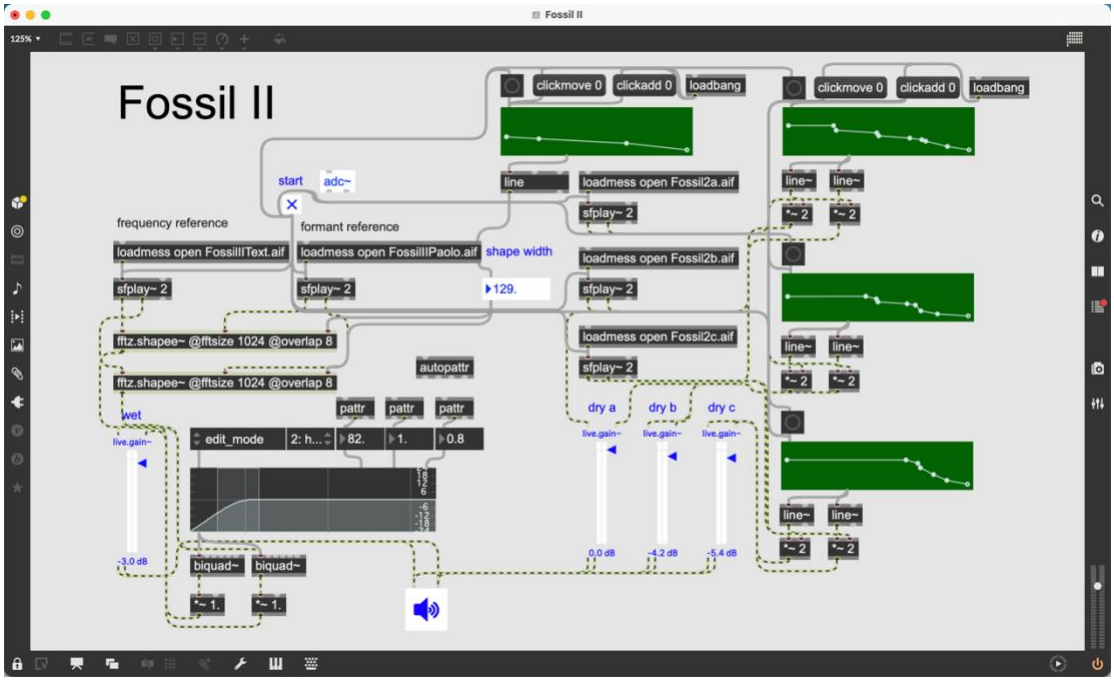

Figure 19: *Max* patch for *Fossil II*, featuring parameter changes over time (green)

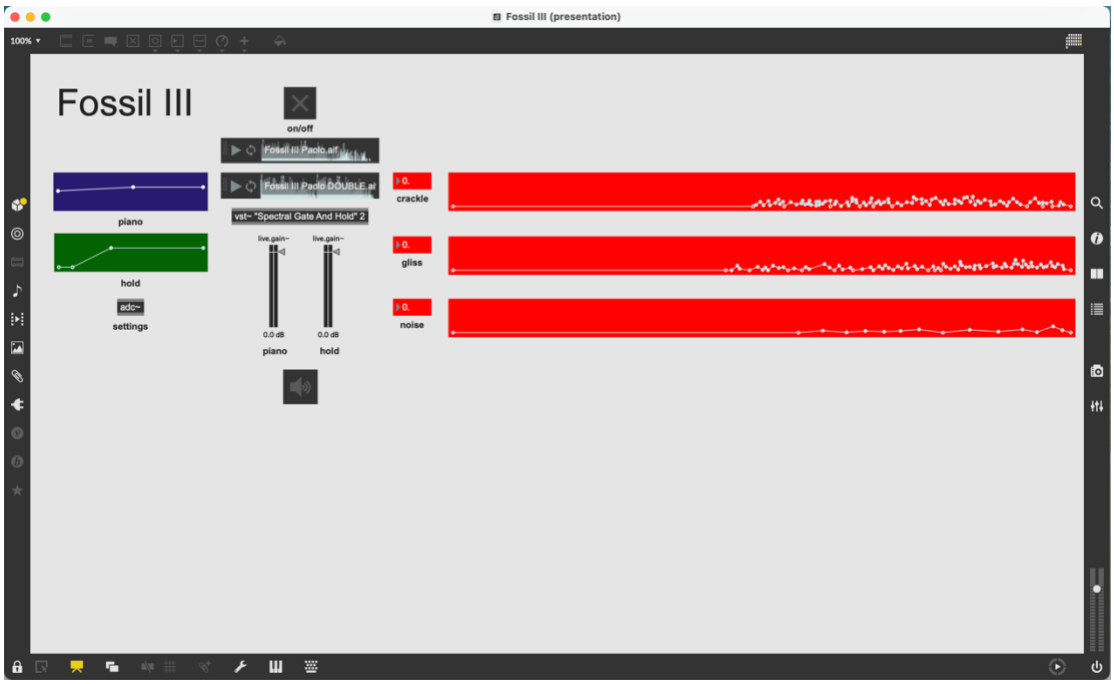

Figure 20: *Max* patch for *Fossil III*, parameter changes over time (purple, green, red)

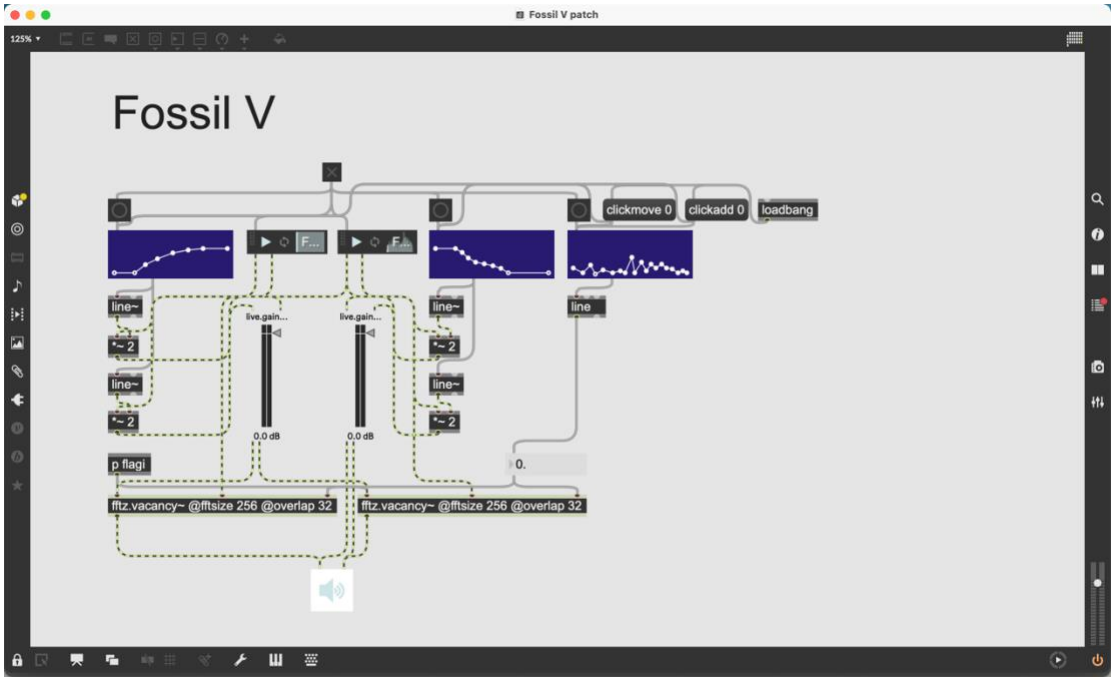

Figure 21: *Max* patch for *Fossil III*, parameter changes over time (purple)

Since in live performance the piano music is always different, unlike in playback of the piano recording, so are the sonic outcomes even of the temporally fixed parameter changes stored within the *Max* patch. Other parameter changes in *Fossils I-VII*, randomised within pre-defined margins, create per definition unique instances. Still other parameters can be changed in performance through sliders within the patch, providing liveness. And within each *Fossil*, the *Max* patch passes through a number of cues, each initialising a new set of settings, and different processing. Also in *Fossils II* and *V*, both featuring pre-recorded material, this material generates unique instances through the cross-synthesis with the live piano. Consequently, *Fossils I-VII* features liveness in all aspects of its realisation in performance.

While *Max/MSP* served as the primary platform for the creation of the electronics, other applications were used as well. In some cases, material was first edited and/or processed in *Logic*, testing possible outcomes of specific processing, to be programmed later in *Max/MSP*. In the creation of the electronics for *Fossil I*, for example, the snippets for the final section were first cut and placed within the timeline environment of *Logic X*. The duration and density of the snippets, and the temporal and dynamic development of the section, could thus easily be explored, before the

respective parameters were programmed within the *Max* patch. In this case, the DAW was thus used not as a "montage field" (Interview with De Graan, 15 May 2018, Appendix 2), but as a 'testing ground'.

In other movements, programming in *Max/MSP* was preceded by sonic experimentation in *Ableton Live*. This application features a large number of native, or standard included, plugins, and it can host a wide variety of third-party plugins. Many of these are unique to the *Ableton Live* platform, and offer processing functionality and sonic characteristics not readily available in other applications. Also some *Max* functionality is supported through *Max for Live*. The granulation in *Fossil IV*, for example, was first realised within *Ableton Live*, with a *Max for Live* plugin. Subsequently, similar processing was programmed in the *Max* patch. In this example, also *Ableton Live* was used as a 'testing ground', as *Logic X* had been in *Fossil I*.

The three compositional environments of *Logic X*, *Max/MSP* and *Ableton Live* thus fed into the creation process of the electronics for *Fossils I-VII*. Operational aspects of these three music software applications impacted on the compositional process. Through the specific affordances and operational characteristics of the applications, they allowed musical results that would otherwise not have been achieved. The musical outcomes of these application-specific creation processes were subsequently translated to *Max/MSP* functionality. During this translation, the processing, and the sounding results, were slightly transformed; this was considered an inevitable and acceptable consequence of working in various software environments.

Once the live electronics for a particular *Fossil* were ready, a recording with the live electronics was made, utilising playback of the respective piano recording within the *Max* patch. Subsequently, within a new *Logic X* project, all resulting recordings of the seven *Fossils* electronics, as well as the piano recordings, were placed on the timeline. In this phase of the realisation process, the role of the DAW had changed from compositional to editorial: the form of the entire work, and the relationship between the piano music and the live electronics, could now be explored and developed, and further compositional was done outside the DAW, within the *Max* patches. When

settings for a specific patch were further refined, a new recording was made within the *Max* patch. This recording then substituted the earlier one within the DAW project. Once all seven patches were finalised, and all finalised recordings positioned on the timeline, the *Logic X* project was mixed and mastered. In this final phase of the realisation process, the role of the DAW had changed from editorial to productional.

Yet, beyond audio post-production, the DAW production phase also allowed for further compositional intervention. In fact, interventions were done in most of the *Fossils*. These involved the application of acoustics, in particular to the electronics, but additionally also to the piano; radical adjustments to the level of the live, or dry, piano sound, impossible in performance, including occasional muting; editing of some of the recorded live electronics output, through the shifting, adding or removing of material; and finally adding further processing to the electronics in some movements and sections.

This resulting version of *Fossils I-VII* offers an entirely clean piano sound, and very articulate live electronics, without any interference between the two - in other words, without any bleeding. Both elements of the composition could thus be treated entirely independently in the post-production, and their interconnections finely shaped and balanced.

The DAW-produced version of *Fossils I-VII* is thus fundamentally different from a live performance involving piano and live electronics. As a discreet version of the work, and not a rendering of a concert performance, it represent the fourth and final realisation setting of the work.

Finally, an integral *Max* patch was designed, encompassing the processing and cues for all seven *Fossils*. The cues were included in the musical notation, with a specification in brief terms of the *Max* actions for each cue (Figure 22). At the time of writing this patch has not been fully built yet. Once it is, it will make *Fossils I-VII* accessible beyond the composer's presence in performance, through its concise pre-programmed functionality, and the standalone convenience of *Max* patches.

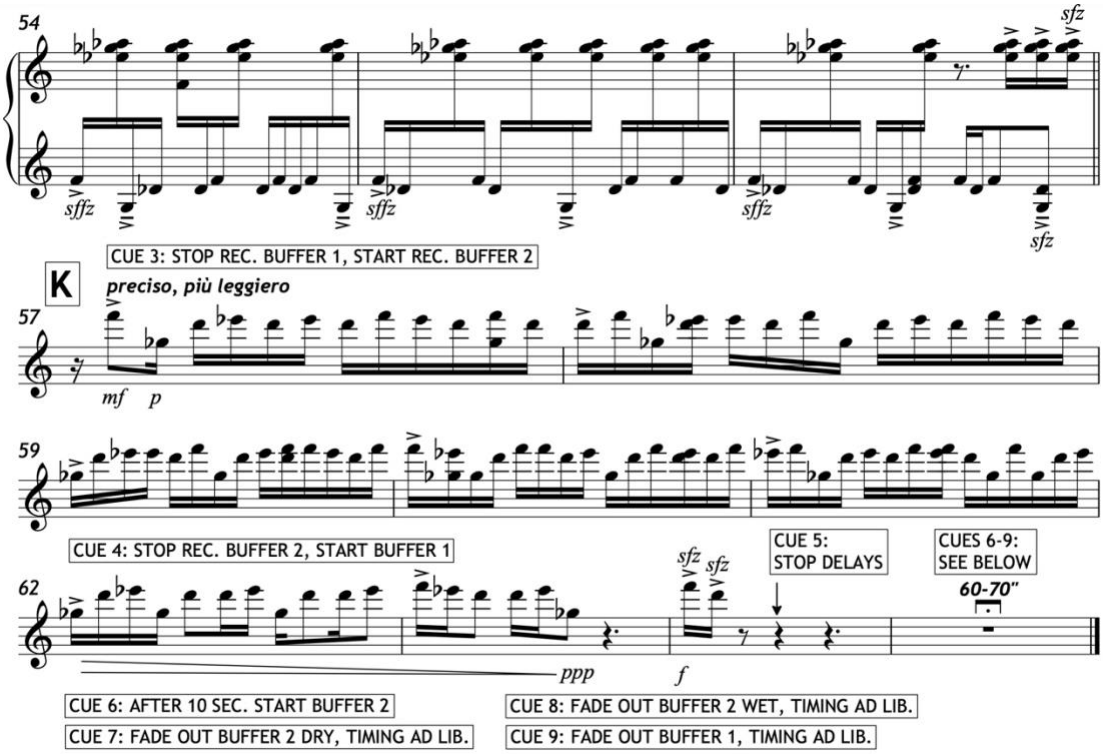

Figure 22: *Fossils I* musical notation with cues specifying *Max* actions

8. Conclusions

8.1. The impact of the DAW on the researcher's practice

In the context of this research project, a portfolio of five compositions was created within the environment of the DAW. In the previous chapters they have been contextualised and discussed. Throughout the research, the DAW has been applied as a compositional device toward the creation of concert music, communicated through music notation, and realised by musicians.

The research has been guided by the following question: *What is the impact of the Digital Audio Workstation on the creation of live concert music?* Looking back on the research process and the outcomes, it becomes clear that the DAW as a musical realisation tool has profoundly shaped my practice. Two DAW affordances may be considered key in this respect. Both distinguish DAW-based composition from composition directly into musical notation. Firstly, all instrumental and vocal material has been generated initially through performance in real-time within the DAW environment. Secondly, throughout the compositional phase, and before being shared with performers and listeners, listening to the music within the composer's space has guided the process. So it could be stated that the two cornerstones in composing the five portfolio works have been 1) performing; and 2) listening. All other DAW functionalities have fed into these two affordances.

Through the role of the composer as a performer in creating musical material in real-time within the DAW environment, liveness, or "the quality or state of being live" (Merriam-Webster, 2020), was achieved throughout the compositional process. An experience of flexibility, playfulness and risk, as in improvisation, was thus integral to the compositional process - rather than the control and security of composition through notation.

The creation phase was followed by DAW-based editing and structuring. In this compositional phase, further liveness was attained, through 'sound crafting', based on the auditioning of the material. Some of the works, especially those involving fixed media or electronics, involved 'dabbling' and 'fiddling around' with the material, through the exploration of DAW functionalities. The original virtual recordings, resulting from the DAW-based compositional phase of all five portfolio compositions, manifest this sense of liveness.

Auditive coordination throughout the DAW-based compositional phase was achieved through the motivic use of rhythm and pulse (though not necessarily the strict pulse of the DAW's temporal grid, but the much more flexible rhythm and pulse of the various parts as they were generated in DAW performance, and as they interrelate). Correspondingly, in live performance of the portfolio works, rhythm and pulse as conceived in the compositional phase allow for auditive, rather than visual, ensemble coordination: the works require neither clicktrack nor conductor in their live realisation. Though composed within a technological environment, their performance thus represents a chamber music practice. Also in the works involving fixed media or live electronics, the coordination takes place auditively, primarily on the basis of rhythm and pulse. In other words, at least partly resulting from the DAW-based compositional phase, all five works demonstrate a major and functional role for pulse and rhythm, within the individual parts, and in their interrelation.

In the transfer from the composer's space to the performer's space, the flexibility, playfulness and risk, experienced in the compositional phase, were captured as much as possible in musical notation. Though standard notation was applied, this was pursued through notational intricacy and rich detail, not least temporal, invoking nuanced interpretation and abandon in performance. In particular the intricate and often complex notated rhythmical interaction between the parts has resulted in live interpretations that evoke to a certain degree the liveliness from the DAW-based compositional phase.

In comparison with the portfolio compositions, some of my other recent works, not created within the DAW environment, but composed directly in musical notation, are structurally, temporally and notationally more straightforward. While at times this has resulted in more controlled performances, the interpretational scope seems enhanced in the five portfolio compositions.

Another DAW affordandance which has been essential in the realisation of the portfolio compositions are its production functionalities, in other words the application of equalising, acoustics and a range of other effects, mixing and mastering. These, in combination with playback, have stimulated in the works a strong focus on timbre, on nuance in tone production and articulation, and on the exploration of acoustics. In a loop process of composition through DAW performance, editing and productional work, always supported by playback, the sonic identity of the compositional material was continuously developed and refined. Consequently, the virtual recordings of all five portfolio works, realised within the DAW before live performance, are timbrally rich and varied. Through notation, this timbral richness was as much as possible transported to live performance.

As a result of the extensive DAW-based productional work in the compositional phase, the experiences in the composer's space, and the resulting virtual recordings, have oftentimes been perceived as convincing performances in their own right. Such experiences have tended to place high demands on the subsequent live realisation of the works by musicians, taking place in the listener's space.

In the final production of the works, following live performance, the portfolio compositions have returned to the composer's space of the DAW. Especially in recording and producing *Fossils I-VII*, the role of the DAW was not just productional, but also editorial, and even compositional. The form and material particularly of the electronics, so far fluid in performance, could now be further explored and developed. Additional interventions, often impossible in live performance, were done with the electronics as well as with the piano part. Whereas the recordings of *Transits* and *Shutterspeed* are mixed and mastered live recordings, and the DAW-produced

versions of *Variances* and *Rapprochement* might be considered (and were in fact intended) to emulate live performance, the DAW-produced recording of *Fossils I-VII* is thus fundamentally different from a live performance. It is a discreet realisation of the work.

8.2. To conclude and to continue

To conclude, I may ask myself the question, how does it feel to compose within the DAW? The DAW environment has made me more confident, and bolder in the exploration of materials and form. Aural imagination does play a role in my compositional practice, as in composition through notation; but it is supplemented by the impact of the sonic experience within the DAW. The DAW has helped removing constraints from my compositional practice, and it has stimulated and enabled new approaches - both despite and thanks to its biases.

Throughout the research project, the DAW's impact has been uncovered, cherished, and questioned, against the background of aspects of musico-technological history, composers' practices, aspects of device interaction, and liveness. I have attempted to make explicit, for myself and for the reader, specific DAW-based strategies and aspects that would otherwise have remained implicit, and hidden within the works.

During the research, musical vistas sought realisation through the DAW. New vistas will suggest new works, and will present new musico-technological challenges, in which the DAW will play a central role. They will no doubt be influenced by the explorations and findings of the past four years.

Particularly the use of electronics in a live setting beyond fixed media, explored in the portfolio compositions *Transits* and *Fossils I-VII*, demands further exploration. This is not so much from the viewpoint of technology, since many practioners in the field of live electronics have a musico-technological expertise beyond mine. But rather, it is the exploration of the agency of electronics in furthering liveness and musical

interaction in the translation of DAW-based composition to concert music involving electronics.

Many applications, such as *Max/MSP* and *Ableton Live*, discussed above, are designed especially for live interaction between musicians and electronics. The DAW was originally developed as a studio tool, or as a tool for the composer's space; yet it does accommodate live application. Such application, the resulting workflow, and the possible musical outcomes, will be topical in upcoming commissions.

A new work commissioned by the Dutch Asko|Schoenberg ensemble, to be performed in September 2022, will build forth on the findings around the five portfolio compositions, by taking the DAW itself from the composer's space into the listener's space. In this work, three so-called sound scouts will operate the DAW in concert, shaping, processing and producing both pre-recorded and live sound, in interplay with nine instrumentalists. DAW-based strategies from the five portfolio compositions will thus be researched and explored in a live setting. The work links up with John Psathas' approach in his work *No Man's Land*, in which "multiple DAWs, and multiple users, and multiple creative entities [...] were feeding into this sort of home base, where I was doing the composing" (Interview with Psathas, 22 March 2018, Appendix 1). In the use of electronics, the responsibility will be shared between the composer and the three sound scouts, so that the work will have "its own logic and life, so that other people might have better, or different, or more interesting approaches to how to do it" (Interview with Kyriakides, 22 March 2018, Appendix 3).

The five portfolio compositions resulting from my research will hopefully have a life beyond the context of the research. They were commissioned by active ensembles and musicians, performed by them, shared with audiences, and recorded. They contribute to a continuum in my compositional practice.

It is hoped that this thesis may provide composers and performers, themselves working in the DAW environment, with a range of approaches relevant to their

practice, and that they build upon these to further explore this versatile compositional environment.

Finally, it is hoped that the five portfolio compositions fulfill what might be considered their primary purpose: to entice listeners, with or without an active involvement in contemporary chamber music or musico-technological practices, into the conodrums, discoveries and pleasures of DAW composition.

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Appendices

Appendix 1: Performances of selected recent DAW-based compositions

Arnold Marinissen - *Mestre Claudinei* *(2015)*

9 July 2015, KunstGarten, Graz, Austria, by Duo Gross & Lucini

11/12 July 2015, concertello/Bellabayer, Hartberg, Austria, by Duo Gross & Lucini

3 August 2016, Cannobio, Italy, by Duo Gross & Lucini

4 August 2016, Buriglio di Vignione, Italy, by Duo Gross & Lucini

18 September 2016, Isola del Garda, Italy, by Duo Gross & Lucini

15 October 2016, Venice, Italy, by Duo Gross & Lucini

22 January 2017, Kasteel Daelenbroeck, Herkenbosch, The Netherlands, by Duo Gross & Lucini

17 June 2017, Novara, Italy, by Duo Gross & Lucini

23 September 2017, Theater Vrijburcht, Amsterdam, The Netherlands, by Duo Gross & Lucini

24 September 2017, Podiumkunsten Emmakade, The Hague, The Netherlands, by Duo Gross & Lucini

21 November 2017, Opéra de Rouen, France, by Duo Ensemble Variances

26 November 2017, De Lievekamp, Oss, The Netherlands, by Duo Gross & Lucini

25 February 2018, Domani, Venlo, The Netherlands, by Duo Gross & Lucini

28 March 2018, St. Aegtenkapel, Amersfoort, The Netherlands, by Duo Gross & Lucini

27 October 2018, Kamermuziekfestival Hoorn, The Netherlands, by Duo Gross & Lucini

13 January 2019, Oude Raadhuis, Hoofddorp, The Netherlands, by Duo Gross & Lucini

4 September 2021, Galerie Marzee, Nijmegen, The Netherlands, by Katharina Gross & Stefan Gerritsen

9 October 2021, Muziekkring Enkhuizen, The Netherlands, by Duo Gross & Lucini

Arnold Marinissen - *La pizia e la marangona* *(2015)*

21-22 November 2015, la Biennale di Venezia, Italy, by Juliane Dennert

25 January 2019, TivoliVredenburg, Utrecht, The Netherlands, by Elisabeth Hetherington

10 November 2019, Theater aan ’t Vrijthof, Maastricht, The Netherlands, by Elisabeth Hetherington

12 November 2019, Musis Sacrum, Arnhem, The Netherlands, by Elisabeth Hetherington

14 November 2019, Muziek aan ’t IJ, Amsterdam, The Netherlands, by Elisabeth Hetherington

17 November 2019, Willem Twee, Den Bosch, The Netherlands, by Elisabeth Hetherington

19 November 2019, Theaters Tilburg, The Netherlands, by Elisabeth Hetherington

20 November 2019, Philharmonie, Haarlem, The Netherlands, by Elisabeth Hetherington

21 November 2019, Muziekgebouw Eindhoven, The Netherlands, by Elisabeth Hetherington

27 November 2019, Theater Orpheus, Apeldoorn, The Netherlands, by Elisabeth Hetherington

4 December 2019, Stadsschouwburg De Harmonie, Leeuwarden, The Netherlands, by Elisabeth Hetherington

5 December 2019, Wilminktheater, Enschede, The Netherlands, by Elisabeth Hetherington

12 December 2019, TivoliVredenburg, Utrecht, The Netherlands, by Elisabeth Hetherington

15 December 2019, De Vereeniging, Nijmegen, The Netherlands, by Elisabeth Hetherington

25 January 2020, TivoliVredenburg, Utrecht, The Netherlands, by Elisabeth Hetherington

Arnold Marinissen - *Variances* *(2017-21)*

21 November 2017, Opéra de Rouen, France, by Ensemble Variances

Arnold Marinissen - *Rapprochement* *(2017)*

14 January 2018, Muziekgebouw aan ’t IJ, Amsterdam, The Netherlands, by Ensemble SCALA

3 March 2019, Muziekgebouw aan ’t IJ, Amsterdam, The Netherlands, by Ensemble SCALA

Arnold Marinissen - *Transits* *(2018-19)*

28 March 2019, Muziekgebouw aan ’t IJ, Amsterdam, The Netherlands, by Silbersee

3 November 2019, TivoliVredenburg, Utrecht, TheNetherlands, by Silbersee

6 November 2019, November Music, Den Bosch, The Netherlands, by Silbersee

Arnold Marinissen - *Shutterspeed* *(2019-20)*

6 June 2020, Dag in de Branding, The Hague, The Netherlands, by Michel Marang

21 November 2020, Uilenburgersjoel, Amsterdam, The Netherlands, by Michel Marang

2 October 2021, Stanislavski Theatre, Moscow, Russia, by Michel Marang

Arnold Marinissen - *Fossils* *(2019-21)*

21 June 2021, Splendor, Amsterdam, The Netherlands, by Paolo Gorini

1 May 2022, Conservatorium van Amsterdam, The Netherlands, by Paolo Gorini

Arnold Marinissen - *Memo* (2020)

17-18 June 2020, Het Paard, The Hague, The Netherlands, Residence Orchestra string trio

4 October 2020, Dag in de Branding, The Hague, The Netherlands, Residence Orchestra string trio

Appendix 2: Interview with John Psathas, London, 22 March 2018

AM: Which DAWs do you use?

JP: I'll tell you the history. When I was a student, in 1988, I bought a *Roland MC 500*. All it did was sync up MIDI data. If you look them up, they're an incredible thing to think about to use these days, because of how limited they are. Then eventually I bought a computer - it's always been *Macintosh* - and the first piece of software that I started using on that was *Mastertracks Pro*, which was a sequencing package. They were quite different from these days; they worked differently. And then I got into a thing called *Easy Vision*, where things became more flexible, and that was a baby version of something called *Studio Vision*. And *Studio Vision* started to have some audio things in it as well, but not many. It was all about MIDI information and libraries. And then I made the big step, because I got a really big project commission. It was the Athens Olympics. And they said: 'Look, we want you to work in *Logic*, because we're doing everything in *Logic*.' The only project I've been involved in where they did all of the scores in *Logic* as well. And they had all of the audio, the MIDI and the scores completely lined up on huge screens that they had put together, so you could see all the information. 2004 were the Olympics, so I started 2003 working with *Logic*. And it was a very hard programme to learn at the time for me, but I got into it and I figured it out. And since then it's been only *Logic*. And while I'm here now [London, March 2018], because I have a bit more spare time, I've started going through all the *Pro Tools* tutorials, and I'm teaching myself how to use, or I've been taught by these tutorials, how to use *Pro Tools*. Because I want to shift, which I'll explain in a minute, into a more audio-based environment for some things, and less MIDI. But generally my composing journey from the very beginning, as soon as it was available, was to compose using MIDI. And the reason for that I think, no, I think I know, is because I can really only compose in a feedback situation, which is to hear what it is I'm writing, as I'm writing it. And I can hear past the really bad sounds, and all of that sort of performance issues that you get in MIDI. I can hear past that and still get excited, because for me the composing process, it's a very sort of visceral, live, responsive

experience. And I'm always very excited when I'm composing. It's a very intense, always a very intense experience. It has never not been that. And, you know, it's been described as, for some people composing has been described as slowed down improvisation. Because you're playing and you're hearing it back and you're responding to it – it's like there's another person and you're responding to what you're hearing, at the same time as making it. That's definitely it for me, you know, very very intense. It's the most intense experience I've ever had in my life, doing anything. But I haven't done many things [laughs]. So I have a limited palate. But the thing is that the journey with the softwares has been very interesting because it has really been a process of getting older, having a bit more money, computers getting better, and more capacity. So the libraries have been growing and getting better, and the way that they respond has been getting better and better. And so my experience of the creative process has actually been intensifying as I moved through time, in response to the technology, being able to do more, and be more realistic and more life-like. So it's always really been *Logic* for me. And *Logic*, I really hated it when I started, because it was so different from everything else.

AM: What did you use before you went digital, so to say?

JP: Well, the thing is, it really started when I was a student. You know, that's when I started using this *MC 500*.

AM: So you never composed at the piano?

JP: I did a little bit when I was a student. There's one piece I've written at the piano that lives today, and that's a solo piece called *Waiting for the aeroplane*. And it still gets played. It's the only piece I ever really wrote at the piano. What the thing is for me, I really really need to know what it sounds like. I can't do this thing as a lot of my students do. I understand as a student it is part of the way, and it can be part of the way forever, which is, I'll find out exactly what it sounds like when people start playing the music. And for me, that's not my way. My way is that it's really about the journey

from the beginning to the end of the work. What is that journey and what is that experience?

AM: So actually, in that piano piece that was case because you played it?

JP: Yeah, and I played it you know, and so it's actually a very playable piece – one of the most playable pieces I've written, except for one part which I've never been able to play. It's beyond me. And the thing that I can say is that everything I've written since I've started using the technology, as a musician, as a player, I can't play any of it. It's beyond my performance capabilities, all of it. But what happens is, I have a situation at home where I have a studio there, and I have an acoustic piano. I have quite a complex computer set-up, with three really large monitors and a lot of capacity, a lot of libraries, and then on the other side I have a really nice electric keyboard. And what I'll do is, I'll go to the piano and work through things very a-rhythmically and non-structurally. But it's really to get the feeling of, what does it mean to move from this harmonic situation to this harmonic situation, what does that feel like? And I'll make a lot of noise and be very clumsy, but I'll feel kind of the underlying essence of things. And then it's, how does this come into focus, how do I turn it into something? And that's when I'll go to the computer and I will start.

AM: And then you play MIDI into the computer?

JP: Most often I will enter notes with the mouse, one by one, yeah, really slowly. And for me, there's a very slow exacting process. Because the thing is, the technology can give you all kinds of shortcuts. But I've never used it for that. I've never used it for the copy and paste or, you know, just the easy way of manipulating. For me it's always been a way of, OK this note, then this note, and then I'll try this note and see what happens. And then I'll listen to it and I'll make a decision about it. And I'll crawl forward through the work.

AM: So you're a slow worker, in that sense?

JP: Slow, because of one reason, I think. And the one reason is that I always start at the beginning. I don't know what happens in the middle when I start. I don't know how it ends, when I start. I don't know any of that stuff. And the writing is a process of discovering what the work actually is. That's my way of approaching it, right. So I never know where it's going. And there have been a couple of times, for various commission reasons, that I've needed to kind of map it out and create structure and so on. And I've enjoyed that way less than the way that I normally do. Because, I mean, this is getting into, I think, my underlying motivation for writing, which is that… You know, in my opinion, when I hear music that I think is great, like it's beyond good but it's great, and that could be a free improv session, it could be a symphony by Beethoven, it could be a Nubian oud player you know, whatever, where it sort of transcends something, and it becomes… It sort of transcends time and place, and style and genre, whatever, what I hear in all of that… My way of describing it is that the creators of that musical experience themselves experienced a kind of revelation in the making of it. But not just that. That revelation that they experienced, the energy that manifests because of that, somehow is coded into the music. So that when you hear it, no matter how many times you hear it, you feel that thing that's in there. You know, that relevatory experience that has been encoded. I mean, you can definitely hear it in the best moments of Beethoven. You can feel him going, oh my God, as this music is being discovered. And so for me that's… You know, I've got attached to that. And so that's why I've always started at the beginning. And every piece for me has been this amazing unfolding of discovery. And there are things in my pieces that are awkward and clumsy and that don't quite work, because I'm just trying to make it, unfolding as well as leading. And this leads all the way back to… I think that the technology has been incredible in enabling that for me. Because I can keep hearing over and over again where it's going. And also, obviously, it has really shaped the way the music is formed, and the way my music has evolved over these decades. Because I'm in this environment. I'm in a kind of virtual reality type space that has its own boundaries and its own strenghts.

AM: I feel, and that is something I state in the introduction to my research work, that for me the Digital Audio Workstation is like an imaginary performance space. Would you agree with that?

JP: Absolutely. That's very much what it is for me. So for instance, when I work, curtains are always closed you know. Everything is shut to a dark cave that I work in. And I am performing when I compose in the sense that I will extend the work a certain amount, and then I will press play and I will go to the back of the room and listen very intensely, and very loudly usually, and be moving around a lot, I mean almost, not dancing, but physically moving around with the music, and engaging with it in that way. And I guess that myself and the software were performing the music together at that point, to each other, to see what will happen next. It absolutely feels like that. And you know what it's like, if you work with something for so long, you become really fluid in the environment, and all your keyboard shortcuts, all of that sort of stuff…

AM: So there is a virtuosity in that?

JP: I would say, for me definitely, I've arrived at the… yeah. It's interesting, because both of my kids, they're into music in a big way, and part of their journey recently was to get their own copy of *Logic*, their own laptops and so on, and for me to show them around the software. And I went crazy at how slowly we had to move through the environment. And they didn't have these keyboard shortcuts that I've built up over twenty years now, or fifteen years, where you can navigate so quickly. Even just managing, you end up managing every aspect of it, like how your libraries function, and the whole backing up and the undo process, all of those things. To be able to jump back in time, to something you were thinking about. I mean, twenty minutes in one of these environments is a long time of creative work, you know. And to be able to go back and look at that and just compare it. And now the new *Logic* has this incredible new feature, incredible for me, which is, it has project alternatives, and it has track alternatives. And I realise I've been waiting for that for so long, this idea of forking the creative process where you think, I really wanna try this out but I don't wanna waste a couple of days if it's gonna be useless, and then backtracking. So you can just park

the work and then go off on this tangent. And you don't have to create a new file, you don't get caught up in all of that stuff. And you can just very quickly compare between different alternatives of the work. And not just that, but within the projects now, within an environment of *Logic*, every track can have multiple alternatives. So you can try different ways of expressing a part within a texture. So that's the next step in terms of the creative journey. And it just keeps opening up and becoming more flexible.

AM: Do you feel that concepts that you develop musically really rely on the [technological] possibilities? Or, for example the No Man's Land *project, is that something you could have possibly done in a different setting?*

JP: I don't think anything I've written since starting working with technology, I would have made. Because the thing is, I was actually thinking about this today, walking around. So I'm reading this incredible book, which is *Second Hand Time* [by Svetlana Alexievich]. It's really incredible, and it's just a long long series of long interviews with people in Russia, before, during and after what happened in the nineties. And it's really one of the most extraordinary books I've ever read. But what I was thinking about was, I've read a lot of science fiction, like all of the good stuff, I've read it many times, and even some of the really badly written stuff, because of the ideas that are in them. And so I'm always leaping towards things that I don't know. I want to know things that are beyond my own imagination. And the reason I think I'm responding to this book so strongly is that it's hyper-real. It's deeply disturbing me, you know. These are things that I could never have imagined. I would never have thought these things happened in the life, in the world. And that's the same with writing with the software, because it enables me to go way beyond anything that I could play, for one thing. And especially rhythmically, like the relationships and the things you can do, and you don't have to physically be able to do those things. And the other thing is, texturally but also structurally, being able to hear large shapes, and decide on whether they work or not, whether they're strong, or whether they can be moulded in a different way. I could never have imagined the stuff that I've written without being able to hear it. I think that's the core of it: being able to hear it, and make your decisions, make your choices, not just imagining it. There is some music I wrote, when I look back, when I was a

student, there are pieces I wrote when I didn't really know what I was doing, in the sense that I wasn't really sure what it would sound like. And sometimes I wasn't sure at all what it would sound like. And then nice surprises, you know. It's like the unknown, and you hear the music and you go wow, that's really interesting. But I never felt like I owned it. And that's the thing, that I really feel like what I create now, it does come out of me, because I can hear it and respond.

AM: So obviously composing and performance hang together. But how about production? When you finish something, is it ready?

JP: There are mutiple levels to that. One is that, as the libraries got better and better, for me the MIDI demo version that I would create became more and more, I suppose, acceptable as a final result.

AM: So you do dynamics, and you do balancing, and you do panning…

JP: Yeah, oh yeah, very detailed. The detail that I'm going to with the MIDI literally takes all the time. It's creating something that is convincing enough for me to feel the music, to actually feel what the music is doing. And so, lately what has been happening is… And the other thing is that, because handing the music over to players, especially if you write music that's difficult, it's such a roll of the dice. And you don't quite know what you're going to get - that I realised very early on. I needed to make kind of results for me, so that I could walk around with my headphones on, listening to my music, in a way that I felt good about it. So I put a lot of effort into that. And until I get a performance… You know how it is, you can write a concerto, and it might have been a commission, but the performance might be two years after you've written it. And until then I need to keep living the work, I need to hear it.

AM: And do you feel that, because you produce a piece until it's almost CD-ready, and you then give it to performers, that it's very hard for them to get up to that level?

JP: Absolutely, yeah, yeah. It's interesting, that's a very important question for me, because I've only just started to realise that quite a bit of my interaction with performers has been shaped by exactly what you have just said, which is that it's never quite good enough. Because I have this kind of perfect, pristine vision. Except that, often what will happen is, performers that can play it, they just totally breathe the life into the whole thing, and it becomes something way way bigger, you know, and much more valuable.

AM: Always?

JP: Not always, no no. I feel very lucky, you know, in that I have… There's a piece I could show you which… You might even know it. It's a marimba solo with backing track called *One Study One Summary*.

AM: Sure, I do.

JP: Yeah, and the thing is that so many people are playing that now, but when it started…

AM: Many of my students in Amsterdam play it…

JP: Oh really? It's having such an amazing life. But the thing is, when it first was made, the response was: 'Man, this is too hard, you know. This is crazy, and there are no breaks, you're just playing all the time, and the concentration…' And now it has just become almost like a standard, right? So the thing was, when I first wrote that piece, it was written for Pedro Carneiro, and Pedro, you know who he is. Do you know him?

AM: Yes, sure.

JP: I mean, I really admire Pedro, I love his playing. For me he's a fantastic musician. And the thing is that he got this piece, and he spent ages, because he's really committed, and there are just a few things that weren't playable, because I had

written impossible corners. And the version that your students are playing has had a lot of things made easier from the original that I wrote, the marimba part. But Pedro didn't have that luxury. He had to learn my unknown useless marimba ignorance about all of that. The thing that I realise in retrospect is that I was way too unforgiving towards Pedro. Because he was basically, I mean he's fantastic. And so if there's something that's really really awkward for him, it's really really awkward [laughs]. It's not like he's not trying hard enough. It's just that I don't know the instrument. And so - this is still answering your question - I think, looking back, and to be honest, I don't want to think about it too much, I think there's been quite a bit of me being dissatisfied for the wrong reason. Because I've just had it easy, you know. I wrote a saxophone concerto for an Italian, Federico Mondelci. And there's a bit at the end where it just goes into the stratosphere, five, six ledger lines all the time. And he's supposed to play really quiet, and really loud, and I was really dissatisfied that I never really heard what I wanted to hear. And that's kind of it: I'm not hearing what I wanna hear man, but in fact…

AM: So the library can do it.

JP: Yeah yeah yeah. And it's such a basic mistake, it's so obvious. You think, well, come on, find out what is impossible. Do that, with an acoustic instrument, go and find out. But I get so excited in the writing that I think, I really want this, I really hope it's possible. And then I would send it out. And what I learnt, after a very long time, is that the performers I have dealt with have been incredibly conscientious, have been really determined to give me what I want, really, I think too much in that way, rather than saying, 'Dude, look, come on, we just need to talk about it. Let's look at what other options there are.' Very few people ever did that with me, and I think they should have. Because they were too generous, too kind, too scared, I don't know what it was.

AM: Did you give them the MIDI version, sometimes, or always?

JP: Yeah, always.

AM: So they had a frame of reference. So they loved those versions probably as much as you did…

JP: Yeah, except they would have listened to them thinking at certain moments, they will have been going: 'Oh my God [laughs], really, is that what I'm going to have to do?' There would have been that. So there's been a big long learning process for me. But no matter how much I learned, the one thing that doesn't change is that when I sit down to write I just get super excited. And I just write what I want to hear. But what I do now, what I never used to do - incredibly, it's so ungenerous of me in retrospect when I think of it - is, I would never send bits to people and say: 'Hey man, this is what it sounds like. This is a little chunk on paper. What do you think?' It was really that I'm going to finish this piece, I don't want anybody to interfere with it. Because you're in this amazing universe of your own, with you and the technology, and you don't want anybody coming into that. Because you have this amazing freedom, and that's really what I think of. And if I move on from there now, – let's say that that question has kind of been answered - the next step, because you asked me about production, is that for me, when I think of production, I don't think of MIDI as production. I think of MIDI as sort of sequencing stuff. But production for me is the introduction of audio elements that are not MIDI into it. And I see that as one of three things: there's your MIDI content, there's the audio content (which is, let's say you wanted to bring in a field recording), and then there's your ability to produce, which is, how good are you with reverb plugins, how good are you with compression, how good are you at mixing, all of that stuff. I think of that as production. And that leads me to an example, somebody that I've been listening to a lot lately, which is Max Richter. Now when I hear his *Sleep* project. Do you know that project? So I've listened to that whole eight hour thing dozens of times. I really love it, you know. But what I hear is that his production ability allows him to have way fewer notes in his music. Because the way that he contextualises the instruments in terms of reverb and space and underlying pads, things that extend the actual notes that people are playing on the piano, or whatever, it has basically allowed him to be way more minimal in terms of how many notes per bar, the rhythmic density of his music. And when I compare that to what I do, especially the earlier music when the libraries were very poor, I had many more notes

in my music, at much higher tempo. Because I was filling all the space with notes. But now that I've got somewhat better at production, and I use reverb and I've got better samples, and the piano library now will have sympathetic resonance and all other kinds of things, and the way the pedals work is much better, my piano writing has opened up.

AM: But does that mean that when you then give the score to someone, and he plays it in a very dry theater, on a bad piano, with no acoustics, it suffers?

JP: Absolutely it suffers, yeah. So I'm not big like Max Richter. I don't have control over that stuff, because there's also that element. But the thing is that is has impacted on how I write, because there's more space in what I write. And there was something else, just going back a step, which is, I was talking about the MIDI version getting better and better. So for me, for a very long time it was just the MIDI. But as that got better and better, library-wise, and my sequencing got better, I introduced production. So, for instance, I started using reverb. And my MIDI stuff got good enough that… For instance, I wrote a piece for timpani and orchestra. It was a concerto called *Planet Damnation*. But the thing is, I put so much time in the MIDI version of that, that it now exists as a karaoke piece. Or I'm starting to call it digital concertos, because it's a bit better than karaoke. That backing track is good enough now for someone to play it live. And there are more and more people playing it as a karaoke version. But the interesting version about it, the point to make, is that I never intended that. The technology kind of made that possible. And it's of course getting a way bigger life through that than it is through being played with an orchestra. Because getting concertos played is tough.

AM: Plus the orchestra would not be as precise, or you don't worry about that?

JP: Of course, yeah. And the orchestra is actually not that tolerant of the timpani at the front of the stage either. They're not really enthusiastic about it. But even the saxophone concerto I wrote for Federico in Italy, I've just now released it as a karaoke version where the backing track is all MIDI and the saxophone player can play… And

so this sort of digital concerto idea has become something that has led me to a whole new space in terms of composing. So basically the technology has led me, or we have led each other, to a space where pretty much everything I'm writing now is for live performers and backing track, so like *One Study One Summary*. And because of that it has opened up this whole new world of production for me. And I'm bringing in a whole lot of audio into my music now that's not performed live, but that's also not MIDI instruments playing a backing track. It's other stuff. And my production abilities are getting better. But I always feel quite behind, which is why I'm getting into *Pro Tools* more, because I want to learn more just about audio and recording and editing and mixing.

AM: Are you self-educated mostly?

JP: Totally. Even in terms of orchestration, like writing acoustic orchestration for orchestras. I did piano and composition, and within the three years of my bachelor degree I essentially realised I'm not going to be a pianist, even though I got the degree. And I realised that what I wanted to do was write music. So I learnt that as an undergraduate, and then I went on and did postgraduate in composition. But those were very different times back then, you know. I did ONE paper of orchestration. And I've written a whole lot of concertos. And all of that stuff is really self-taught. And you can tell, you can tell when you look at it. It gets by, and it's OK, but it's not wizardry with the orchestra, by any means. It's kind of functional orchestration that does its job. And that has also been impacted by, if you think about it, the fact that I've only ever written for orchestra using a DAW. And I've been essentially hostaged to the quality of the samples. And you can hear that through the music that I've written for orchestra. It goes from being incredibly busy, everybody playing a lot of notes - because that's the only way you could make the samples work - to something that becomes more spacious, a bit more solidly conceptual. But if you look at my orchestral writing, there are almost, I think probably zero examples of extended technique. Because that just didn't exist in DAWs. And so there's none of that in there. There's no space time notation.

AM: So actually, when you go into notation, you don't add things that are not in the produced version?

JP: It's all completely aligned, right.

AM: But you may have written sul tasto *or* sul pont*., even though the library didn't have that at the time?*

JP: Even though these days you do, but back then, yes, I would do that. I would probably try and achieve *sul pont.* with an EQ, or something like that.

AM: And you would write a Bartok pizz*., or you wouldn't?*

JP: I would, I would, that stuff I would know. I might add a little percussion sound with the *pizz.*, just so that I kind of feel what it is. These days of course it's all there. But yeah, there's a severe limitation in terms of my development, because of the software, no extended technique, no space time or free time notation, because I just couldn't figure out how to do it with the software, in a way that I could control it and turn it into a score. There's no chance…

AM: Did you ever play completely freely in a regular meter, regular tempo, and then just export that? Because that, of course, if you leave all tuplets open, gives you very interesting notation…

JP: Yeah, that's right. So I did once a piano duo called *Motet*, in which I improvised at a MIDI keyboard, and recorded it, and then I brought it roughly into notation. But I used those beams, like you've got semiquaver beams that get thinner and they join, accelerating and descelerating. That's as far as I ever went into that world. So you know, it's a really interesting dimension; limitation, if you think about it in that way.

AM: And so you notate in Sibelius*, or…?*

JP: No, hand, still by hand.

AM: Everything by hand?

JP: Yeah, I just finished a new piece for snare drum and backing track [shows the score].

AM: And so you send it…

JP: to someone to typeset. And this is my score. I did it on one of these big excercise books. So that's me just writing it out. It's all fairly straightforward.

AM: You always do it that way?

JP: Always by hand, and by pencil, yeah. I've never done it any other way. And I'll tell you, in terms of a career, because I was very lucky and started…

AM: So you see it in Logic…

JP: in piano roll. I never work with notation when I'm composing. It's all looking at it, how it looks. And it's interesting, even that development over time, now that I think about it. It used to be: I would write like ten bars, twenty bars, sixty bars, and know that it was OK. And then I would write it out. And then I would go back to composing the next… however, and then I would write it out. And so the score would just be slightly behind the software, the *Logic*. But now what I'm doing is, I forget completely about the score and I just write the whole piece. Just purely by sound, what I want to hear. But also keep in mind that at my age and with what I've done, there's a lot I understand in my head about what's going on in the music itself. I don't need to see it to understand what's going on. And now I write the whole thing out at the end, and then send it off.

But what I was going to say, just in terms of a career, intuitively, when I was younger - because I got commissions straight away, even at university, and it's been continuous since I was there - I just figured out very young that it's better to spend even up to half of the commission on somebody else doing the score, and get another commission. So what you're doing is composing fulltime. You're not actually doing composing, then typesetting, composing, then typesetting. I didn't do that from the very beginning, but maybe after five or six years. Because back then you had to write your scores by hand with pen. And I did orchestral scores. Anyway, it was just terrible, a terrible sort of time. But the one thing I like about writing it out by hand in pencil now, still, the reason why I won't ever stop doing it, is, it makes you consider everything all over again. Because when you work with software, even though I don't copy and paste (I never do it; performers really complain: 'Don't you repeat anything?') I work incredibly quickly. And writing it out by hand is a way of checking everything. And you look at it and you go: 'Oh that's really really hard. Just those four notes, it's crazy. Change it, now is the opportunity.' And it's a fine toothcomb checking as well.

AM: And does the person who notates your music also work with your audio, double-checking, or just from the hand-written score?

JP: I think they want a degree of separation. They just send me the notes. And I've also got this other thing, which is, I'll send them the score, just notes, nothing else, no dynamics, nothing at all. They do all of that, I proof it, because proofing is a big deal for me, and I'll proof it all, and then send it back all marked-up in red, if they've made mistakes or whatever. And then I send it back and I know that the notes are OK. Then I add dynamics, pedaling, phrasing, all of that.

AM: You do that?

JP: Yeah, I do all that. And when I do that, I go right back to the software, track by track or part by part. I will listen to it, and that's when I'll go, is that a *forte* or a *fortissimo*? Not how loud it is decibel-wise, but what does it feel like? With what intensity is the person going to be playing that?

AM: So the notation phase is actually still a composition phase?

JP: Absolutely it is, in the sense that that's the stage when I think about, OK, this is a performance that I'm creating, with the score. Not creating but generating. And so, to guide… Dynamics for me have always been a huge dilemma. And that's software related, which is, are you going to say, rule of thumb you know, -10 [dB] is a *forte*, 0 [dB] is a *fortissimo*? You know, you can't make those kinds of rules. And so I'll go through and listen to the parts and just think, I think this is a *fortissimo*. And it might be later on that the context is different, and you're getting the same meter level, and actually I think this is just a *mezzoforte* here, given the intensity of the music and what's going on.

AM: So it is in a way a translation, the notation?

JP: Definitely, that's a good word for it. And then I'll do the other thing, where I put everything together and listen to it all together and think, what is the overall dynamic intensity here? And then I'll try, I'll see if that reconciles with my understanding of the individual parts. But I often, often really fuck it up, you know. And especially within multi-layer things where there's lots of people playing. I'll get too involved in that, and I should be a bit more general. And I'll just… You know there will be, this one is *mf*, this one is *mp*, this person is *forte*. And then at the end you think, how do the performers figure out what I want with all of that? So that translation from the mix that you get in your DAW to dynamics in the score is still a real problem for me. I haven't really figured out how to get that right.

AM: And eventually, when you loosen yourself a bit from the piece, do you then, listening back a few years later to the best performance and your original MIDI [version], do you prefer your own MIDI [version] or the best performance?

JP: It varies of course. I'll give you a really great example. One of the very early pieces I wrote using the technology was a string quartet called *Abhisheka*, which had quarter tones and slides and things like that. And I spent ages sequencing that, getting it all

how I wanted it. I gave it to the New Zealand String Quartet, they played it, and they played it a lot. They took it all around and they played it for ten, fifteen years. And I went to a festival performance where they played it, and I hadn't heard them play it for a really long time. And I had this incredible experience of having things revealed to me about the work that I didn't know. Because they were much more in the piece than I ever was, because of their journey with it. And that's where the live performance not only is sort of better than the MIDI, but it transcends, you know, what I had understood the work to be. And the work has grown into something else. So that's very special. But then I've had experiences where people had played, say, a piece for piano and backing track, or the one I've just done, which is for six pianos and backing track. And you'll hear it played in a concert situation, and you know how concerts are. They have their own energy about them, and they have their own forgiveness about them too, about what can happen. And I'll be at this concert, and everybody afterwards is just going: 'Oh my God, this was so incredible', and I'm going: 'Oh, it was really incredible.' And then I listen back to the recording of it – there was so much wrong. But you just… It doesn't matter. But then if you take it away from the performance, and you compare it with the MIDI, you think, the MIDI is way better. But you would never play the MIDI in a concert, because that's not the same experience for the audience.

AM: Are you a control freak?

JP: Yeah, well, performers would say that I definitely am a control freak. But then I'm learning to be more generous, and to also have a broader perspective about things, which is to think that… You know, I have to always appreciate that I've been so lucky, so many performances and so many things happening, that I've had to train myself to be in a situation to think: this isn't everything. This is a performance of a piece, and this person is just trying their hardest. All I need to do is appreciate that this person is trying so hard. That's what I need to appreciate. Because you know, life is short. And energy needs to be positive, as much as possible. And so I've often found myself quite consoling and counseling performers, and say: 'Look, don't worry, it's OK, just relax, it doesn't really...' Whereas it used to be like: 'Hm, wow, really, you can't…' You know, I

was more like that. And I guess it comes with age, and more knowledge about life, and value, and all of that. I've just come to the point where I appreciate far more the fact that somebody gives a shit, and they're trying really hard, and they really love the music. That sort of matters much more.

AM: But do you feel - that has to do with the question whether you're a control freak – that your music has a big margin [in the relationship between a precise and a musically successful performance]?

JP: I would say it's more in the zero margin. Because this thing that I'm doing with the backing tracks… Somebody said it to me really well, which is two things. They compared me to [New Zealand composer] Gareth Farr, and they said: 'The thing about Gareth is that he writes music that sounds really hard but that is not too hard to play. The thing about your music is, it looks really hard and it is really hard.' And so the thing in that context is, from an audience point of view, you tend to know when somebody makes a mistake, because you can kind of… There's something about the message you're getting from the performance. And then the second thing; somebody said to me: 'Look, the thing about your music is, you can't bullshit. It's just really obvious when you've made a mistake.' And that's a whole way of having to learn and play with that kind of music, where you can't hide anything.

AM: It's transparent.

JP: Yeah. It's always like you are set up to be exposed if you do something wrong. And I feel bad about that. I wish I knew other ways of doing what I want to do, because for me, I always have to hear what I wanna hear.

AM: Does this transparency have to do with the DAW?

JP: I think it's because, especially with the karaoke pieces now, of which there are more and more, you can't hide, there's so much precision and alignment. And also in ensemble pieces, the piano and percussion pieces that I've written, all the concertos,

the interaction is so tight and so precise, in order for the music to work, everybody has got to be locked into this thing. And there's no repetition, and no one is doing the same thing as anybody else. So when it goes sideways, and because I write modal music, tonally it's really obvious what the world is. If you step outside of it, it's obviously an error. You know, there's this thing about contemporary music, which is that, if you have a premiere of a new piece, audience doesn't know if it's going well or not. They can't tell if they don't know the piece. But with my music it's often more obvious than with other kinds of music. Sorry, I am rambling on…

AM: No no, also your talking is very transparent [JP laughs]. So in No Man's Land*, and also in* Between Zero And One*, you invite other people to offer you material. Has that been a big step?*

JP: Really big, really big. The *No Man's Land* project is the culmination of all of that, in which, in order to… It would be interesting to talk about the use of the DAW for that project alone. But that entire project encompassed every kind of approach to making music. So that there's an amazing Sufi ney player from Istanbul in that, [Muhammet] Sadrettin [Özçimi], and he didn't wanna know anything. He just wanted to… I mean, he didn't even ask what the key was. He just heard a few seconds of the music, he knew straight away and he just said, roll, film and recorder, I'm ready. He just played and it was extraordinary. So that was like almost zero dialogue with the musician, apart from being in the same room at the same time. And then I had in the project a shakuhachi player, different kinds of singers, where we would talk about the feeling, what are we heading for, talk about the key, and I would say things like: 'It would be really great if you could make this kind of shape. Maybe hit a kind of peak really close to the end. Or don't have a peak, just keep stable all the way through.' You know, just talking about energies and things like that. And answering questions. Percussionists were really interesting, because they came from a whole lot of traditions. And I sent them stuff like guide tracks. I mean, everybody got guide tracks. But I sent them stuff that had me mocking up loops and things like that. And I said, basically this kind of groove. And when I turned up they would go: 'Yeah yeah yeah, that's great, but look, I was thinking, let's do this.' [laughs] And the thing is, every single one of their

suggestions was way better. Because they know what they're doing. So part of the process, or being the person in that project, is being able to accommodate those sorts of things. But also, when someone says like: 'The tabla thing, I want to turn it around. You've got it on the end of two; I'm thinking the end of three is better, and maybe doing this on the one.' You have to be able to do a really quick computation in your own head and think, what does that mean for all the other parts at that point, and do they line up, and is that going to work for overall groove? So there's that. And they were given very rudimentary notation, and there would be the odd one who would say…

AM: So you sometimes gave them notation?

JP: Yeah, yeah, very basic stuff, like eight bars of this kind of thing, sixteen bars of that. And then there were… I had an orchestra there and a choir, and they were playing off completely notated things. So it was the whole continuum of dealing with lots of different kinds of improvisation, and levels of freedom, and of control. And then going to the completely controled, which is the western classical thing. And you've got Sadrettin at the other end, who just doesn't want to even have a conversation. He just wants to play; it's all about the music, and the more we talk about it, the less magic or devine it's going to be for him. So he doesn't want anything taken away. And the thing is, for *No Man's Land* I had to create a mockup for the entire work, so that we had timecode going from beginning to end, that we were going to film and edit to. And so the music came first, had to have everything in place, right down to the frame, every frame. And I had to mock up… So I had a fake shakuhachi solo on there, I had a fake ney solo on there, fake as I'd grab it from an audio recording, put it in the right key, and put it on top of what was going on, so that we had an idea of what it would feel like. And that's getting much more to the audio thing. Not sequencing a ney solo, I wouldn't, I didn't do that. And then the vocal things were basically… For example Meeta [Pandit], I would send her the backing track and some description of it. And then we would Skype, and she would sing to me over Skype while playing the backing track off the phone, and I would listen to that, be recording it as well. And then I would say: 'Hey look, can you just sing that and record it on your phone, and send that to

me?' And then I would put that into the mockup. I would have a mockup of her in the actual thing. So that's using the DAW as a kind of net to capture a whole bunch of things as well.

AM: Were you a band leader, perhaps partly?

JP: Well, because I just mostly worked with people one on one during the process, the most I ever had together was like three or four musicians. And then we had orchestra. They have their own leaders, you know. And so it was not really a band leader in that we never really had a band together at any point. That only happened in the live show, when we had this group of seven live musicians.

AM: One more question. How does it [No Mans' Land] *relate to* Between Zero And One*? How did one lead to…*

JP: Yeah yeah. So *Between Zero And One* was this percussion sextet playing to a backing track. It was the first ensemble version, really, of this idea. But within that, there's a piece called *Between Zero And One* that has these videos of people. And that was something I had wanted to do for ages. And we had to do it with no budget, so I basically just wrote to friends and said: 'Well, is there any chance you could…?' I set up a camera, I set up the microphone, and I said: 'Don't worry about the quality of the camera, because we're going to have lots of different kinds. But get a good mike, so that we've got good audio.' And we managed to do that. We assembled it so that people came and went on the screen. And they played with [New Zealand percussion ensemble] *STRIKE* on stage. And it was a very special thing, you know. It really struck me that the audience, all they talked about afterwards was that one part. They said: 'Oh, there's just this feeling of… I know you were trying to manipulate me and make me feel that way. But I couldn't help it, because it was just really special.' It's like the world coming into the space, you know.

AM: And what kind of control did you have of the situation?

JP: Well, that was a very intense one on one with everybody. So for instance the bass player in New York, Matt Penman, I sent him everything. I had MIDI'd up a bass guide with all the notes and things, like the groove and all that. And he just took that into the single take of him playing. He got it, he nailed it. Someone like Serj Tankian, who was playing the piano in that, I had to ask him: 'Oh, do you read music?' And he goes: 'I read audio dude' [both laugh]. So what I did with him was, I had a camera over my piano, and one by one I played the chords on the keyboard, so that he could see exactly what they looked like on the piano. And them I sent him a guide of a MIDI performance of the piano part. And from that he was able to get his hands on the chords, because that's really easy to figure out from there. And then he was listening to the guide, and he got the groove and the feel of it. It was a really great solution actually, thinking back on that. And then, when I worked with the singer - there are two singers - Leila at the beginning, I sent her the guide and said: 'Roughly this idea.' And she sent me back about five takes, and she said: 'Use whichever one you want.' There are quite a few of them that did that. They sent multiple takes back and said: 'You pick the one that you want.'

AM: That was actually also a question for No Man's Land*: if you fiddled around a lot with the material that you got from the various people. Did you take it almost like field recordings?*

JP: Well, the thing about *No Man's Land* that was kind of unique for us was that we had to marry the video to the audio. So in general we had to use complete takes. That meant that, doing a film and a recording, it had that extra challenge of, we've got to make sure we get a complete take that we can use. And sometimes we would… If we did ever edit - because there are a few places where we did - we would cut away to archive image or some other footage and then come back. We managed to cheat it a few times. And there were some things like… There were a couple of musicians that turned up that actually couldn't play in time. And we ended up doing a huge amount of editing, of tidying them all up. But thankfully for the instruments that they were playing you just couldn't tell. It just looked totally fine, you know. And there was one other… No, in general that was it. The thing about *No Man's Land* that is extraordinary

is that, apart from two cheats, everything is recorded on the set. It's just incredible that that worked in the way that it did as an audio thing.

AM: Do you think that from a DAW perspective, No Man's Land *is the most special thing? Or is it just a chain of different approaches?*

JP: No, the thing about *No Man's Land* is that the DAW really served a purpose, which is, it was much more functional. I used it in some ways as not particularly creative software. I was creating a soundtrack for film. That's what I was doing. Whereas with this piece [*Demonic Thesis*], which I'm going to show you a bit of, the new piece which I've done for six pianos and audio, the DAW to me really came to its own in this process. I was doing this where… This piece is a very big narrative. It's 40 minutes and it's… a lot of things. But it got to the point where I was thinking, I need the sound of a crowd of a thousand angry people. And I would actually commission somebody else just to create that for me. And so that would actually go into their DAW, and they would go in YouTube and find all these recordings of people screaming and shouting, and create these textures for me and send them to me. And I would bring them into my stereo audio file. But they would also send me the *Logic* file that they had made it in, so I could go in if I wanted to, to remix and redo stuff. And there were things like - some things I didn't end up putting in the piece – where I wanted the sound of the music gradually being submerged under water. And they would go away and do this, and create these various ways of imagining and hearing that. And so the DAW grew into multiple DAWs, and multiple users, and multiple creative entities, that were feeding into this sort of home base, where I was doing the composing. And I would do things where I would say, 'I really quickly need to build up a really chaotic cacophony of forest, gradually introducing layers of sounds, so that it becomes incredibly overwhelming. It's supposed to depict the world without us, you know, nature reasserting itself and so on.' And so I would get that, and it would be like fifty layers of animals, but also all of the automation, and the EQ, all of these things that someone else had done. I would pull that into my system, and then I would have the control over it, and I would change it how I want it and shape it myself. And so it's really interesting, that idea of it slowly becoming a network of DAWs now.

AM: Actually, the way a film director puts people in action?

JP: Yeah, exactly. And then I would go into a studio and record a singer for it, that I wanted to, and then I would bring her recording into my session. But then I would play with it. So I would start cutting it up, and then I would use it in a different part of the same movement, and reverse it, and make it very ghostly and ethereal so it sounds like it's coming from the past… You know, all of these other things that I would do with the sounds, which is getting much more into production at that point.

AM: And was this triggered by the work on No Man's Land*, where you worked with a bigger team?*

JP: Not really. This was a really new way for me. I mean, *No Man's Land* was really me composing. But this is more… It's almost like meta-composing at times, where you're curating almost.

So I will show you a couple of things here. Firstly I will give you an example of. So this is the piece that I've written for this *Piano Circus*, they call them [plays music].

AM: Was this piece planned, from beginning to end? Because at some point you said that you compose just chronologically almost.

JP: This one was with a narrative. But the thing is, I had a narrative and didn't know at all what it would sound like.

AM: So that's a new thing actually?

JP: Definitely that level of planning. I will just show you quickly on my… to give you an idea of the planning. Here we go. The piece is called *Voices Of The End*. So I knew it was going to be 40 minutes, because that was the commission. And then this is all content that has inspired it. So it is transcribed from the movie *Planetary* here. Have you seen that film?

AM: No, I have not.

JP: Really worth seeing, yeah. And these were the sections. So a prologue and an epilogue, with three things in the middle. And these are the three sort of ideas: that we keep going as we are, or we could talk about how it's all falling apart, or we could talk about how it's going to turn around. It's just the three different stories that we might tell about ourselves. And then this is breaking them down into sections.

AM: And is this something you always do in your work?

JP: No, but this was very complex, because the thing that is entering into my work now is, I don't feel I can just keep writing abstract music that has to do with notes and sound. It needs to have more to it than that, you know. Because I guess I'm wanting there to be more meaning in what I'm doing, and not just this kind of exploration of sound, but more than that. And it's kind of in some ways going against the university idea of, music is pure research. Where does the music take you? For me it's really about, what sort of contribution is it making? What is it bringing into the world that has some point, some value, some relevance, and some meaning? And because I'm Greek I'm addicted to tragedy and misery, it's sort of very end-of-the-world-ish, this kind of thing. Because for me it's impossible to look around and not be overwhelmed by that side of things. But in the work itself there is the pursuit of finding hope, you know, a way of looking at things in a more positive light. But honestly, I'm actually really feeling that, like *No Man's Land*, in some ways the whole point of that project was to see, is it possible to get to a place where you can create a commemorative work about the First World War that has something positive in it. Because for me it's utterly tragic, and it's retarded behaviour. And commemorating it is often really stupid, the way that it's done. And so the thing that I found within *No Man's Land* was this idea that at least a hundred years later, in Polygon Wood in Belgium, Scottish people are not murdering German people. At least that is not happening, you know? And at least the border between France and Germany where millions of people died fighting over that line on the map… you drive over it now and you don't know that you've done it! Because it's open now. Those are positive things. So it's finding

something like that. In this piece, the voices at the end, the positive for me is really just at least an expression of hope, which is that we have this massive evolutionary pressure behind us, of surviving. You know, that's been the driver for us, survival. How we do it, I don't know, but there is some comfort to be taken in the fact that even at an evolutionary level, a genetic level, we are programmed to survive. So there's something there…

AM: Do you feel that the DAW possibly distracts users from dealing with content, or with deeper meaning?

JP: Absolutely, because it's this incredible playground. It's like a *PS4*, when you're playing a game. It's like: 'This is addictive, I'm loving this, and it takes me to the next thing, and I can add this, I can play with this new plugin, I can buy a new library. This is so much fun.' It is so much fun. And I think it absolutely can distract. It did that to me for years. I think that working with MIDI, sampled instruments playing notes, is in some ways the most removed you can be, because none of it is real. And it's a playground, it can be a playground. And my journey has been about, and I think part of it is, like I say and I keep saying it, that I've been happy in that so much has happened for me, that I've kind of gotten over this incredulity that my music is being played and that it exists. And I think that's awesome, that's great, that's kind of there. What else? I mean, what's really important now? And that's why I think I've moved into this. Unfortunately it has become uber-serious, everything, it has become, well, part of me… My family said: 'Man, do you know how to have fun dad'? [laughs, then shows and plays bits from *No Man's Land*, including several field recordings]

AM: So now that you go deeper into content, you actually use more field recordings?

JP: That's the great thing about the DAW, that there's a kind of limitlessness about it now. It has gone from being limiting in the sense that it's MIDI notes, and the sounds are not very good, and I write too many notes because there's no body to the sounds. It's gone from that to, I can bring everything into this, literally everything. So one of the movements of this ends with the recordings made by the Voyager probe of space.

I don't know if you've heard those? They are magnetic recordings that have been put through a speaker and they create sound. And they are all perfectly tonal, they are these tonal fields. It's incredible. That is the recordings I've made, but also the broadcasting of our message, the UN ambassador saying: 'Greetings from planet earth.' That's our voice going into space. That's in there, in one of the movements. And we played that at this preview, a month or so ago, and people were saying, they couldn't describe how they felt, to hear our black box recording going into space, you know, our voice going into the cosmos. All of that stuff coming into a work, which is beyond the notes that people are playing. And there are so many layers of reference within in. But it is contained. And it is curating multiple layers of meaning, to try and generate a vision, an overall vision.

AM: But in the earlier years, when you were on your own in your DAW, how was that if you talk about emotion? You were extremely into it you told; was that…

JP: Well, I had nothing to do with anything other than the music itself. It was entirely about the music. For me it was about the trajectory, how is it unfolding, what is it becoming, and isn't it amazing? There's a lot of that going on. But that was all about music, the pitches, and the rhythms, and the textures, and the shapes, dynamics. And something growing from nothing. It was really about that. And I think what has happened here is that there is a different kind of purpose now. I was satisfied I think because I could work with a DAW to do it. I was satisfied with going in parallel with the unfolding of the work, and feeding into it and it feeding into me. This bio-feedback loop going all the way through until the end of the work. I was satisfied with that. And if you listen to a lot of my music you will hear me in it, going: 'Wow, wow!' all the time, you know. And that's literally what was happening. I think that working with the software has enabled me to put that feeling into the music, so that when somebody else hears it, they feel it as well. Now I'm sort of going beyond that, and I think, well, I've done that and it has been great. But now I want to do something beyond me, about a reality that is shared by more people.

[more listening to field recording and excerpts from the work for six pianos and backing track]

JP: The technology thing has been my secret door into the world of music making. It has been my free pass. Because I have never had to front up and perform.

AM: It's your instrument, in a way.

JP: That's right, it's my instrument. But I can't really play it with anyone else…

AM: Are there general observations about people using DAWs, general things that you notice?

JP: What's interesting for me is to observe my students using them. Because in some ways they have way more ability and facility with the software. And they will come up with something that's like a song, a rock song or a pop song. And what they do with the drums sequencing and the guitar sounds, it's so incredible what they can do, and they are so fast. But there's something about having that facility that I think is limiting, because… It is like you can get to a result, you go, I need a really great seventies drum sound, I need the style and everything. And they will get to that and they will do it, but they have not done that thing where… Well, this is an amazing sort of interface. It has just got drums, you can tap them and they play, you can change the actual drums, and just go on this weird non-directional journey, with exploration of the software. And I think that the software has become amazingly good at getting you to a destination, a pre-conceived destination. And I see this like, we have developed a film scoring programme where I teach. So everybody has got Logic and sample libraries, and they are all doing it in a box, composing for full orchestra and everything. And they will go for the sample library that gives them the Hollywood string sound straight away. So everything has been recorded, compressed, mixed, and you can just quickly create textures, and they sound great. And there is no exploration there. It's just straight to the destination. For instance, in the new stuff you have a fader for the degree of inaccuracy within sections. They will do that, but they don't… Well, if I would

have had that, I would just play with the inaccuracy settings all day [laughs] and see what happens! Because it's going to give you something really amazing that you can't imagine. You can't immediately imagine where it might take you.

AM: So you go to the edges of the possibilities…

JP: Yeah!

AM: Do you feel that Logic*, as it is now, directs your actions?*

JP: I think so. I think I've got some good strategies for getting around things. You know, the way you set up a session, the way you slowly build things… The one thing about Logic that has changed a lot is that… You know, this laptop cost me a fortune. It's got a 2 TB Solid State Drive in it. Almost 90% of it is my libraries, so everything is here. And it can do anything. It never really crashes or struggles with anything. That's a big shift. I think prior to that I was directed quite a bit by what it could not do. And I would think: 'Well, I can't add another track. It's not going to work if I add another track.' Or: 'I can't add reverb, because it just can't cope.' Whereas now, I have stopped worrying about that. I would say that's one thing. The one thing I wish it could do, that I don't think any software does – or maybe it does – is multiple clock speeds. The fact that anything is on that one clock. If you wanted to have different parts… Even [Conlon] Nancarrow, the player piano stuff, I show my students that stuff. I look at some of it and I ask my students: 'How would you sequence this?' And they look at those multiple tempos, and they look at the tempos accelerating within themselves, and they just go: 'How do you do this?' I find it fantastic for Nancarrow to have got to a place that we still can't easily replicate. That's kind of amazing. So there's that. But the thing for me is that I always think of myself as actually quite an amateur with all of this stuff. Because whenever I go to a recording studio, and there's somebody there setting up all of the stuff, the plugins, and the great sounds, compression and all that, I think: 'Man, there's so much I don't know.' And so I tend to feel like I'm an amateur. So because of that I feel freer! I don't feel like I have to achieve a kind of professional quality in terms of production, I feel a bit freer from that. And it's just so vast, the

Logic environment, it is really so vast, that I just feel like I'm going to be exploring it for the rest of my life. I'm not going to… I don't think it's ever going to run out for me. This is a good closing…

AM: There was one thing you forgot you wanted to say?

JP: That's what it was – it was to do with the virtual performer, the karaoke music, which is essentialy giving somebody a virtual partner on stage. You mentioned it before, there is security in there, because it will always be the same, it will always be perfect. And the other thing is, it allows you the sort of confidence when composing. You know that these elements are all going to be there, and they are going to work. So you are freer to create the live part. But then also for me, my approach to working with the karaoke thing is that I've always understood that the performer, the person playing live, has to be the storyteller. They have to be the primary narrative element in the work. Otherwise, why do they need to be there, you know? There has to be a very strong reason for them to be there. And so that's just part of my approach, my philosophy, which is: I just put the performer in the foreground of the storytelling all the time.

AM: That relates very nicely to my very last question, which is, of course a DAW also allows for live electronics. Live electronics can create another storyteller on stage…

JP: I've never been near that. And part of it is… It's a control thing, which is that I've never felt confident enough about giving that up. And also, if you're going to have pre-recorded stuff, live performance and live electronics, there's an even bigger question of, why do you need the electronics to be live? If there are electronics, why can you not pre-programme those things? So that thing about why is really important: why is that person there, why is that person not there? I've seen laptop artists at more poppy gigs, like there was one in New Zealand. Talvin Singh, a tabla player, came, and he had a laptop dude with him. And he would press enter, probably, and this huge thing would happen in the system. And then he would basically just do this bouncing his hands with the music. I was watching – the visual energy does not match the audio

energy that I'm getting. There's a real disconnect between these things. And I have always believed they have to match. Otherwise the audience is having a confusing or limited experience. They are not really able to engage with the musical narrative. And you get that a lot with anything that is amplified. It's a risk, and I think you have to really manage it. That is why for instance the performers are really working hard in my pieces, because they have to sell the work, not the electronics…

AM: I think that's a great final statement.

Appendix 3: Interview with Danny de Graan, Amsterdam, 15 May 2018

AM: Which DAWs do you use?

DG: I use *Logic Pro*, the latest version, *Ableton Live 9* and *Sibelius*. And if you see *Max/MSP* as a DAW, I use that too. Besides I also use, and you can do everything with it, *MetaSynth*. I use that regularly.

AM: And *SuperCollider*?

DG: No, I don't use that. Very rarely to process something perhaps, but I couldn't say I use it often.

AM: Do you feel the DAW impacts on your conceptual, aesthetic, musical approach in your composing, in creating music?

DG: Yes, a lot, really a lot – in a positive and in a negative sense. In a negative sense: sometimes it limits me in my freedom of thinking, for example in dealing with meter. Or, when making scores, and not necessarily in *Sibelius* but in *Logic* or *Ableton*… For example, I am now working on a piece with 9 against 7 against 6 against 5 against 4, that kind of thing. Well, that doesn't work in *Logic*. But I want it, so it keeps me busy. So such things I have to do in *Sibelius*. In the past I didn't do it because I couldn't. So if it doesn't work in the DAW, you don't do it. You reach the limits of what you can do. If it is on your mind, and in your creation process, I experience it as limiting. And I realised in the past year it was becoming a limitation. I wrote an orchestral piece last year and I tried to create this rhythmic complexity, but within *Logic*.

AM: Within the range of possibilities of Logic*?*

DG: Yes, exactly. And looking back, I shouldn't have done it in *Logic*, I should have started in *Sibelius*. I now started with a new orchestral work for [Ensemble] Insomnio, and for that piece I decided to work in in *Sibelius* and *Logic*.

AM: In *Sibelius* as well as *Logic*?

DG: Yes, simultaneously. I do that with a rewire connection, so when I start one, the other starts too. And what I do is, I notate in *Sibelius*. It's a piece for *Mini Moog* solo and orchestra, a *Mini Moog Concerto*. The *Mini Moog* is operated by *Logic* and the virtual orchestra comes from *Sibelius*. I've also got some electronics, an electronic part so to say, and that comes from *Logic* too. And I really only do that because I became aware that the textures I was imagining couldn't be realised in *Logic*.

AM: And making the whole thing in *Sibelius* isn't possible either?

DG: No, because *Sibelius* has no audio editor. For me, the DAW is a digital audio environment, and this entire audio part of it… You could load a virtual orchestra into *Sibelius*, and audio fragments perhaps… In theory it could work; you could load them into a sampler.

AM: An EXS player?

DG: Not in *Sibelius*, but perhaps in *Kontakt*. But it would limit you a lot; you cannot use effects, manipulate the sound. It would limit you a lot. So now I've chosen the best of both worlds. I don't want to be limited by my DAW anymore.

AM: That division of concept, aesthetics, musical results; do you start with a concept?

DG: Yes, I couldn't start without a concept.

AM: How much are your concepts led by how you work, or would like to work, with the DAW? Or is it elsewhere?

DG: It is elsewhere. But I've also changed my composition technique in the past years. I've involved myself increasingly with spectral music, and I've used *Max* a lot. By studying scores of other composers' works, for examples older works by Ligeti, like *Atmosphères*, or new works by for example Haas, I discovered the complexity in their scores – I knew about Ligeti, but I didn't know about Haas – a complexity I was, and am, looking for. I understood more or less how it works, and I was hoping to catch it within *Logic*, but it didn't work as well as I was hoping. So therefore I decided to write [the *Mini moog Concerto*] really in *Sibelius*.

AM: So the concept comes before the DAW?

DG: Yes!

AM: And when you develop your concept, you see how you can make it work within the DAW?

DG: Yes, in the past years this is how I've started to work. I simply wasn't happy with some decisions I took in my work, with what I had made.

AM: That brings us to the aesthetic and the resulting work.

DG: What I discovered is that when you work with a virtual orchestra - on the one hand I enjoy working with it; on the other hand I notice it limits me in my work. What happens is that you become dependent on the samples you use, and you expect that these samples are a translation of reality. And oftentimes that isn't the case. For example, the high registers are tricky for almost all instruments. But if you use samples, it sounds easy. If you don't know that, you have to experience it. And that has to do with your background, your education, and whether you already wrote for those instruments. But I've made that mistake a couple of times, writing too high. A virtual orchestra can do that really well, and it sounds great. Some riffs for specific instruments - for example the trombone cannot play so fast in the low register, and some note sequences. If you don't know that, and you never wrote for the instrument,

and your virtual orchestra can do it; those are mistakes I made in the past. I've made sure to remember that; I've gone through any possible orchestration book. Those kind of things won't happen to me again. I discovered by using those virtual libraries that it's a real danger. And I know many composers who made the same mistake, or still do. You just notice that technology doesn't completely line up with reality.

AM: Clear. And on the positive side?

DG: I know exactly how my pieces should sound! I know exactly when someone makes a mistake, during a rehearsal or performance. That's a big advantage. I know exactly how a harmony should sound, or a rhythm. I know all the details of a piece, because, when an orchestral piece is ready, there are at least 90 iterations, if not more. I've listened to it so often, I know exactly how it has to be. And I know the long lines; I find this very important. I'm really focused on form, so I find this very important. I don't like boring my audience. So if I drift off during a composition – I try to avoid it. I work with the golden mean a lot, and I made a *Max* patch for it. I know roughly how long my pieces need to be. That duration I put in my patch, it gives me subdivisions, and those I put in *Logic*. I've now made a couple of templates for *Logic*, and I've calculated the golden mean at the top. So I always see it as a kind of timeline at the top, points I work towards. My pieces are always constructed according to specific proportions.

AM: Could you say the DAW for you is a means to realise what you want, but it doesn't define your approach?

DG: Well, sometimes it does. What I like in *Logic*, for example; in the past I used many sample editors. Now I've got a lot of plugins that do roughly the same. I could make a spectral FFT transform in *Max*, but I've now got plugins that do it, all in real-time, so I don't need to programme it. So I can take an audio fragment, and I want to transform it spectrally; I've now got a plugin for that. And if I want to do something granular, or additive, or whatever, I've got plugins for that. It saves me a lot of time, and I can try a lot of things immediately in *Logic*. I can also make a chain of several of those

processes, without any effort. From that perspective, I couldn't work without it. I really like working in *Logic* that way.

AM: You've got several kinds of output in your composing. Some of it is audio, some of it is performed live on stage, and you've got dance music. I don't know if you see that as a part of the same story?

DG: I've been asked to make a project proposal for a festival in which I would integrate the two. So I'm thinking about it, but they are different worlds for me now.

AM: So we are now speaking about world of composition?

DG: Yes.

AM: Am I correct about those two kinds of output?

DG: No, more… Well, it's correct.

AM: Performance with live electronics perhaps?

DG: The piece I wrote for Lunapark for example, *Feed my Speaker*, that's an electronic piece, in fact, which is performed live.

AM: So the two extremes, and various hybrids?

DG: Yes, exactly.

AM: About the impact of the DAW; you told about things that are realised by musicians on stage, and the risks involved. How about music which has electronic output, fixed media?

DG: I've also made acoustic works completely in the DAW. For example, I've written the very first piece for the Fokker organ, for the introduction of the revised Fokker organ, and that piece was created entirely electronically. They are MIDI data, there's no notation. The piece is called *Forma*. It is inspired on Stockhausen's *Klavieretüde No. 2*, and in that piece he uses shapes: triangles, squares, rectangles. I've literally drawn these shapes in the DAW, and I've made algorithms in *Max* to generate these, using *Logic* to make things larger and smaller, time compression, data compression, expansion. I made a fully electronic piece with it, but acoustic. And I also make electronic music with *Logic*: concert music, classical electronic music.

AM: And are there any risks involved, as you describe for your instrumental music?

DG: No, not really. Perhaps I've got a blind spot there, that's possible. No, actually… I could say a few positive things about *Logic* that also relate to this. The nice thing about *Logic*, as I just described with the plugins; I use it as a montage field, so I construct my audio in it. But in the past years I've also been producing my audio in *Logic*. Not always; the piece I'm writing now, I do that in *Max*, and then I import it into *Logic*. But I often process sounds in *Logic*, simple sounds, and I make textures, and that works really well nowadays. It can be done with internal plugins, or with third party plugins. The other thing I wanted to say about the advantage of writing in *Logic*, and why I don't like writing in *Sibelius*... I really have to get used to it. What I do with *Logic* a lot is, I compose a fragment, possibly for a large group of instruments, possibly a few, possibly one, and what I can do is place it further away along the timeline so that I don't occupy myself with it anymore. I can, say, place it five hours down the timeline. This way I can take and place hundreds of short fragments, and shift them around, put them in a specific order, and this can be done really fast.

AM: So you're talking about the creative process.

DG: Yes. Trying things out. I find that hard in *Sibelius*. If I'm not happy, I need to write it out all over again. There are tricks for that, a notepad and all that, but I don't find it

practical. It's not within one window. And I can't easily try this fragment, that fragment, combine it, see how it works.

AM: So you're sketching on different sheets?

DG: Yes, that's how it works in *Sibelius*. And in *Logic* it's just one large sheet, all the pieces of the puzzle can be shifted around, horizontally, vertically. It gives me enormous freedom. I miss that, working in *Sibelius*. I work like that all the time. For the previous orchestral piece I generated five hours of material. I made it all in *Max*; I worked with two algorithms that made specific material for me, and I was tweaking those algorithms to get the material I wanted. And everything I made with those algorithms I put in *Logic*, for the full orchestra. The nice thing about it is, at a certain moment I had four, five hours, and I could go through it and think: 'This is cool!' And I had completely forgotten it, because I had continued with the iterations of the algorithms, and the original one I had forgotten. I gave it a colour, I marked it red. At a certain moment I had lots of fragments of which I thought, they are good. Those I assembled, and with those I've been composing, cutting pieces out, changing, modifying, extending…

AM: It seems the way of working is familiar, but translated to the DAW. These were sketches; you were working with sketches.

DG: Yes.

AM: Are there any things you really wouldn't have done, ever, apart from the technical realisation, but purely in composition technique, had there never been a DAW? So not thinking about working with audio, but purely compositionally?

DG: I think everything is possible without the DAW, in theory, through writing notes. But the way I work, and like to work, and what I aim to do, it is just not possible.

AM: Why?

DG: Well, I work a lot with algorithms. I often generate algorithms in *Max/MSP*, generating notes according to specific rules. There's a large degree of randomness involved, controlled randomness, within specific parameters. Randomness is applied within certain values. Not always though; for example, I'm now involved with a row of partials, but within those partials, choices are randomised. The algorithm makes choices I wouldn't make necessarily. Surprising choices.

AM: And if you would use dice?

DG: Yes, but I just don't have the patience. Perhaps, it would certainly be possible. You're thinking of Cage's I Ching?

AM: Yes.

DG: But in my algorithms, a lot of choices are made at the same time. So you have to throw a lot of dice to generate the material. I can also make choices for a full orchestra, in one go. Using dice… You can of course also connect rules to throwing the dice. But the way I work, it's not easy, let me put it that way. I don't know if doing it my way produces the best music, and that's also not the point for me. For me this is just a great way of working, and it currently interests me a lot.

AM: And a big difference between dice and your approach is that you can listen back immediately.

DG: Yes, that's true. And I've got more choices. I've got hundreds. I don't use them all, I always limit them, otherwise it will end in chaos. I'm not looking for chaos; that's not my goal. A choice might be: what note duration. Or a sequence of notes, that works too. What I've got now: I've made a couple of rhythm algorithms. And I've programmed a couple of rhythmic patterns I discovered and like a lot. And they can be chosen. I've also got algorithms for pitch, algorithms for sound synthesis, because sound synthesis and pitch are related. And all that has to - I find it important that there's a kind of unity. So if the electronics change, the row in which the instrument

plays changes as well. If you would do all of that with dice, it would take you a long time …

AM: Can you compare? Did you ever compose with just notation software, or manually, not using DAWs?

DG: Yes, I tried. But it was - I lost speed. I did make sketches manually, which I then exported to *Sibelius*, or *Logic*, but I never made an entire composition, no. All of my works I made with a DAW.

AM: Is there a specific work of yours you would like to talk about in this contect?

DG: I've made a piece, *Equilibrium*, for the Fokker organ, with electronics. And I'm not a microtonal composer at all, but the organ is operated microtonally, and the electronics are microtonal too. And that piece I've composed entirely in *Max*. I've made algorithms in *Max*, a layering of five I think, and if I would press play now, independently – I recorded it in *Max* – you would hear the piece again. I'm very happy with the piece, in a certain way, I don't know why. I do know why: I simply find it a beautiful piece. But I find it really cool that the electronics and the organ are so unified, because I used the same algorithm for both. So I used one and the same algorithm to control both the electronics and the organ.

AM: Is that specific for that piece?

DG: It's particular for that piece, yes. It's one of the first pieces in which I started composing entirely with algorithms. And it's sort of one on one, so that at some point you cannot perceive the difference anymore between the organ and the electronics. I found that really interesting. Later I also studied a piece by Jonathan Harvey in which he realised that with orchestra and electronics. I find that very interesting, being able to realise that. But it's very challenging, these algorithms. It all needs to connect, you see? It all becomes one. And it needs to fit; in this case it was an organ that can play

anything you want. An orchestra is a different story, but [Harvey] did it really well. He sometimes makes the orchestra talk, baby babbling – you can really hear it.

AM: Did this trigger you in your own work?

DG: No no, I discovered the piece later. I discovered it a few years later, looking for works that do the same thing, and spectralism as well. That's when I found it, and it keeps interesting me.

AM: How do you see your influences anyway? Do you feel you work quite autonomously, that, in your concepts, you rely on your own questions or ideas?

DG: Timbre-wise I'm very much influenced by others, I cannot deny that. I'm really impressed by spectral music at the moment, and I'm always looking for textures, and really inspired by how others do such things. I think [spectralism] is quite popular at the moment, I'm not sure. I know for certain one person in The Netherlands working with it, otherwise none. But conceptually I'm not so interested in - for example Tristan Murail, one of the first who started composing spectrally, who started analysing instruments. He took the partials and imitated them with an orchestra or ensemble. He recorded a wave and analysed it. I find it interesting, but not as a musical starting point. My concepts go beyond that, in most cases. I find this more of a way of doing things, it's a technique. In my *Mini Moog Concerto* I basically do the same thing, but the concept is completely different. It's the way I work. The concept has to do with the content of the piece, what it communicates, and not so much how the material was created. A carpenter is also not going to tell you about how the tree is cut, the timber is sawn, and then the chest is made. You see what I mean?

AM: Another example of how you use the DAW just as a tool in your work, in composing. The point is what you want to communicate. Correct?

DG: Yes! What I really want to avoid is technique, or technology, leading me in my concepts. I don't see filters in a synthesizer, or playing really soft on a instrument, as

something conceptual. Bad examples perhaps; they might be concepts. But I don't see them as starting points, they are means to an end. Just like the DAW for me is a means to an end, just a tool.

AM: It's a working environment?

DG: Yes, it's simply my studio. That's how I see it. I've always made sure to avoid it taking the lead. It doesn't, for me. What I also avoid - let me put it like this. Three years ago I got the third prize for an orchestral work. It's called *ZAP!*, and I made it with algorithms. I was researching an algorithm of the magic square at the time. I was in the middle of the compositional process. I discovered the magical square through that Dutch composer -

AM: Richard Rijnvos?

DG: Yes, correct. I then started researching it. I made an algorithm, and, seriously, Richard Rijnvos' music simply poored out. I pressed play and I was like, wow, that's cool! Many of Richard's pieces I find really great. I had a piece, an entire concept, and at some point, halfway through the piece, I was a bit stuck. I thought, let's check it out, and out came that music. I thought, wow, so cool. I recorded it, did some editing, selected the good stuff and put it together; well, it was great. And - it didn't fit at all. Right in the middle of the piece this fragment appears, I found something that works great and I like it lot, but it just doesn't fit in my concept. You know what I did? I threw it out. It took me a week to make up my mind, really, but eventually I threw it out. Simply because it didn't fit the concept at all, even though it was good. It was great, but it just was Richard Rijnvos and not Danny de Graan [laughs]. You see, I threw it out, and the decision I took I find much better now. What I want to say is, something that results from a specific technique doesn't necessarily fit the concept. It took me a week of thinking, how can I make it fit the concept, and it didn't. It was nonsense. You have to be radical then. I found it hard. I didn't throw it away; I saved it, and I'm sure I may use it at some point. The funny thing is that it takes [Rijnvos] really a long time to calculate it all, whereas I press a button and, boom, there it is [laughs].

AM: We can only guess how - for you it's pressing a button, him it takes a long time. I don't know - do you know if he does it digitally?

DG: Anthony [Fiumara] told me he does it all manually. He told him so in an interview. We spoke about it, he told about the algorithm, and I checked it out.

AM: The question is if the route you take, by generating it, still makes a difference? You say it sounds completely like Richard Rijnvos.

DG: Yes!

AM: Does the human interface have the final word?

DG: Well, you make decisions. Many people think that if you create an algorithm, the music is there. It isn't.

AM: When does it become music, at which point in the creation process?

DG: It has to do with aesthetics; what are you looking for, what you aim for.

AM: That's a question not related to the DAW: it's about you, and the music you want to create.

DG: Of course, yes. With due respect to the DAW, it's a tool. I record with it, I edit in it, but it only becomes music when I finish work on it, and when I'm happy with it, you see. Otherwise it's like the sketches we spoke about. In this case it became Richard Rijnvos, because the scale I chose, the notes I chose, sounded in such a way that for each hit in the square... You've got a square which can be read in 29 ways, resulting in 29 harmonies, or clusters. But if you choose the wrong notes, or notes that don't fit together, the result is bad. So for me the challenge was to make something beautiful. Also for that I had made an algorithm [laughs] - a sieve I had made for Xenakis.

AM: I was just about to mention Xenakis.

DG: Yes, he used a lot of algorithms.

AM: Do you see in your approach, and in Xenakis' approach...

DG: Actually, I made a lot of objects in *Max* which I use a lot, and which I called *Xena*, after Xenakis: tiny algorithms that do something for me. For example a random algorithm: if you take a random algorithm in *Max*, it generates random values between 0 and a number you specify. What [Xenakis] did in some electronic works, and in acoustic works as well, is specify the bandwidth. That's what my object does. I use it a lot, and I copied it from him. I'm not the only one; it's used by many composers. But I've made an algorithm in *Max* that I always use when I want to go random. I never use random just like that; I always use that algorithm. You can make a very narrow band within which randomness is created. So randomness can be created between three notes, three numbers, but also between a million numbers, if you like. That's really his idea. You can see it in his scores, also in his electronic scores; he's got those too. You see clouds appearing, and that is literally what he does: he generates random values, he opens the bandwidth, he's got control data, he controls minimal and maximum values for the algorithm, and clouds appear. If you then link notes to that, of a certain scale covering multiples octaves, or a sieve as I just mentioned, you get a cloud that is consistent, but which also develops, by opening and closing the bandwidth. That's a common technique in electronic music, and it's also used a lot in acoustic music. Ligeti used it, and - many other composers.

AM: It's also interesting that Xenakis started many of his works with paper sketches.

DG: Yes, later on he started working with algorithms a lot, but in his early works very simple algorithms were used explicitly.

AM: Also in his late works, like Rebonds *for solo percussion, paper sketches are at the basis of the piece – from 1988-89, a rather late work.*

DG: OK, I didn't know. But I can imagine that these kind of things - I also start sketching on paper, not necessarily notes, more like shapes and those kinds of things. I also often write down the kind of expression I aim for – and what I often do as well is write a scenario. So I start with, how would I like the piece to develop? With keywords, and I use these in the algorithm too. Some time ago I had a deadline for a piece, and I was a bit stuck. Then I did that, and it worked so well that I'm still developing that approach.

AM: Is there one piece you would like to mention in particular, regarding the use of the DAW? Probably impossible, since you made all of your work in the DAW. Could you pick out something?

DG: That one orchestral work I spoke about, it's called *Cataracta*, that is entirely made in the DAW, with *Max* and *Logic*. It would never have existed… It's so many notes, so very many... If you would imagine doing that with the I Ching... You can clearly see it's been generated algorithmically. And I edited it manually of course, but to do this completely manually or with dice, it's not possible. Too many choices are made. It's all instructions for musicans. And if you have to create so many instructions with dice, within such a short time, it's a lot of dice throwing.

AM: Yes, I understand. In your interaction with musicians, do you notice the impact of the DAW use? We already touched this implicitly.

DG: Well, writing things that cannot be played.

AM: Regarding range, dynamics, playing technique.

DG: Yes.

AM: And, as you mentioned, that you know the piece so well that you know each note and aspect when you go into rehearsal. No doubt this influences the working process?

DG: Yes, that also has to do with politeness. You're not immediately going to - you just don't. That's a matter of a few rehearsals. And you learn that in the beginning things need to work globally, and then gradually you can make some comments. If in the last two rehearsals thing don't work well, you can speak with the conductor: 'It would be great if you could do this or that.' Often musicians realise it themselves. What I also notice is that through the complexity I spoke about, one may become too... Each DAW, except *Sibelius* or *Finale* (real notation software) is limiting. One may write too simplistically I find. Sometimes things might be more exciting, more interesting, if they were handwritten, I think.

AM: Why?

DG: I'm not sure, but I guess that if you compose manually, you are more creative in, well, you deal with each individual note. With a DAW you can simply play something, very quickly. And then your playing technique, how well you play, may be a limiting factor too.

AM: A limiting factor, or possibly an enriching factor as well?

DG: Sure, it is enriching if you can play something and it is notated for you right away, and you don't need to do anything to it. That's great. But I also see it as a risk, more and more. When I study scores which show me the way to go… I challenge myself, I keep learning. And when I study scores by other composers, in particular some of the big ones, I see how simple they write for orchestra. If you want to write as complex for orchestra as *In Vain* by Haas... It's very simply written, but very complex. And that complexity is often how he writes 9 against 7, you know, what we spoke about before. I just don't see that happen with a DAW. I don't know how you see that, but if you work with *Logic* or another DAW, it's so hard to do. And if it's that hard, you don't do it. That's it I think.

AM: Unless your output is electronic?

DG: Yes, of course. The truth is, when I work electronically, I don't work in bars – but with time. I just don't think about bars. But when I write for an instrumentalist, I need to think in meter.

AM: This sounds like you are not a composer-performer in your DAW work processes, not a composer-performer at the keyboard…

DG: I do that, absolutely, I do that too.

AM: Playing…

DG: Those algorithms are all in real-time. I don't play myself, but it's all recorded in real-time. And I influence it, often live. Through the bandwidths I spoke about ….

AM: A performer of the 21st century?

DG: I sometimes play too, but there's that limiting factor… I'm now writing a piece for a saxophonist, and I already wrote the piece twice. And the first time I had played it myself. And it sounded cool, and the saxophonist said: 'When can I have it?' And I just wasn't happy with it. That's partly because of that limiting factor in my own playing. It's not that I play badly, I just know that there's more. And better. So now I wrote it again, and I wasn't happy again. And now I'm writing it, and the concept is clear. It's all clear now. And now it's played by an algorithm.

AM: Where exactly is the 'better'; is it in the creative skills?

DG: What I aim for in these situations: I want to create, from the generated material, a strong concept, from the rhythm a strong concept, and the form… And timbre, but let's leave that for now. And if I do that manually, the rhythm, the pitches, timing, I cannot do that. I'm just not a musician. It's just not who I am. But I do aim for that complexity, those special twists… But what I can do really well: I'm very good at

programming things. I can make a pattern, turn it around, make an algorithm that can do that for me. And very complex, as I could never…

AM: When you say musician, you mean performing musician?

DG: Yes, I'm just not a performing musician.

AM: But you're a musician?!

DG: Well, I perform, but not like that. I play the saxophone, but I will never call myself a saxophonist. I'm just not a saxophonist. I studied it, a bit. And I also play the piano, but I will never call myself a pianist. What I can do well is perform live with electronics. I can do that really well.

AM: That's your instrument.

DG: That's my instrument.

AM: So instrumental instruments are not your instruments.

DG: No, but I write for them, and I've got ideas about them, and it's my job. I just do it. So I need to find ways to do it. And I could do it partly manually. But if I do that, I find it limiting. As I said, it's too slow for me, because I want to try things fast. And I prefer hearing immediately what I did. That's why I make those algorithms. Besides, there's a complexity I could not play myself. Except when I would play it very slowly - that might work. But what I like about the algorithms is that on each iteration - unless I programme it - it does it slightly differently. That's why I always record it, I record everything it does. Because if I don't, and this sometimes happens, when I'm just trying it out: I press play, I hear it, and then when I think it's good, I didn't record it! You see what I mean? I make a change, check if it works, and something great comes out...

AM: You use some words that may be related to other words. For example, when you say generating: does this relate to composing? And when you say randomness, does this relate to improvisation?

DG: Yes.

AM: I don't mean to say it's the same, but…

DG: Yes, well, it is… I see improvisation taking place within a certain framework. And my algorithms always deal with randomness within a certain framework. It's never, just go for it. That's not how it works for me. I've always made a lot of decisions before I let the algorithm play. But that's not how it works just for me, that's how algorithms works. They are just a set of rules. Many people think that algorithms produce notes just like that, but that's not how they work. The algorithms I create and that generate music, I consider it my music. You see what I mean? I see myself as the composer. If I don't make that algorithm the way I do, that music is not generated. The decisions are made according to my rules.

AM: My research is around music creation at the crossroad of composition, performance and production. We spoke about composition a lot. We also touched performance. If you don't create anything within a DAW, nothing sounds. How do you see the aspect of production - something the DAW offers, and pen and paper don't?

DG: In fact, for me, production fully relies on the DAW. All my productions have passed through the DAW - unless it's a fully acoustic work.

AM: And the other way around? Everything you make passes through the DAW, but does everything you make within the DAW also pass through a production phase? Perhaps the answer is no; John Psathas' answer was yes. There's no work that wasn't fully produced within the DAW. This might also be true for Jacob ter Veldhuis.

DG: You mean a recording of, for example, an orchestral work, processed in the DAW?

AM: No, what I mean is that a piece, for any instrumentation, would have been heard by you as "CD-ready" before it was ever performed by musicians.

DG: I think that wouldn't be possible. I do agree though that - what I do, I have to be honest, is that I make it sound very realistic. I use things like key switches, switching between playing techniques, those kind of things. And sometimes - I have to admit that I sometimes prefer the MIDI version above the performed version [laughs].

AM: Sometimes of always [laughs]?

DG: Sometimes, yes, sometimes.

AM: And why? Because they are more accurate?

DG: Because they sound better, because the recordings are often not as good. Performance, yes… For example, two years ago I wrote a piece for the Fokker organ and Lieke Marsman, an author. She recited a poem and I wrote music for it. But that music is completely derived from her voice. Everything. And the organ talks. I analysed her voice spectrally, and the organ emulates her. So she says certain things, and the organ repeats them. It works really well. But the recording is just not good, I prefer the studio version. You hear the organ much better, the organ talks better, and the sound quality is simply better. The bass register sounds like a real bass … When you produce in the DAW, you're working with the full frequency range, balancing, optimising, getting the levels right, the right acoustics. And with an ensemble or orchestra, you have no influence. Unless you are allowed to do everything that is needed…

AM: And post-production.

DG: Yes, exactly. But you need the luck to be allowed to do it. It's not always allowed. So some factors you cannot influence.

AM: And about the creation process; for you, does producing play an essential role in getting an idea of how the work will sound??

DG: Yes, it does. And there's a danger in that. You just spoke about Jacob ter Veldhuis. I also studied his music, and I like it a lot. He's not someone who works with playing techniques a lot; it is quite straightforward. I don't mean that in a negative sense, but he is not so involved with the timbres of an instrument, orchestra, or ensemble. If you are (and I am, in many ways, because I look more from a spectral viewpoint), you need to work on that much more. And the big disadvantage of the DAW, or similar tools, is that those playing techniques are not available. Unless you record it all with an instrumentalist. But doing that for a full orchestra is hardly possible. There's an increasing number of sample libraries that offer more techniques, but it's still not always as you would like. Especially if you write for a solo instrument, or chamber music, and you want very specific sounds… And you may be misled, as I've often noticed, by the samples, in how you write for the instruments, also using such playing techniques. It may sound great, and you can use key switches to make it sound realistic. I like that, and if you write straightforward, it can work well. But if you want some more depth in the sound, it gets hard. I find it risky, relying on the samples you use. They are often unrealistic: close-miked, and produced. What people don't realise is that these libraries are made for film composers, and they just have to make an impact. When you play the violin very softly, but close-miked, you can set the level as high as you like, and it will sound great. But if you play the violin that soft in a hall, you just won't hear it. It has a completely different impact. In your productions it can sound great, but you have to be aware that using such libraries, such samples, may have consequences. So, yes, I do it…

AM: You're speaking now about the translation of a DAW product to live performance?

DG: Correct, yes. It will just never sound the same, unless it is really straightforward. You might be able to emulate a work by Beethoven with a DAW. But a work by Lachenmann, for example, or Haas - forget it. No way you will succeed. Microtonality is another factor. That's hard to realise. I just did it for the first time in *Kontakt*, within

the DAW. It works, but it's hard. So I always do this producing, I make a MIDI version that sounds good, but I realise that this is not the final product. However, an organ or piano can be emulated quite well.

AM: Harp…

DG: Yes, harp, those kinds of instruments. I wrote a piece for the Conlon [foundation]. I received an honorary mention for that piece [*Riding the Euclidean Planes*]. It is for computer-operated piano, electronics and video. But what I did, secretly: I operated the piano with the computer, so a real piano, but added a bit of another piano in the tape, to enhance the sound, to make it sound just a bit better in performance.

AM: Then it needs to be in the right tuning! You can adjust that of course… How do you feel about perfectionism; do you feel that the DAW suggests a degree of perfection that cannot be achieved by the human interface? Do you see that as an issue?

DG: Yes, well, issue…

AM: When you say that you often prefer the MIDI version above the performed version, that may relate to sound quality and recording aspects, but perhaps also to aspects of performance?

DG: Well, musicians who just don't play so precise, or miss notes, may ruin a recording; that cannot be denied. A piece may not necessarily be too hard; you see, sometimes it has not been sufficiently practiced. That's possible, and I'm well aware of it. I know my piece really well, and I know when someone makes a mistake, but at some point it works out well. And often there's an interaction, balance, musicality, that you cannot achieve in the DAW. That's what you're aiming for. In the DAW it is often straightforward, precise. And you might manipulate that, but when you're writing, you just don't have the time. You want to finish the piece, you want to make the notes sound good, that's all. In your mind there's a certain strictness, and in rehearsal that imagination will loosen up a bit. In the past I found that hard; now I can let go a bit

more. If a musician doesn't... You know, I find that problematic. I just don't like it if someone doesn't try their best. But honestly, that's the exception. But there is a risk.

AM: In your expectations?

DG: Yes. It's also a matter of getting used to this - experience I guess.

AM: But is this DAW-related? In the past composers wrote highly demanding stuff without the DAW.

DG: That's true. But in the DAW you always hear a performance. When you press play, you just hear a performance.

AM: Yes, precisely, there's that aspect! So when you work in Sibelius *, for example, with the basic library, which is rather limited, and with articulations that don't sound great, you have to use your imagination right from the start. Whereas, when you work with* Vienna [Symphonic Library]*, or other libraries, in* Logic*, you create an illusion.*

DG: Yes, exactly, that's it. But I think you just need the experience to listen through that. You have an ensemble background, and I guess you played with orchestras as well. So you know what to expect. But if you're only a composer, you're locked up in your studio, or at your writing desk, and you're constantly exposed to what you hear from your computer...

AM: Summing up, you might say that this requires a new kind of expertise?

DG: Yes, but it's unreasonable to expect it from a composer.

AM: But you said that you developed such expertise.

DG: You mean in letting go of the control?

AM: In knowing about the pitfalls in composing with the DAW, and then making a translation for the performers - does that require a new kind of expertise? A kind of craftmanship that Bach didn't need: he knew exactly what could be done, since he played the keyboard when writing for keyboard; and he could play the violin too, and he could sing…

DG: Yes, that's absolutely true. As a composer you're constantly learning, improving yourself. You're constantly trying to avoid, in your new work, mistakes you made in the past. You're constantly growing, and avoiding pitfalls. It's fun...! I often have the feeling - and I know this from others too - that each time I start a new composition, I have to start all over again. I have to learn composing again.

(Translation by Arnold Marinissen)

Appendix 4: Interview with Yannis Kyriakides, Amsterdam, 17 May 2019

AM: Which DAWs do you use?

YK: I use primarily *Logic*, actually, really for the creative process, for putting ideas down, and seeing how they work together. But I also use *Ableton*, but not the timeline in *Ableton*, but more the [session view] live function, not all the time, but sometimes, for the live processing, in work that I do.

AM: And do you use SuperCollider*,* Max*...?*

YK: I use a lot of other programmes. *SuperCollider* I use primarily to process sounds. I used it in the past for live processing algorithms for concerts. But then I shifted to *Kymo*, I don't know if you have come across that?

AM: Yes.

YK: I'm using that now in a project with sensors. What is interesting about *Kyma*, somehow, in some ways it is a cross between a DAW and this more non-linear way of working. Because you have a timeline, but that timeline is really flexible, and you can stop it and start it in various sorts of strange ways.

AM: Similar to the Collider *[application] that Wouter Snoei built?*

YK: Yes, I think so, I've used that once. It is similar in the sense that you get this thing, you wait until the process is done, you trigger the next thing, so this kind of semi-flexibility. And actually, often when I work with *[Ableton] Live*, partially it is using this concept where you're thinking in terms of scenes. You're in one scene, but then you can be flexible how long you stay there, and in another scene, in another scene, in another scene... That way of combining both linearity and infinite, endless processing possibilities, I think that is interesting. *Logic* is frustrating because you can't do that.

What I find great with *Logic* is the way you can - at least maybe that's what I'm used to - achieve flexibility of the automation, how deep you can go with automating things. Doing anything live is clumsy with *Logic*. There are ways of doing it, but it's just somehow...

AM: Because we're talking about a studio situation, and a live situation.

YK: Exactly. In a live situation where I have really complex multi-channel pieces, I then go for *Logic* rather than *Ableton*, because *Ableton*, up until this year or last year, didn't really manage the multi-channel things very well. Now I think it's better. But in a studio situation, when it comes to editing stuff - because I don't use *ProTools* - composing, trying things out, also, I don't know so many people who do this, but also for sketching out notation, I use *Logic*.

AM: In the past, more people did it, in the early days.

YK: I suppose I got stuck in the early days. One of the first programmes I had, pre-*Logic*, was *Notator*. I had that, and *Notator* was a German company, and it got bought by *Logic*. E-magic was the company. So I was really there from the beginning. It was a programme that really just coincided with developing my own work.

AM: So you sometimes go to the notation window in Logic*.*

YK: Because most of my work tends to be with some kind of electronics, *Logic* is the perfect programme to align electronics with notation. And then what I usually do is use not very sophisticated samples, but basic samples, just to get a sense of the form, and I usually make the notation, I print out a notation that is my sketch. And then on that I go back to pen, just make not notation on...

AM Physical pen?

YK: Physical pen, all the articulations, dynamics, extra stuff, editing. And then using that, I import all the MIDI data into *Finale*. And then I make the final score with all the details, in combination with this sketch that I made.

AM: And do you input the notes through a keyboard?

YK: No, mouse-clicks.

AM: Not piano keyboard?

YK: No.

AM: Never?

YK: Sometimes I... I often work algorithmically to a certain level, before. So before I go to *Logic* I work with other programmes. What I tend to use quite often these days is *AC Toolbox*, a programme created by Paul Berg, who used to teach next to me in The Hague. When I started using that I used to go to him and say, how can I do this, this and this. And he would say, ah, just do this, or - let me write that for you. So sometimes it's a case of having an algorithm in it and generating MIDI data, which I import into *Logic*.

AM: Because generating algorithms within Logic *is not possible - although there are plugins.*

YK: Yes you can; there is a sort of script thing with a MIDI effect you can use. What you can do is manipulate MIDI data. So often that is what happens. An example of this process is, I wrote this twelve hour piece for this *Disklavier*-type instrument that was based on an algorithmic process on a book, which I encoded into music and then brought into *Logic*. Imagine you had twelve hours of MIDI data. It took me a month, or two months, to just go through the whole piece and re-edit it and re-shape it. For *Logic*, what was good about that, I can cut it up into various pieces and say, OK, select

all of this note and do this to it; select all velocities below this and do this to it. For that level of processing it's quite handy.

AM: Just a side question; have you ever worked with ProTools*?*

YK: I worked with it a few times, in recording sessions, when the engineers said, I use *ProTools*. So I've kind of used it, but I never bought it, I didn't bother with it.

AM: How about the playback functionality of the DAW? You said you use quite basic libraries.

YK: I do really appreciate that in a composition process I can step back and listen to what I've done. Obviously it's quite common these days for composers to do that. But I remember when I first started using it, not many composers were doing that yet. I also started composing with pen and paper, making scores by hand.

AM: Those were your beginnings?

YK: Yes. And I wrote quite a few pieces - I remember when I first started writing - well, I started writing at a very young age, but let's say, at York University in England, I got in the habit of writing with pen. We had this group of friends, and one of them who was doing a PhD at that time, Gordon McPherson, he had this very macho idea that if you are really sure about what you write, just do it in pen. First time, no mistakes [laughs]. So we got into this idea of, to be a real composer you had to just put it down in pen first time. So I got into this habit of the score being 'the thing that you make', of making very beautiful scores with pen. And then when I came to Holland, Andriessen, whom I was studying with, was like: no, I forbid you to write with pen. You have to write with pencil.

AM: Otherwise you can only talk about the next piece, and not about this one...

YK: So then I started to write in pencil again, making the final copy in pen. But at a certain point, I think it was only when I started working with electronics, and I was with Dick Raaymakers, I was involved in my last year of studying in a project with him with *Die Glückliche Hand*, and it was the idea that we write these pianola pieces...

AM: I remember, I was there!

YK: I never got into the analogue studio that was in The Hague.

AM: You skipped the analogue studio?

YK: I skipped that and I went straight into MIDI, and through MIDI I got into the laptop scene, Lo-Fi stuff, and then laptop scene. And then I rediscovered the idea of the studio after. But still I don't think I'm really comfortable working in the studio. It's just such a different paradigm.

AM: Although if you look at your room here, it looks like a studio!

YK: Exactly. But if you see all the analogue stuff - even though now I do sort of improvise with it and I record stuff, and I edit it, it's really primarily thought of as stuff that I take to the podium, live, rather than the idea of... I don't have so many pieces that are purely tape pieces, or fixed media pieces.

AM: So is this like a virtual stage, or a private stage?

YK: Yes, well, it's more like my stage and my bedroom [laughs]. They often say in the last fifty years there's three main stages of electronics. You have this studio paradigm; which is taken over by MIDI, and all the possibilities of computer music handling MIDI data; and then you have the laptop scene. And now we're into this analogue, modular thing - these kinds of trends. And I feel as though I came in towards the end of the MIDI stage, at the beginning of the laptop scene. Something like that.

So what I wanted to say, then I started using MIDI data to play the piano, I really got into this idea of having the feedback from the sound. And what I think that did compositionally, it allowed me - because I was already in that process, anyway - stretching out temporal aspects of the music. I was always fascinated by creating much more space in the music. And I think it generally allowed me to take a step back, and not be so on top of the detail. Because I think in a composition process when you are working really bar by bar, and you're listening to the piece, you're so actively involved that you forget sometimes to take distance and experience the timescale.

AM: So that's talking about form.

YK: Yes.

AM: And about instrumentation; when you talk about playback, would you base instrumentation decisions on what you hear while playing back?

YK: Partly yes. I don't know if it was being a student of Andriessen, that it was a result of that, that I was never into elaborate instrumentation. It was always quite paired down. So I never had really major concerns about orchestration, this more colouristic way of working. Not that you couldn't do that on the computer, but working with MIDI data, there were enough parameters to deal with in terms of timings, pitch, duration, more basic... So I think it meant in the first period of my composition with computer I wasn't so concerned with orchestration in that sense. And I remember when I wrote my first orchestra piece, also my last I would say, I realised even though I was a musician, I had played in an orchestra, I had the sound of an orchestra in my mind (though I wouldn't call myself an orchestral goer, I wasn't really deep in that world), I felt as though I needed to hear with MIDI instruments: OK, what if I voice the harmony with the oboe here, clarinet here, flute here, what if I change it? Just needing to hear back the differences of voicings, of chords, through the computer. So even in that sense orchestrating did help me. I wouldn't say I had a thorough grounding in that. And then for more elaborate pieces, with more elaborate techniques, then I would go and record those sounds and use them as samples, to see how they work. Once you

start working with that, you do want to hear a sort of rough idea. I never go to the extent of getting every articulation, every dynamic right, but...

AM: The pizzicati, the Bartok pizz.

YK: Yes, exactly, not really, unless it's easy to do. That partly also had to do with, also around that time, after I finished studying, I did a lot of pieces for dance. I worked a lot with dance. The immediacy of going into the [dance] studio, seeing what there is, bringing material the next day, changing it, needing to hear the process, was also partly the way I got my chops, into using this software.

AM: I suppose there's a big difference in creating stuff you know is going to be played back through loudspeakers in the live situation, or stuff that is handed out to musicians; it's of course two different kinds of output of the DAW...

YK: Exactly. There's things that software, possibilities that software affords you. People would often in the beginning criticise the drawbacks of using the DAW, like for instance making possible rhythmic things that the computer can play and musicans couldn't play. Or the sort of copy and paste aspects that's easy to do in DAWs. And maybe if you're writing it out you think: maybe I'm making a few variations. I never really had a problem with that, in a sense of, when you have a new technology, to a certain extent you have to drop the old paradigm. It's not like an easy way of writing the old music; you have to think of the new possibilities that it affords. Of course you could even say a DAW is sort of halfway between the linear thinking of composition, and all the non-linear ways of thinking the computer could give you. But what I found, all those little things that the computer, even the DAW could give you... I did a few pieces with clicktracks of multiple tempos; or simply also the possibilities of using different media synchronised together. People say, using a clicktrack is not the most sophisticated way; in some ways it is, actually. It gives you the possibility of music that there wasn't before. I enjoyed exploring these possibilities.

AM: Would you guess that if you had to create something now, away from the studio, with pencil and paper, just an instrumental piece, and you would create it either in a DAW situation, or with pencil and paper, would it potentially be quite different?

YK: Yes, definitely yes.

AM: Do you sometimes do that, still?

YK: I still sketch out stuff on paper.

AM: Before you would get started?

YK: Yes, I would. But it would tend to be not worked out in time, but more like ideas of harmonies, or melodic material maybe. So really material I would say. And I think if you'd said to me, OK, write a piece now without the computer, it would probably go the direction of a much more open score. Because a lot of pieces that I've written away from the DAW in the last few years tended to be open score pieces. Still written with the computer, but with programmes - like processing, more algorithmically driven, open score type situations...

AM: Less like timeline pieces...

YK: Having also that experience of working with [Amsterdam-based ensemble] MAZE or other groups in an open score situation, you see the potential of musicians creating something out of nothing, not nothing, but out of the kernel of an idea - how exciting that is. So I think I would... Probably you could say with a DAW, sometimes it fixes you too much to a fixed timeline.

AM: And how is that anyway, when you finish a piece and you hand it out to the musicians? What they do, how does that compare with what you heard, or what you imagined, when it was still inside the DAW?

YK: I'm much more open about different interpretations. I'm not so fixed. In terms of amplification and general balance, if I'm working with a soundtrack of some kind, I still want the electronics to be very present. Often, the electronics for me have a kind of immersive quality; I want it to alter your sense of the space. So sometimes, more classical musicians tend to underplay that it's the accompaniment. I'm always concerned that the balances are good, because it has to have... I like playing with extreme dynamics, in terms of very very quiet, and very loud. So that's mostly what I'm concerned about.

AM: A studio, headphones, a DAW environment, is very immersive by nature I think, more than a concert stage.

YK: Yes. In fact I'm not a big lover of acoustic spaces, acoustic sound, because these buildings are often made with a specific idea about sound. And I don't think that often... Maybe in certain situations, a space has a particular acoustics, so that you think: I want to do something for that specific acoustics. In general, you want the experience of the studio to be transferred to the concert hall. In that sense the role of the performer is important, because I don't want to drown the performer in terms of the presence. That's why on a performative level I really feel I sometimes like it if the performer takes more freedom. So stuff like putting their own expressive interpretations, or being flexible with the tempo, or even... I'm less concerned with that. I want them to actually take a bit more freedom there. But that doesn't mean that I want them to be 6 to 10 dB louder than the electronics. That wouldn't make sense for me. I'm thinking of the pieces specifically that have a fixed soundtrack and live performance. These days I tend to be a bit more free in the relation between the two temporally. There is more tempo freedom.

AM: You know John Psathas' music?

YK: That's really highly synced! I don't really do that so much anymore. I used to do that.

AM: What triggered that change? Experience with great musicians perhaps?

YK: Maybe. Maybe it's this last point, that you don't want them to loose that presence. But I realise that this aspect of the electronics, creating this spatial immersive aspect, is still important for me. I'm thinking of the last piece, this piece *Face* that I did, that was also a fixed soundtrack with clicktrack. All those pieces could also be done without clicktrack, with lots of cues, which I've also done, using *QLab* or something like that. I'm always sensitive to the fact that giving space for the musicians... And then sometimes, when the electronics do take over, that it is only temporarily, to remind the presence of this other thing. This constant chance of perspective is important.

AM: The electronics are one of the ensemble players?

YK: Yes, even though in this piece there's also live electronics. But it is this kind of malleable element, this other ensemble player, but it morphs into different functions. I think that's really one thing that I'm more consciously doing these days. It's one of these things I'm constantly going on to students about, and something I'm conscious about in my own music: changes of perspective during the piece. Generally I like things to transform, from an emotional transformation, to a perceptional transformation, many different... And also in these relationships between media. I find that interesting, how you're hearing the music through the film, but then it switches the other way around. From the electronics to the instruments... So changes of perspective are one way of dealing with imbalances. They don't have to be always fity-fifty balanced. It's OK if things are a-symmetrical. But it's also interesting then if it changes.

AM: Is this interest partly technology-driven? When you have a mixing desk, you can play around with balance.

YK: Partly it is. I remember when doing a mix, mixing recordings, also with a sound engineer next to me, the sort of orthodoxy of the sound engineer, specifically in classical music: you set your levels, that's it. But I would always radically change the

levels, to kind of orchestrate it in the mix. Maybe that's obviously more done in pop music. But still, for me it would be much more extreme. I really like the idea of this kind of dynamic composition. And a sound engineer would be like: no, you can't do that. I made quite a few CDs of my own music, and I often will want to mix them myself.

AM: There's a few moments in the creation process where the DAW appears: in the making, in the notation (you could argue that notation software is also an audio workstation, if you use sample libraries), and definitely also in the production.

YK: In that sense, a programme like *Logic* serves all those purposes. And not only that, but also playback, if you have a live concert, or you're using film... So my last project with this piece *Face* for Elektra was also playing back with *Logic*. We had it slaved to *QLab*; we had a sync system through different platforms.

AM: And do the pieces change still in the production phase? You've written something in the DAW, it's perhaps only instrumental, or instrumental with electronics, it's performed, it's recorded, and it goes back into the DAW for production...

YK: Yes, it will change, and it's happened to quite a few of my larger scale pieces, and I had this in my new piece *Face* that we're recording in July. I already know that... I was 90% happy with the result, but I still feel as though I need to shape it a bit more, specifically the relation between voices, not the sung voices but the computer voices. I also had a lot of live processing in the piece; each instrument was being processed in a different way. That was partly automated, but partly done live by me. So I know in the final stage that has to be perfectly done, in terms of - every grain of the granulation has to be just right...

AM: So that would mean that the final production of a piece that was performed live and recorded would then per definition be ideal?

YK: When you make a recording, the piece has its own life in this recorded version. It's there online, accessible, and I want that to be close to perfect, what I would imagine. But after that, I really don't want people to do versions of the piece exactly like that. If people want to do, in future versions, their own versions of it...

AM: But it's there for reference?

YK: It's there for reference. I'm really open, I'm totally open to different interpretations of my music, and I want people to make different interpretations. Because I know, as the composer I can make my version of the piece, but it doesn't mean that it's the definitive version. I feel as though the piece has its own logic and life, so that other people might have better, or different, or more interesting approaches to how to do it. So I'm totally open to that.

AM: Some people feel that perhaps working in a DAW, and using the playback functionality, makes you kind of a control freak. But not for you?

YK: I think, because it gives you that ultimate control, there is that tendency. But once you've finished the piece, you've stepped away from it, the piece has its own life, in a sense. I remember for instance when you did *Lab Fly Dreams* [for solo percussion and fixed media]. That piece also went through various changes; this large ensemble piece became a solo piece for [percussionist] Claire Edwardes. And then you did this version of it, where you chose your own instrumentation, did it totally differently. And I love that. It's a sort of setup instrumentation that I would never thought have about myself. The way you did it in terms of the dynamics, or the sort of articulation. I was so happy that you put your own vision on that piece. Even though you could say that for the rest it's quite fixed, because it's this fixed soundtrack.

AM: Is there a specific piece in your oeuvre where you think: in that piece the DAW allowed me to do something really special, something noteworthy; or gave me a very hard time, because something I wanted didn't work out at all?

YK: I would say that these couple of pieces that deal with microshifts of material, like *StrOBO*... It's one for Slagwerkgroep Den Haag which I wrote in [2001], six percussionists playing these glass panes, and each had clicktrack, but each person's tempo was speeding up and slowing down at different rates. So you had these kinds of rhythmic patterns that you can create. They had a click on the first beat of the bar, and they played with the click, and it would slow down and speed up. So it was something that I could notate in a very simple way, but I couldn't do it without this - working with a DAW. Similarly there's a piece, *Wavespace*, that I wrote [in 2011]. It was generated with these mathematical patterns in *AC Toolbox*, vortex-like patterns of movement, with extreme tempo changes. And again that was a piece that only works with... It was eight musicians, each with an independent clicktrack.

AM: And the clicktrack would be run live through Logic?

YK: Yes. So what I did then was, the MIDI data was generated with this slowing down and speeding up, so then there was a global tempo in *Logic*, but within *Logic* itself there were also extreme tempo changes, tempo curves within that. A very complex thing, but I could still line it up in *Logic* and send clicks with *Logic*. So something like that is something you can only... Of course you can do it with *Max* or *SuperCollider*, but it was pushing the DAW to its furthest you can do in terms of flexibility.

AM: In theory you could have six people manipulating a normal metronome, and the musicians playing to it.

YK: What a brilliant idea. That's a great idea.

AM: But you could never have checked the sounding result.

YK: Yes. Actually another piece is *Telegraphic*. The musicians are playing these changing drones, six musicians, and then six players playing telegraph keys, and switching the amplification of the drones on and off. It's very analogue, similar to what you say. But to actually compose that piece, I had to use a DAW.

AM: Were these kinds of ideas also triggered by the fact that you were using a DAW?

YK: Yes, definitely yes. In this case it was...

AM: Like muting and unmuting.

YK: Yes, it's a kind of solo muting and unmuting thing, but it actually came from the idea of noise gates on a DAW. So I would have one signal switching another signal on and off. It was this idea, and so you could do really intricate patterns. What this piece was: you got a kind of melody created from all these drones. To actually write the melody - I first wrote the melody, then I worked it out on the DAW, how that can come through logistically. The piece is played without a DAW, purely on telegraph keys, but it really needed that way of working.

AM: I guess a final question; if you move from the DAW, from the MIDI files, into notation, what does that do for the piece?

YK: I don't listen back with *Finale*. I know a lot of people work with listening back through *Sibelius* or *Finale*; I never do that. But because I've already listened to it so many times with the DAW, with *Finale* for me it's just simply seeing it from a musician's point of view, making sure it all makes sense: articulations, the score looks OK. I'm not a score fetishist, it just has to... Actually that's interesting, because I've noticed for some composers the logic of their work really comes from the score in some ways. The score affords you the ability to do something, of which, maybe, the end result is unsure. I work the other way: I have an idea what I want, and the score is somehow the sketching out of this. But it's setting it in a possible way, and it can be notated in many different ways, you could say. Because it comes last in the process, it's a different balance of working. So I never really think through a score, that's what I'm trying to say.

AM: That's quite radically different from the early days, when you wrote with pen on paper? Then it was the first thing that came, and also the final thing.

YK: But on the other hand, even back in those days, it was really like: first I have to have it in my head, then I can write it down. So it wasn't: what if I wrote this thing, I wonder what that will sound like. It wasn't that approach. So I wasn't using the score as a sort of toolbox. It's the other way around...

Appendix 5: E-mail correspondence with Hildegard Westerkamp, January 2021

AM: Did you have a specific approach planned (similar to or different from earlier approaches) in dealing with your technological tools, when starting work on the piece?

HW: The difference to most of my other pieces was, that I did not go out specifically to make recordings for the piece. I selected favourite recordings from my large collection of field recordings that I have made over the years.

AM: While recording the various voices, (how) did you interact with the readers of the poem on how they would read/interpret it?

HW: I spent at least 30 - 60 minutes with most of the people I recorded. Some of them had never read poems out loud, nor had they been recorded doing so. In those cases, the work was to make them feel comfortable, give them a chance to access their natural voice, their expressiveness and feelings. It also involved discussing the poem and finding out, how it touched them. We experimented reading it in different voices, with different emotions, sometimes even contrary to what the emotion in the poem might be. It opened up interesting possibilities and ways of vocal expressiveness. Those who had experience with reading poetry out loud and also with being recorded, tended to experiment a little more, pushing some boundaries. It was a lot of fun! Only my mother (who was 97 at that point) and Murray Schafer (who read it in both German and English) read the poem two or three times only, firmly believing that no further experimentation was necessary!

AM: Did you collect all the recordings before starting the compositional work, or did you keep on adding material along the way?

HW: I attempted to collect most of the recordings I thought I might use ahead of time, especially since I was going to be far away from home, at the ZKM in Karlsruhe, Germany. But knowing my process, I also took much more than I would ever need.

The sonic context of any given stage in the compositional process can suggest a sound or recording that I know I have somewhere in the collection, and it was good, when I happened to have it with me. Most of the second part of the piece was continued in Vancouver, in the Sonic Studio at Simon Fraser University, so I was closer to all my recordings. It was a great surprise to me when one recording that I had made years ago in the context of *Beneath the Forest Floor,* and that I loved very much, but that never made it into that piece nor into any other one for that matter, ended up in *Für Dich - For You*. It is a recording of two ravens flying through the old-growth forest, calling out to each other as if in dialogue. The recording appears in its entirety and without any changes or processing, between about 10:58 and 12:10 in the piece. It was as if it had found its right place among my compositions!

AM: Did you go with the nature of the recorded material in structuring the piece, and/or did you create the work according to a preconceived structure?

HW: I never have a preconceived structure for my pieces, precisely because in my experience the recorded materials will allow for a structure to emerge. It is a bit as if my initial idea for a piece, the concept, and the materials are in constant conversation with each other during the compositional process and together create the flow of the piece. I write about this in more detail in my article “Linking Soundscape Composition and Acoustic Ecology".

AM: How did you, in this specific work, go about deciding on processing/transforming the recorded material, versus using it in its pure form?

HW: There are usually sounds that have internal musical qualities, resonances, rhythms, that are attractive or inspiring and that I want to explore further. If the recording is close-miked enough and of good enough quality, I will use these sounds to explore their richness further, taking a similar approach to that taken in the *musique concrète* style, treating them like sound objects that can be abstracted from their original semantic and sonic meaning. Not all recordings or sounds lend themselves for that, much as we might desire for certain sounds to function in certain

ways. But this is precisely the inspiring, if sometimes challenging, part of working with environmental sounds. They do not always fit into preconceived ideas or structures, which then demands from the composer to really listen carefully to what they do express and 'say'. From that careful listening then comes a creative process that acknowledges the inherent quality of a recorded sound or soundscape and may inspire a change in the compositional process. It requires flexibility and a love for improvisation. In that process new discoveries are made that may lead the piece in a different direction than originally thought.

AM: Looking back on the piece, what place does it occupy in your compositional work?

HW: It's one of my favourites!

Appendix 6: *Shutterspeed*, recorded photo devices

* Arax CM-MLU
* 2x Canon A-1
* Canon EOS 5D
* Canon EOS 1100D
* Canon FTb
* Canon FTb QL
* Fujifilm GFX 50 S
* Hasselblad 2000 FCW
* KMZ Horizon 35 mm
* KMZ Horizon 202
* KMZ Zenit-E
* KMZ Zorki 4
* Minox C Chrome
* Nagel 33
* Nikon SB-16 flash
* Olympus mju-II
* Olympus OM-2N
* Pentacon six TL
* Rollei 35
* Rollei XF 35
* Thornton-Pickard shutter

Appendix 7: *Shutterspeed*, clarinet motifs

* Berio, Luciano - *Sequenza IX*
* Boulez, Pierre - *Dialogue de l'ombre double*
* Debussy, Claude (arr. Stephan Koncz) *Préludes / Book 1, L. 117*
* Feidman, Giora - *The Magic Of The Klezmer, Papirossen*
* Fidele, Ivan - *High*
* Kovács, Béla - *Hommage à Manuel de Falla*
* Kurtág, György - *Kroó György in memoriam*
* Messiaen, Olivier - *Quator pour la fin du temps: 3. Abîme*
* Mozart, Wolfgang Amadeus - *Clarinet Quintet in B-Flat Major, K. Anh. 91*
* Pousseur, Henri - *Madrigal I*
* Schubert, Frans (arr. Reinbert de Leeuw) - *Die Winterreise: Im Dorfe*
* Smith, William O. - *5 Pieces for Clarinet Alone: No. 2 Flowing*
* Stamitz, Carl - *Clarinet Concerto No. 7 in E Flat Major (Darmstädter No. 1) 3: Rondeau*
* Stockhausen, Karlheinz - *Tanze Luzifa!*
* Stravinsky, Igor - *3 Pieces for Clarinet Solo: 1.*