Collaborative Computer Music Composition and the Emergence of the Computer Music Designer

Brunel UNIVERSITY LONDON

A thesis submitted for the degree of Doctor of Philosophy (by Publication) in the College of Business, Arts and Social Sciences, Brunel University

by

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Dedication

To my sons Jeremy, Josquin and Dashiell for their ever evolving collaborations, and to Emanuela Gellini for her patience, her unquestioning understanding and her unflinching support.

Acknowledgement

I have never experienced the creative act without some sort of difficulty – that process of bringing something into existence is never a simple affair. I believe the result is worth the effort. I would like to thank all those I have collaborated with for allowing me to take part in this uniquely rewarding activity.

I would like to thank my supervisors Christopher Fox, for his wit, his brilliance and his insight, and John Croft, for his openness, his dedication, and for reminding me that there are many wonderful words I should use in the English language. Thank you.

Declarations

Declaration of Authorship

I, Carl Faia, declare that this thesis titled, *Collaborative Computer Music Composition and the Emergence of the Computer Music Designer* and the work presented in it is my own.

I declare that:
(i) This thesis is not one for which a degree has been or will be conferred by any other university or institution.
(ii) This thesis is not one for which a degree has already been conferred by this university.
(iii) The work for the thesis is my own work and that, where material submitted by me for another degree or work undertaken by me as part of a research group has been incorporated into the thesis, the extent of the work thus incorporated has been clearly indicated.
(iv) The composition of the thesis is my own work.

Signed:

Carl Faia

Date: 29 September 2014

Abstract

This submission explores the development of collaborative computer music creation and the role of the Musical Assistant, or Computer Music Designer, or Live Electronics Designer, or RIM (Réalisateur en informatique musicale) and does so primarily through the consideration of a series of collaborations with composers over the last 18 years. The submission documents and evaluates a number of projects which exemplify my practice within collaborative computer music creation, whether in the form of live electronics, tape-based or fixed media work, as a live electronics performer, or working with composers and others to create original tools and music for artistic creations. A selection of works is presented to exemplify archetypes found within the relational structures of collaborative work.

The relatively recent development of this activity as an independent metier is located within its historical context, a context in which my work has played a significant role. The submission evidences the innovative aspects of that work and, more generally, of the role of the Computer Music Designer through consideration of a number of Max patches and program examples especially created for the works under discussion. Finally, the validation of the role of the Computer Music Designer as a new entity within the world of music creation is explored in a range of contexts, demonstrating the ways in which Computer Music Designers not only collaborate in the creation of new work but also generate new resources for computer-based music and new creative paradigms.

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List of Publications of collaborative work

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Date of composition: 1997
Duration: 15 minutes
Publisher: Billaudot, Paris
Commission: Südwestfunk Baden-Baden (Southwest Radio) for the Donaueschingen Festival and IRCAM-Centre Pompidou
Dedication: Carl Faia
Instrumentation: 2 piano, 2 percussion, hardware and software (Max) based samplers
Premiere: October 18, 1997, Donaueschingen Festival, Germany, by Ictus: Jean-Luc Fafchamps, Jean-Luc Plouvier: pianos, Miguel-Angel Bernat, Gerrit Nulens: percussions direction: Georges-Elie Octors.
Studio: IRCAM
Computer music design, sound design and creation, analysis/re-synthesis, concert patch for performance and score following for premiere: Carl Faia
Commercial recording: Nocturne : Soupir Edition, 2004. (Leroux, 2004)

Publication 2: Wood, J., (1998) Mountain Language

Duration: 25 minutes
Publisher: Edition composer
Commission: IRCAM-Centre Pompidou
Instrumentation: 1 alphorn, 1 cowbells (percussionist), 1 electronic keyboard / MIDI /
Computer music design, analysis/re-synthesis, spatialisation design, studio spatialising patches, performance and score following for premiere: Carl Faia
Premiere: June 20, 1998, Espace de projection at IRCAM, Paris, by Benny Sluchin: alphorn, Vincent Bauer: percussion, James Wood: MIDI keyboard direction: James Wood. (Wood, 1998)

Publication 3: Dillon, J. (1999-2000) La Coupure

Duration: 1 hour
Publisher: Peters, London
Cycle: *Nine rivers* V
Commission: IRCAM-Centre Pompidou, Ars Musica Festival (Brussels) and Archipelago Festival (Geneva)
Instrumentation: percussionist- multi-instruments, live video, live electronics
Computer music design, sound design, analysis/re-synthesis, spatialisation design, studio spatialising patches, video tracking and sensor development, performance and score following for premiere: Carl Faia
Premiere: March 11, 2000, Espace de projection at IRCAM, Paris, by Steven Schick.
Recording available via YouTube: https://www.youtube.com/watch?v=_g9R1-2I27Q

Publication 4: Stockhausen, K. (1965/1999*) Solo

Duration: 15 minutes
Commission: Art Zoyd Studios
Instrumentation: basset horn with live electronics
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Computer music design, performance: Carl Faia
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Publication 5: Harvey, J. (2001) The Summer Cloud's Awakening

Duration: 32 minutes
Publisher: Faber Music
Commission: New London Chamber Choir and Oxford Contemporary Music for the 20th anniversary of the choir.
Text: Richard Wagner, Shakyamuni
Instrumentation: 4 voice mixed choir [SATB], flute, cello, electronic keyboard / MIDI / synthesiser [with two technicians]
Computer music design, analysis/re-synthesis, spatialisation design, studio spatialising patches, performance and score following for premiere: Carl Faia
Premiere: April 12, 2002, Sheldonian Theatre, Oxford, United Kingdom, by the New London Chamber Choir and members of the Critical Band, directed by: James Wood.
Commercial recording: Hyperion, 2011. (Harvey, 2011)

Publication 6: Robinson, C. (2008) Laima

Duration: 21 minutes
Commission: Art Zoyd Studios
Instrumentation: basset horn with live electronics
Computer music design and development, creation of independent performance patch: Carl Faia
Premiere: May 26, 2008, Les Beaux Arts de Valenciennes, France
Video available via Youtube: https://www.youtube.com/watch?v=KnANLLySEEM
Commercial recording: In-possible records, 2010. (Ensemble Itinéraire, 2010)

1 Introduction and context

Bebe and Louis Barron are credited only for "electronic tonalities" in the 1956 film "Forbidden Planet". They didn't belong to the Musicians' Union. The full impact of the Barrons' contribution can only be realised when one understands that they did not even know what to call their creations. It was John Cage, working with the Barrons in their studio for his earliest electronic work, who convinced them that it was "music". ("Bebe and Louis Barron," 2013).

Composer Ron Grainer on hearing Delia Derbyshire's rendition of his theme for *Doctor Who*: "Did I really write this?" to which Derbyshire replied "Most of it". "Grainer attempted to get her a co-composer credit but the attempt was prevented by the BBC bureaucracy, which then preferred to keep the members of the workshop anonymous". ("Delia Derbyshire ," 2013)

"composition, n" 1. The action of putting together or combining; the fact of being put together or combined; combination (of things as parts or elements of a whole). ("Composition, n. : Oxford English Dictionary," 2013)

In a web log entry from 2012, Laura Zattra, researcher specialising in electronic music, writes:

> My present research brings to light an infrequently studied professional figure: the Musical Assistant (or "Computer Music Designer", or "RIM – *Réalisateur en informatique musicale*"), who has been unreasonably neglected, both in the literature and by music listeners. As one frustrated French musical assistant acknowledged: "the fact is, by and large the public ignores the implications of a musical assistant for the creation of contemporary music". (Zattra, 2012)

She was citing an article published in 2002 that I had co-authored (Faia, Mays, & Poletti, 2002). I would later receive a request from Miss Zattra (Zattra, 2012) to take a survey she had created as part of her research into the development of this relatively new professional activity. My own experience as an *Assistant Musical*[1] at IRCAM (Institut de Recherche et Coordination Acoustique/Musique in Paris) had been marked by the many discussions within the body of assistants and led to rather heated discussions with the direction of IRCAM and, in the end, to a certain number of changes.

I will be presenting a series of works undertaken in collaboration with composers, performers or other creators in which my role as a *Computer Music Designer* will be detailed and the influence that I, as *Computer Music Designer*, have had on the creative process will be made evident. Though composers have traditionally been seen by the public (as well as by

1 This was the title I had while at IRCAM between 1996-2000, even though the term was not official. In fact I was classed within the hierarchy of a museum conservationist as IRCAM is part of the Centre Pompidou. Had I been at IRCAM in the 1980's, I would have been called a tutor, and from 2000 until present this job is now called Computer Music Designer or RIM (Réalisateur en informatique musicale).

themselves) as the sole creator of a musical work, within the classically trained music tradition it is understood that composers rely on the abilities and talents of the performer interpreting the music. Unless, of course, the composer is also the performer. Then there is, one can argue, a more direct link between the compositional idea, the talent/skill of composers to compose and the talent/skill of composers to perform their own work. Similarly, a composer capable of manipulating the various computer music programs to create a new work with technology, concentrates both the compositional idea, the interpretation of the idea into the electronic music medium and the talents/skills to realise a final work that is a viable and presentable oeuvre. Both cases – composer being also a professional performer, or composer being also professional Computer Music Designer – are the exceptions. While we see that creating electronic sounds today had become as easy as pushing a few buttons and dragging and dropping some prefabricated loops into a sequencer to be tempo-synced in the style of your choice, the traditional art of composition (I'll include the art of improvisation here as well) requires a skill set that comes only through an extensive period of experience. Once these, arguably specialised, skills are acquired, then one needs to add the, even more specialised, skill set of performer or Computer Music Designer.

The composer in need of a collaborator that is both an expert in advanced computer music technology and is professionally proficient with music making is the rule I will be exploring here. It is not the focus of the present work to detail the history and the politics of the evolution of this new professional activity, I suggest that one refer to the research Zattra has published (see Zattra, 2013) for further information on the development of this new metier.

Music, broadly defined, is a collaborative art form. Perhaps, even, the ultimate collaborative art form. The interdependence of the various actors within the field is manifestly clear: composers need performers to create their music, performers need composers to create music for them. One can not completely exist without the other. The composer might depend on the intimate knowledge the performer has with his instrument (Brahms and his Violin Concerto in D major Op. 77 was written with the collaboration of his friend, the violinist Joseph Joachim) to create that unique work. Using the computer can be seen in the same context. The computer today can be used as an aid to develop pre-compositional ideas and material as well as a machine for exploring musical ideas and also as an instrument in the performance of a work.

There is the prevalent consensus in serious music circles that the composer should be the master of everything: not just the composition of the work, but also the orchestration and even the performance of the work as conductor or instrumentalist. The place of timbre as a formal element in composition is, understandably, an important factor in the circle of serious music. Relinquishing this aspect of composition, then, might be synonymous with not

composing the work at all. There are examples of composers not doing the orchestration of their work, but this remains rare in the serious music scene. On the other hand, in the film or popular music circles, it is common that the composer is the one who invents the melody while the arranger will take care of the harmony, and then there might be an orchestrator as well as a conductor before the work is brought to its final form. It is also possible that each of these roles might be blurred or exchanged during the process of creation. Then there is there is the situation where the artist/composer/performer has an idea and the producer/DJ/engineer will create everything else around the idea: tracks, beats, formal development according to style and context and, in some cases, the remix so that the work can fit into different performance spaces. Where is the composer's work in such instances? But the point is that, in many other music circles, it is acceptable that the composer is not alone in the creative process.

I am not challenging the place of the serious music composer or the working methods here. While I do believe that it is interesting to mix up genres and try new things, there are reasons why creative methods, or rituals, exist and will remain as they are. My observations have led me to believe, however, that there is a real place for Computer Music Designers at the side of serious music composers. In the same way that it is unrealistic to imagine a composer to be an expert performer in every instrument (bar the rare Hindemithesque composer), I believe it is unrealistic to expect every serious music composer to be an expert in technology. At the same time, I think that it is exactly because they are not versed in technology that these very same composers can be the most interesting to work with and give back to the collective a perspective nearly impossible for a non-neophyte to see.

1.1 Research Questions

After consideration of the relevant contexts, the main questions that have driven the research for this thesis are:

1. What is the role of the assistant in the studio, generally, and my role particularly?
2. What are the changing needs in the education and training of composers within the context of the development of computer music and technology?
3. How might one clarify the apparently ambiguous role of the collaborator?
    a. What are some possible implications of the normalisation of the RIM?
    b. In this kind of close collaboration, who is the author and how might this be recognised?
4. Is intense collaboration an essential activity to advance the art of music with computers and technology?

While I am not presenting sociological or anthropological questions nor positing theories on these subjects, I do believe that there is an interesting body of work to develop along these lines. My priority is to discuss the practice based elements of the collaboration and to focus on the craft and artistic output. Moreover, the study of collaboration within all the arts is another subject outside the scope of the present theses.

1.2 Background

My background as a composer led me to IRCAM in 1993. I had already passed a certain stage in my career as a composer. I had been published since 1990[2], I was awarded a Fulbright grant to study in Denmark with composers Karl Aage Rasmussen and Per Nørgaard. This training and experience had given me a certain confidence in composing. Indeed, I decided to stay in Europe and I moved to Paris in late 1992 because, as I saw it, the culture of music seemed to be part of everyday culture and not relegated to university concert spaces. After attending a summer academy at IRCAM in 1993, I was invited to participate in the composer class offered by the pedagogical department. I did this off and on over the next two years. In early 1996 I was hired to become a *musical assistant* at IRCAM.

IRCAM is divided into production, scientific and pedagogical departments. These each have their own department heads and teams and agendas while enjoying a certain osmosis between the dividing lines created as much from the place itself as from the people within the departments. The composer is typically invited, because of a commission from the institute or by a partner entity, to create a work using electronics and, preferably, the latest technologies being developed in-house. This person may or may not have experience with technology. It was decided early on that regardless of the experience of any invited composer, there would always be a musical assistant attached to the production. This was as much for controlling what was going on in the studios as it was to liaise with the house. This role can mean different things for different projects. Andrew Gerzso, original assistant to Pierre Boulez and head of pedagogy at IRCAM, writes in the *Contemporary Music Review* referring to this role as a mediator:

> One of the essential conditions is the presence of mediators (called at IRCAM 'réalisateurs en informatique musicale'–dubbed 'RIM' in French corresponding to the expression 'computer musician' in English) who act as 'go betweens' among scientists, composers and instrumentalists. These mediators play an important role in the definition of objectives of both musical research projects and relevant hardware and software development. They serve as 'translators' between the scientific and artistic domains. The wide vision they

2 Appendix 1 is a list of my published works under the name Carl Harrison.

> possess helps to identify generic features and new paradigms as they emerge within a project and across a multitude of projects. At IRCAM, the mediators are active both in the production domains (i.e. working with composers whose compositions will be performed during the musical season) and the research domains (i.e. working in teams made up of scientists and composers). (Gerzso, 2013)

It is clear here that this role is key to the way that IRCAM works. It is also important to note that there is not any particular type of person in this role: to my knowledge, everyone taking on the role of "mediator" is, in one form or another, a musician (composer, performer, musicologist), but that is as far as the similarities reach. This person could be more interested in research than performance, but as a group they have a broad knowledge of music, an expert knowledge of computer music, and a very acute practical experience when it comes to performance.

The other item of interest that is left out of most official and institutionally originated communication, is the presentation of this person to the public. This is detailed in some of the research that Zattra will be publishing. Generally, though, there has been until recently, a tendency to underplay or minimise the breadth of the role itself. As the post becomes more accepted and stable, this approach becomes less viable. While it does appear that the role, as seen in the name change, is becoming more prevalent, there is still some need for clarification. The fluctuating appreciation of the role itself might also be the source of some animosity as seen between composer and "mediator" and I will touch on this in a later chapter.

The composer, to be clear, is not one entity. Indeed, I use the word composer here as a catchall for composer, improvising performer, theatre director and even sound engineer. I have worked with all forms. I can generalise about some aspects of these collaborations but the most prominent generalisation is that they are all very different. While I could group them into categories, I won't. The composers I present here are all very different, from classic conservatory trained professional composers, to composer/performer to improvisor/performer some with and some without experience in electronics and/or computer music. I consider it a privilege to have worked so closely with these artists. What follows should in no way detract from what they have accomplished. In my professional experience as practitioner and observer of close collaborations, it is sometimes impossible to define clear authorship of certain details. I believe that this is a sign of a good collaboration.

1.3 Defining 'collaboration'

Here are the accepted definitions of the word:

> United labour, co-operation; esp. in literary, artistic, or scientific work. 2.Traitorous cooperation with the enemy.("Collaboration, n. : Oxford English Dictionary," 2013)

While the first is closer to what is done in the studio with composers, the second has great significance especially in France where I have been most active as a collaborator. It is not incidental that the word is not often used to describe collective projects. This might well be part of the difficulty in simply putting in the program "in collaboration with Carl Faia". While this is a part of the general reticence in accepting the fact that the composer is not alone in the creation process the other part is probably as much cultural as it is psychological. I am not going to enter into this kind of discussion, though it does merit further research.

The collaboration I present here is defined in the first instance of the definition. It does have many facets and is rarely the same from project to project. There might be a need to be a "sounding board" for the ideas of a composer and then, once these ideas have taken from, to interpret and realise them for a concert performance or installation or other output. The work is the result of a united labour and would not be possible without input from more than one person.

Collaboration is not, in my experience, a simple process. It requires many varied technical and social skills that may or may not be innate but most certainly do need to be honed. Experience is also of great importance. Not just the experience of collaboration, but multiple experiences inside the various creative forms.

Finally, music is a collaborative art form, as described above. This will be clear to anyone practising the art, but its very pervasiveness is one cause of the lack of recognition. Composers, in most cases, compose a work for an instrument or group of instruments to be played – arguably, its final and true form. There is often an entire chain of collaboration in this process: from consulting with the instrumentalist(s), to the copyist who will correct mistakes and sometime make suggestions to the composer, to the interpretation necessary once the graphic representations of music are placed in front to the performer (there might even be a further collaboration with a conductor). Then, of course, there is the collaboration necessary for the performers to play the work together, with or without conductor.

My collaboration with the composer is at once the same as that of an instrumentalist but with a speciality in "computer music instrument," as well as an augmentation of that role. As a composer, I have experience in making the music that will be played and understand what that entails. But I am also part of the creative process that is, mostly, private and part of the composer's process. I will sit with a composer as he composes. I will provide material in real-time for the composer to use within a work. I will experiment with ideas, hers or mine or ours,

that may be important in the final work... or not. There is time, effort, discussion, research, creation and finally, more time as essential ingredients to the collaborative process. It is not unusual that a special bond will be created between us during that process (a bond that may or may not last once past the premiere). I neither want to belittle or exaggerate the importance of my work in this process: I want to expose this process as an important and, perhaps, inevitable part of creation today.

In what follows I will present elements from various works I have collaborated on over the last 18 years. This will be in the form of highlights or extracts of collaboration as analysing each work completely would be a major undertaking and is outside the scope of the present thesis. I will present in as practical terms as possible what it means for the composer and the "mediator" to collaborate. Being able to translate the work of a researcher into terms that a composer might be able to use (and thus validate, in some form, the research itself) within the context of a creative activity is as important as understanding the capabilities of the production team – sound engineers and technicians – to realise the final project in a real-world concert format. The end result is always a public presentation and is not always what was imagined at the start of the project.

2. Building Blocks of Collaboration

While at IRCAM, I would be involved from the very first days with many concurrent projects and duties including those of musical assistant to invited composers, as well as being the coordinator representing production needs with new audio programs in development in the studios by in-house researchers. The two works presented below are the earliest completed projects in which I collaborated and represent the basis for my approach to collaboration in subsequent projects. Both these works involve extensive use of IRCAM programs *AudioSculpt* (for analysis/re-synthesis and non-realtime treatments) and *Diphone* (for re-synthesis of segments of pre-analysed materials). While other programs would be used (notably *Csound*, *Lemur* or *SoundHack*), IRCAM programs would be at the centre of my work not only because of the experimental nature of the program, but also because of the number of users and the hours of experience available to me in close proximity.

The process of collaboration is never completely natural and requires effort from all parties. While my experience as composer allowed me a sense of empathy and understanding, there would be differences in age, background social standing, education and gender that would all play a role in the work itself. There is also a certain metaphoric starkness that inevitably

appears when assumption meets reality and we start working on the details of a project. Our respective ignorances become evident and we need to have confidence in the other to reveal what we don't know or know incompletely. In any event, this is an important aspect of collaboration, as is the psychological interaction that might be important in certain projects. In summation, collaboration would mean, as I would learn, being the liaison with the house (IRCAM), being responsible for the feasibility of the final project and working towards that goal at an attainable rate of advancement, being a conduit between research, development and creation and, sometimes, being the moral support in times of crises and doubt or looming deadlines. The examples I have selected for this thesis will develop this element of the research. In various guises, this role has remained a central one to my activities and I see it as a key aspect of nearly every collaboration.

2.1 Publication 1: Leroux, P., (1997) M

Date of composition: 1997
Duration: 15 minutes
Publisher: Billaudot, Paris
Commission: Südwestfunk (Southwest Radio) Baden-Baden for the Donaueschingen Festival and IRCAM-Centre Pompidou
Dedication: Carl Faia
Instrumentation: 2 piano, 2 percussion, hardware and software (Max) based samplers
Premiere: October 18, 1997, Donaueschingen Festival, Germany, by Ictus: Jean-Luc Fafchamps, Jean-Luc Plouvier: pianos, Miguel-Angel Bernat, Gerrit Nulens: percussions direction: Georges-Elie Octors.
Studio: IRCAM
Commercial recording: Nocturne : Soupir Edition, 2004. (Leroux, 2004)

2.1.1 Introduction to the work and some basics

The following is a rough English translation of the program note that we wrote for the premiere of the work, found at the previously cited reference:

> For the realisation of the computer part, we began by analysing some piano resonances using the software AudioSculpt and Patchwork, developed at IRCAM. These resonances, obviously rich in partials, sometimes strangely inharmonic (all sounds are initially analysed for fundamentals) and dynamic (the attack of the sound, with all its transients, to its decay where there remain no more than one or two partials, sometimes very far from the fundamental). We then isolated the internal harmonies and transitions: these then are used as new recording materials, allowing for various types of interpolations made with the programme Diphone developed at IRCAM by Xavier Rodet and Adrien Lefèvre. These harmonies were finally used to create parts of pure synthesis using, in part,

> Csound. Thus, the synthesised sounds of the electronics are also modified by morphing re-synthesis of instrumental analysis (percussion and piano); For example, you can hear sounds synthesis with partials isolated from glockenspiel analysis, or possibly cross-synthesis of sinusoids with sounds from interpolations of complex piano resonances.

This is a work for two percussion and two pianos, an ensemble made common through the popularity of the Bartók *Sonata for Two Pianos and Percussion* (1937), but with electronics commissioned by and to be developed at IRCAM. Leroux had studied at the Paris conservatory and had already passed through the studios of GRM (*Groupe de Recherches Musicales* in Paris) before arriving in residence at IRCAM, though I did not know his music and was unaware of his electroacoustic work before I was assigned the project. While I did get to know the composer's acoustic work, he never presented his previous electronic pieces to me. The newly commissioned work was nascent, nothing was yet written, and this is usually the best place to start with the composer.

As this was the first time I collaborated with a composer at IRCAM, I learned that the typical steps in a collaboration would be meeting the composer and discussing in detail the work. These early meetings would involve technical discussions, as well as a certain social aspect that is not definable. Working out the technical and practical understanding the composer has for electronics, understanding the wants of the composer and already trying to build a glossary of usable definitions for descriptions of sound that are non-technical (like saying "really soft" for pp):what does blue metal sound like? Then there are stages of studies or examples created to hear and explore. Sometimes this might seem a little like showing off your trick pony while the buyer decides if he wants that one or not.

In any event, there follows a period of gestation and writing or realisation by the composer and myself on decided or probable materials. This might be in the form of isolated materials, a manipulated marimba sample transposed to extreme degrees then mixed with another resonance. In this case, once the basis of the sounds were worked out, the composer would come in with pages written and we would make a demo of the electronic sounds even before we were sure of the treatments we would do to get the sounds we wanted. ProTools would be used for this period of the collaboration.

Once the different parts are ready, there is a period of intense realisation that leads to a concert or first performance. This includes creating the final concert form of the Max patch (while this would not be the case for every piece created at IRCAM, it would be mine). It is often here at this juncture that choices need to be made on whether we can continue to explore a sound, an effect or concept, or if it is too risky to continue in light of the oncoming deadline. It is fine to start off a project with everything possible, as I like to do, but the process or ritual

of making a Max patch to combine all the necessary parts creates a de facto filter. Anything that can't be included in the allowed time is left behind for another day, or not.

The earlier I can get in on the project the better for the final outcome because there is an early understanding of the needs and the limits of the work allowing the composer to create with the electronics and not add them in later. This is not always possible, but my experience has shown that when the circumstances permit this close collaboration, the final work is generally more authentic, more successful.

2.1.2 Research topics and major aspects of the work

While there were many aspects of the work that would involve different synthesis and audio treatment techniques, the work would be heavily influenced by the analysis re-synthesis research at IRCAM. Xavier Rodet and his team had developed a certain number of techniques and programs for analysing and processing recorded voice. While this was mostly in Unix based binary programs created by the researchers themselves and designed to do highly specific tasks, a new program was being developed around these techniques. The Macintosh developer Adrian Lefevre had been tasked to create a GUI on the Macintosh that would enable users without programming skills to create their sounds with these techniques. I was tasked as the co-ordinator between the users (mostly Musical Assistants) and the developers due to my early adoption in using the analysis/synthesis techniques in composition. This role is, incidentally, also highly collaborative. Other aspects of importance in this work included the concert Max patch developed and programmed for the performance and working out the general complications of the audio equipment needed to interact and perform in the work. This was a period of transition in the audio world and many aspects of audio and MIDI interfacing and computer based workstations were in constant evolution. Deciding what we could and should use for the performance would impact not only the immediate playability of the piece but also its longevity and portability.

Nevertheless, the most exciting research aspect was in the rather unexpected discovery that we could morph complex sounds. Morphing had been something that was used in pictures using computer animation techniques, but sound morphing was new. There had been various attempts and even some commercial plugins within a few years that made this possible in some ways, but not like what we would be doing.

The technique had already been used in the 1994 film *Farinelli* to create a hybrid voice that would be that of the (now non existent) castrato singer through a combination of the voice of a soprano and that of a countertenor. In brief, this was done by analysing the respective voices then combining them in intricate combinations and sequences to create a believable, though artificial, voice. This technology was at the centre of *Diphone* and that is

what we would be using in its earliest stages of development to create complex instrumental audio morphing.

2.1.2.1 Analysis/re-synthesis and the development of Diphone

After discussions and various experimentations, many of which ended up in the final work, it was decided that the main focus would be around a series of chords realised from the analysis data of single sampled low piano notes. These chords played on an acoustic piano would, in turn, be recorded and analysed though the Additive program that would provide instantaneous frequency, amplitude and phase information in a text file format. This would be the first step as part of the process in which *Diphone* would be programmed to take the analysed data, in the from of dynamic partials, and morph them from one sound segment (or phone) to another. This was a long and slow process and would eventually cause several problems for the IRCAM systems administrator: I was doing the bulk of this on the mainframe computer which meant that during my processing, any other user on the system was reduced to a fraction of a percentage of the computer processor and checking email could take several minutes instead of seconds. This is where my ignorance showed and I was quickly corrected and just as quickly learned how to program the necessary analysis during the late night hours when I would not bother other users.

In the following figures, typical analysis and re-synthesis captures from the production period are shown. In **Figure 1 (there are several additional elements of this work supplied in Appendix C located in the relative folders)**, the IRCAM program Audiosculpt is being used to analyse and represent the audio and frequency domain graphs of a C#1 piano sample. Markers have been placed in the sonogram to delineate the harmonic evolution of the partials. The red horizontal lines mark the most prominent partials and will be exported in frequency/amplitude pairs to be used as harmonic material for the composition of the work and to create further complex chords for analysis, re-synthesis and morphing. Many samples were analysed and processed in this manner. I would then use the IRCAM program Patchwork, **Figure 2**, to import, filter and normalise the partials into 1/2 tone adjusted chords as shown in **Figure 3**. These chords would eventually be used by the composer in the composition of the work.

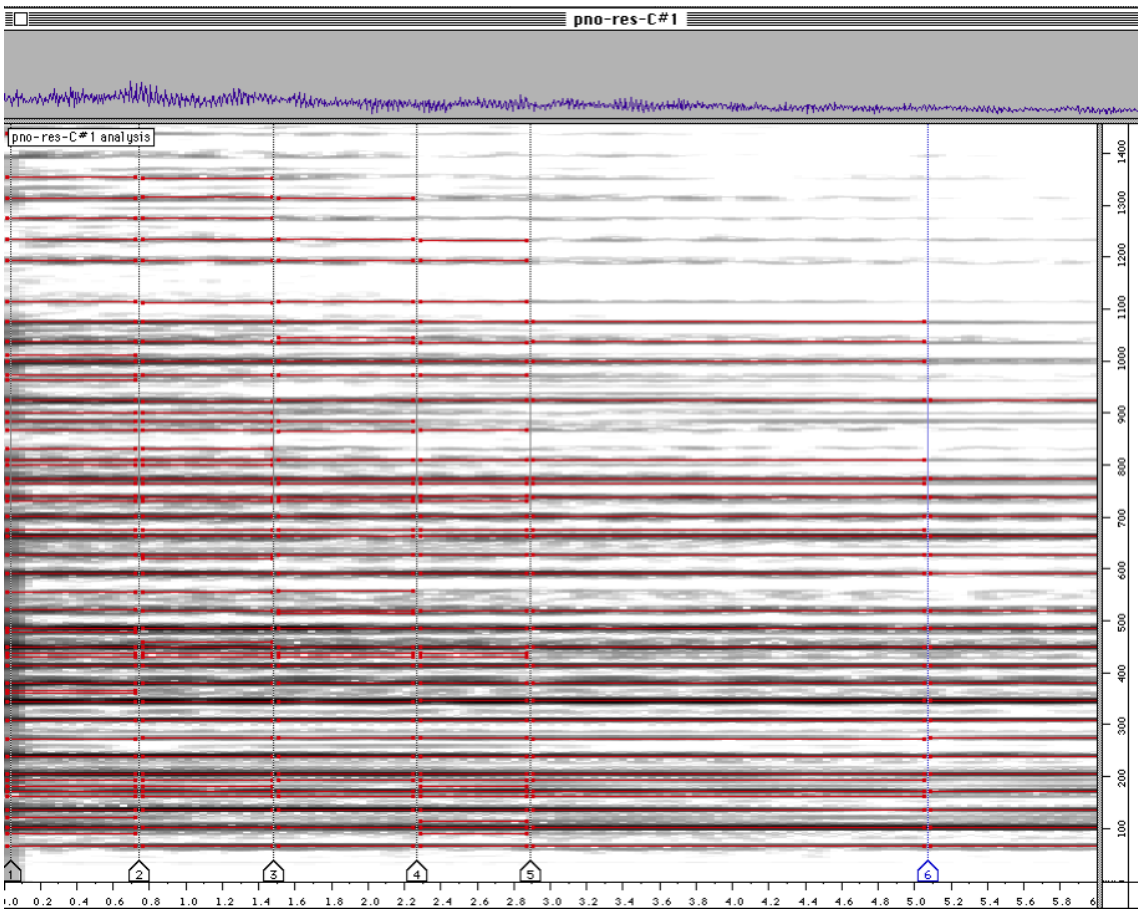


FIGURE 1. AUDIOSCULPT ANALYSIS USED TO DELINEATE CHANGES IN THE EVOLUTION OF A C#1 PIANO SAMPLE.

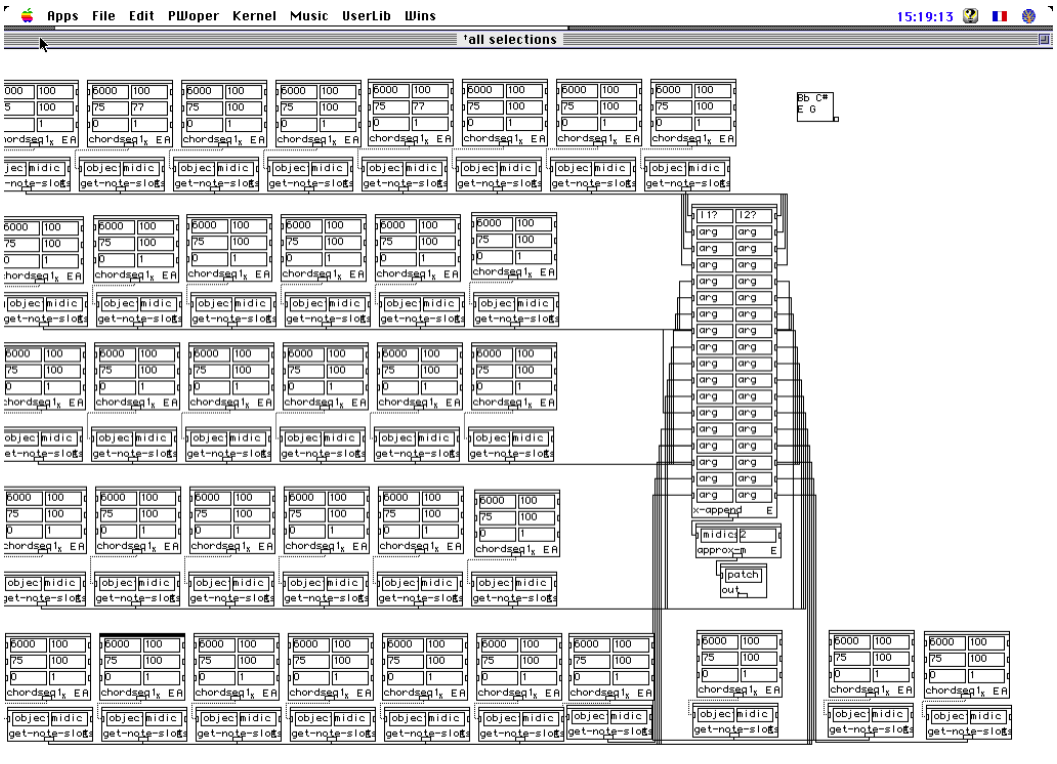


FIGURE 2. A PATCHWORK PROGRAM MADE TO COMBINE ALL CHORD SEQUENCES TAKEN FROM ANALYSIS DATA.

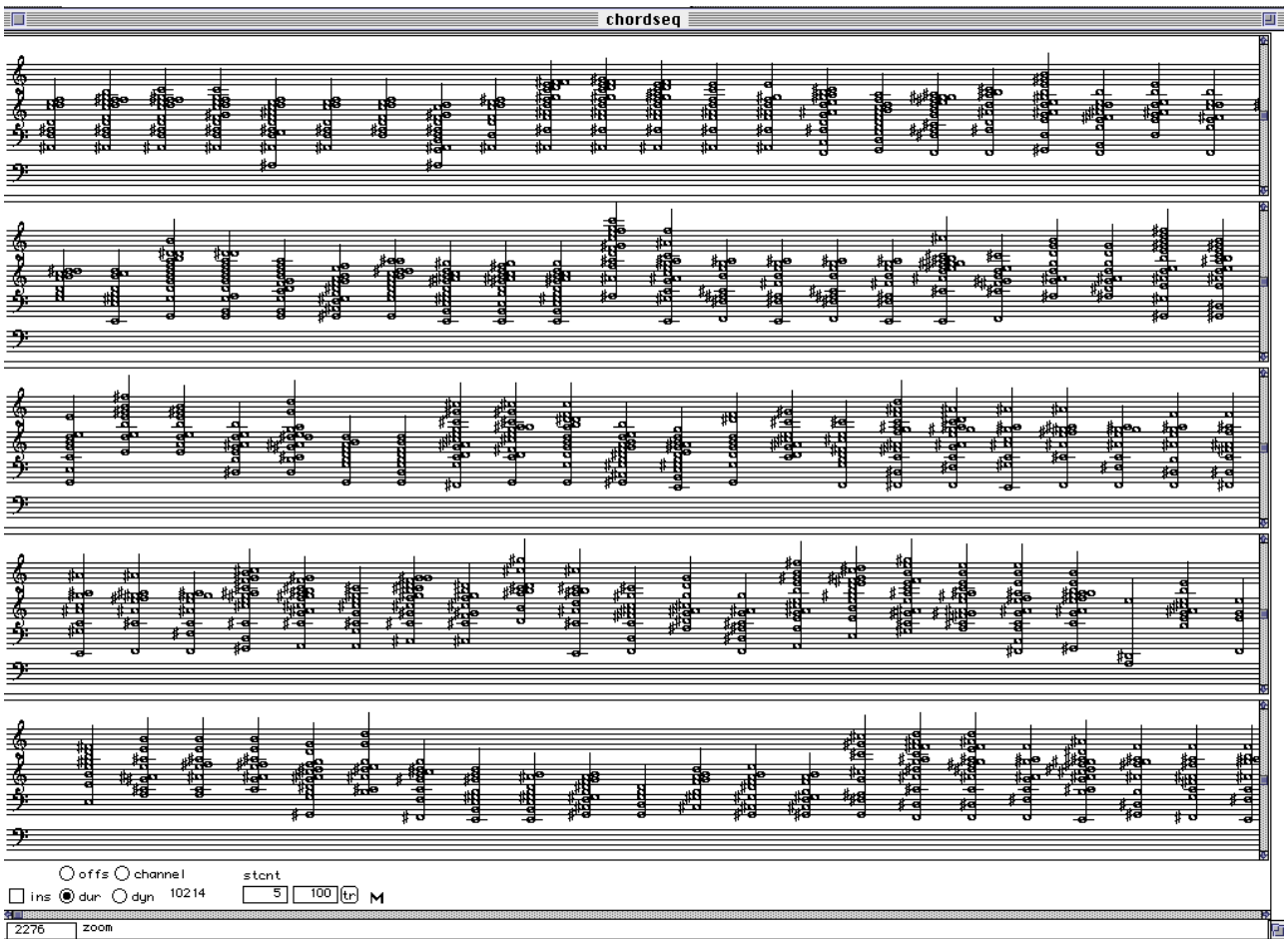


FIGURE 3. CHORDS FROM THE PATCHWORK PROGRAM IN FIGURE 2.

The total time for this project was 10 weeks broken into two period of about 5 weeks each. While there were recording sessions with percussionists and pianists, the majority of this time was spent in the studio doing analysis and re-synthesis which involved a lot of processing power and time waiting for importing/exporting to be done. The key element to this work, the morphing, was done with *Diphone*. The original idea behind the development of this program was to take the smallest part of a spoken text, a phone, and morph it into another phone possibly from another source (essentially analysing two audio sources speaking the text *mama*, dividing them into respective *ma1 ma2* phones and then morphing the source 1 *ma1* to source 2 *ma2*). While this worked well for short and relatively limited data collections, the massive analysis data and complexity of long piano resonances would cause many problems before I arrived at something musical with the program. Indeed, the program had not been conceived for nor had it been expected to treat such complex and large masses of information. Through many late night sessions with Xavier Rodet, I began to develop a method for accomplishing these complex operations.[3]

3 It is probably because of this intense experience that I would continue to be the Diphone expert at Ircam until I left, and that Diphone would also be a tool that I would use whenever possible. In any event, each of the assistants at IRCAM would have their speciality, thus their own sound.

Briefly, the sources needed to be very cleanly recorded, editied and noise removed. The analysis process would be limited to 100 partials, to help simplify the analysis and later re-synthesis The difficulty was finding and then applying an artificial fundamental to disparate harmonic sources — in this case, mostly piano chords of complex pitch content — to create a unified partial numbering across sources that would be used in the morphing process (for example, partials from a C major and a G major chord could be analysed with a common fundamental of a very low C frequency, even though this actual frequency is not actually present in either chord).

The process can be seen graphically in **Figure 4A** and **Figure 4B**. These are the screenshots of partials from (rather large) "phonemes" within the Diphone program. **Figure 4A** shows the un-morphed but aligned partials, while **Figure 4B** shows a preview of the final morphed sound after re-synthesis. A short example of an interpolation as written in the score can be seen in **Figure 5**. Examples of this effect can be heard from measure 1 of the work and are clearly heard throughout the work. The entire composition contains many instances of these sounds as well as other examples of morphing, notably between keyboard percussion and piano, including unusual glissandi of marimbas. All the sounds are organic in the way that they have been produced from acoustic samples.

One final example, **Figure 6A**, of the power of Diphone can be first heard at time 2:32 of the commercial recording. A long glissando of complex harmonics is heard that comes from a non-normalised partial numbering in the synthesis process: essentially an accident that was pleasant to our ears and used in the piece with formal repercussions. The arrival of the glissandi is shown as written in the score in **Figure 6B**.

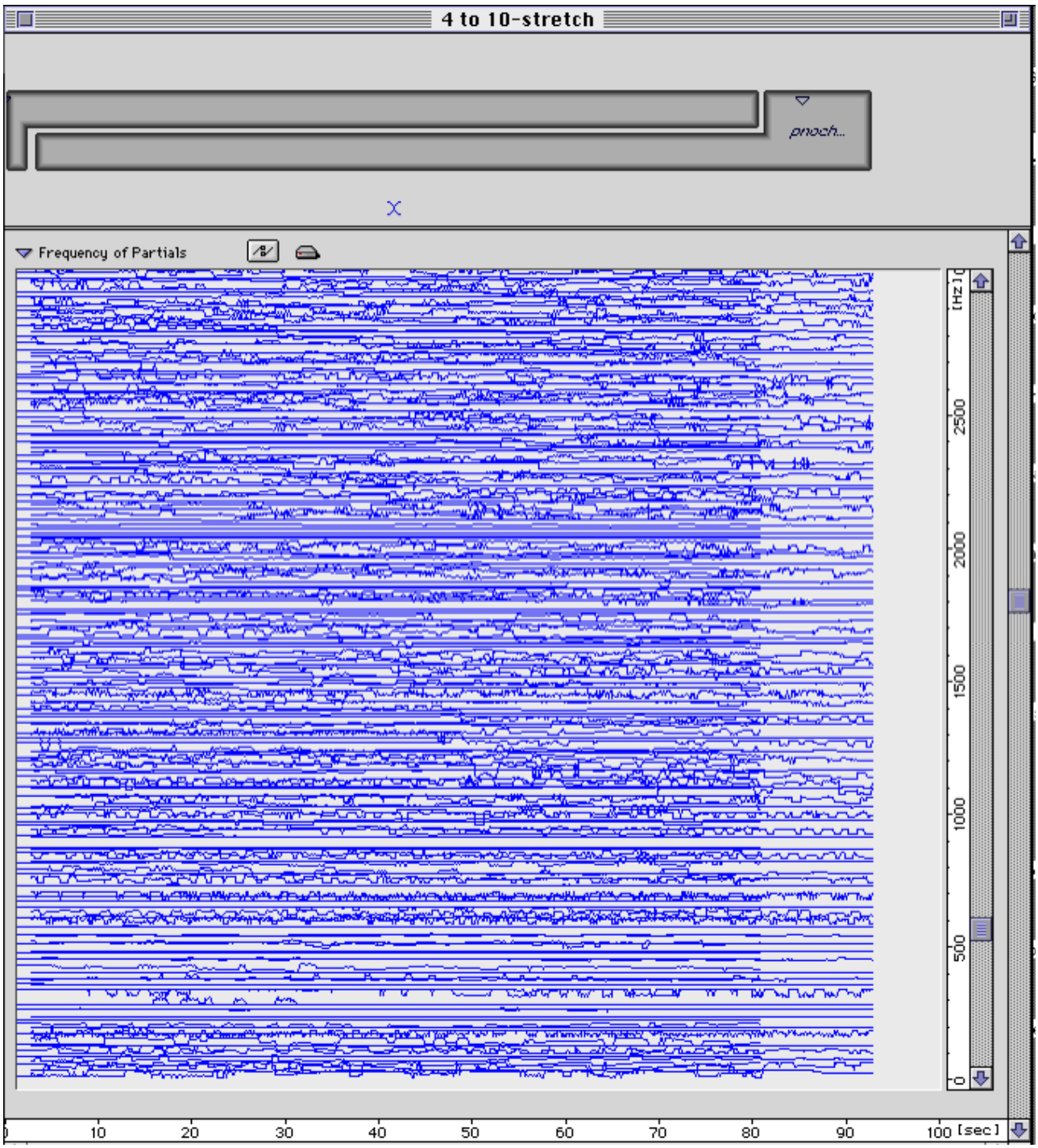


FIGURE 4A. ANALYSIS DATA OF TWO PIANO CHORDS BEFORE MORPHING.

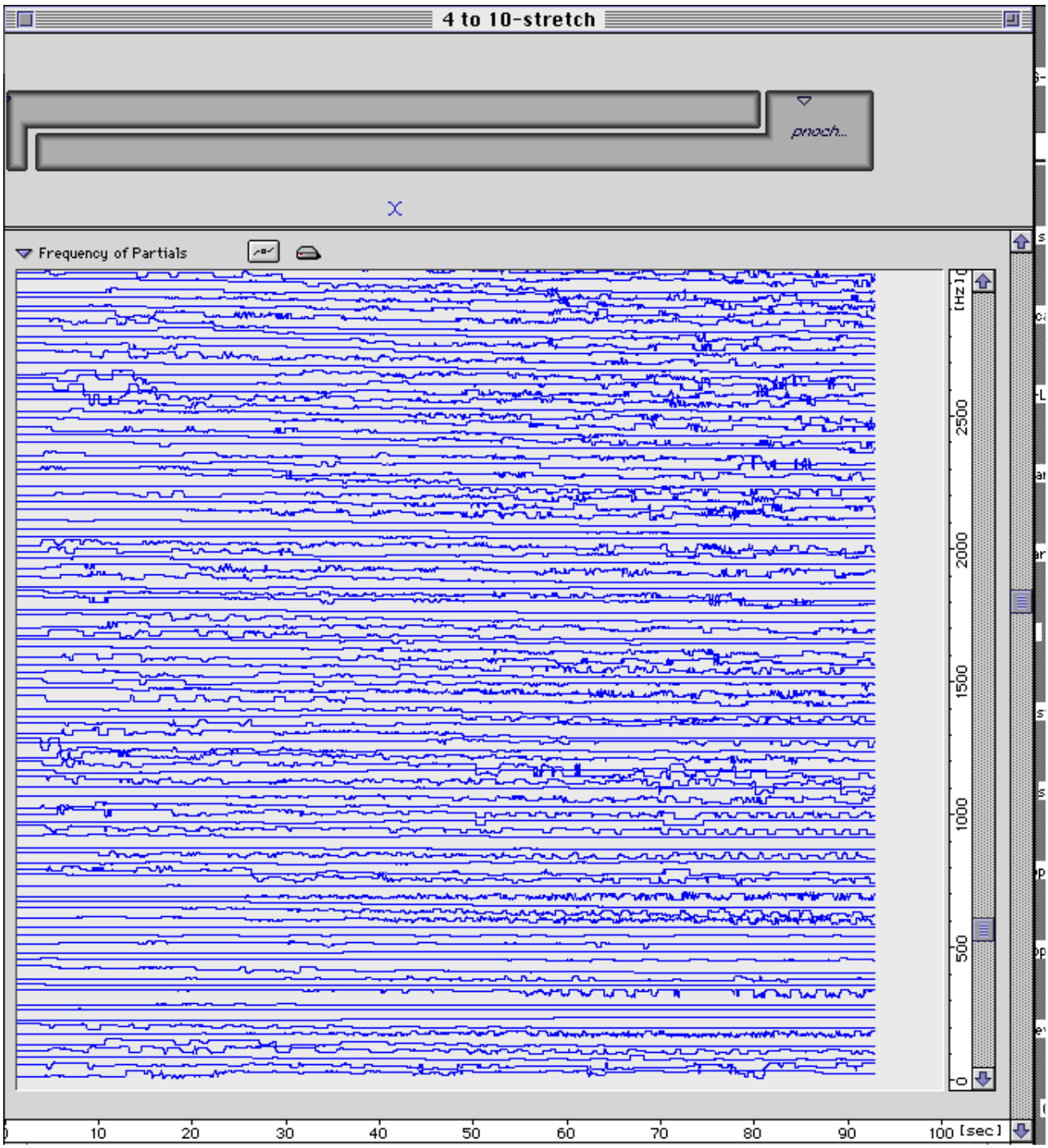


FIGURE 4B. ANALYSIS DATA OF THE TWO CHORDS WITH MORPHING PREVIEW.

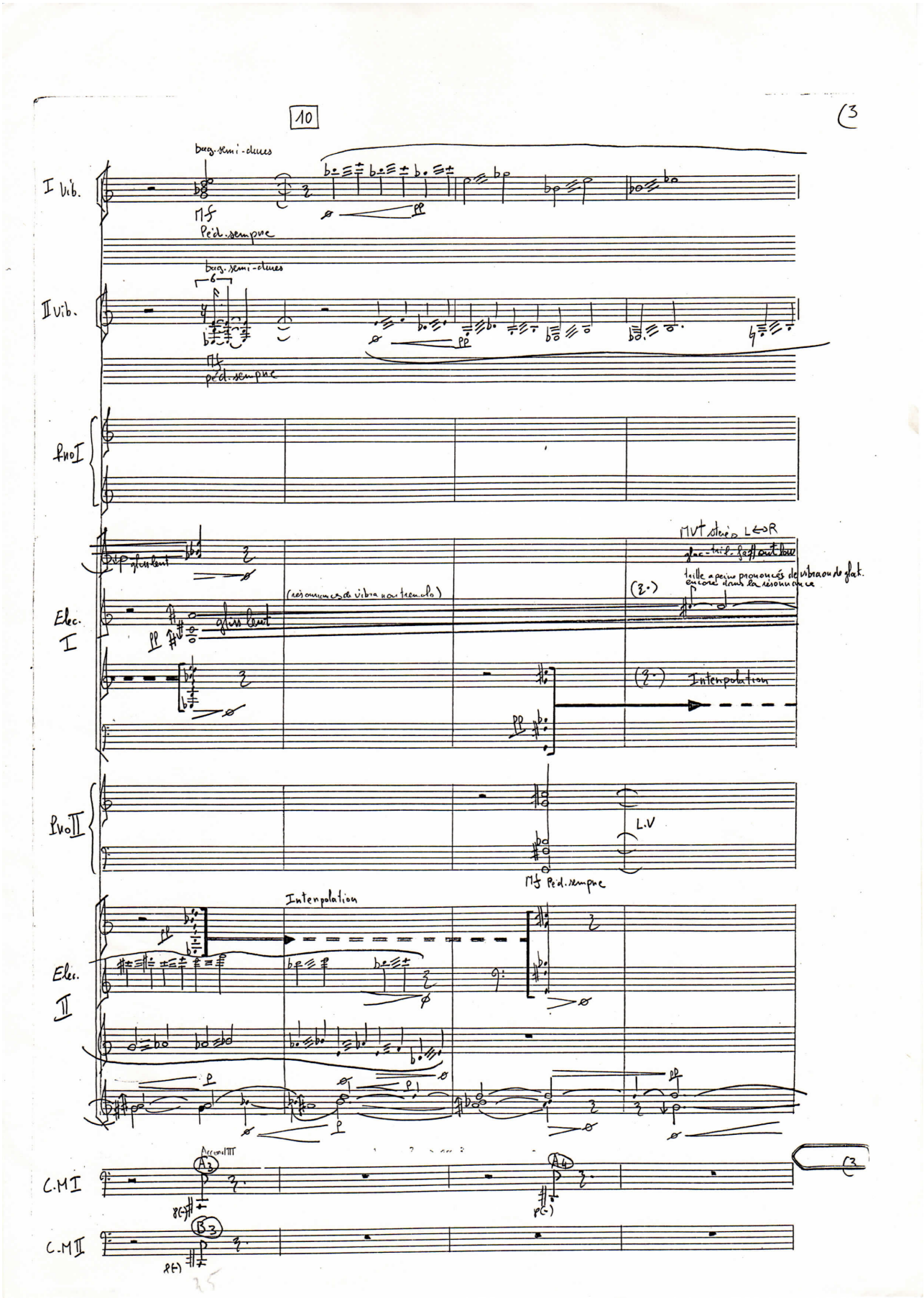


FIGURE 5. *M* **SCORE PAGE 3 INTERPOLATION BETWEEN TWO COMPLEX PIANO CHORDS.**

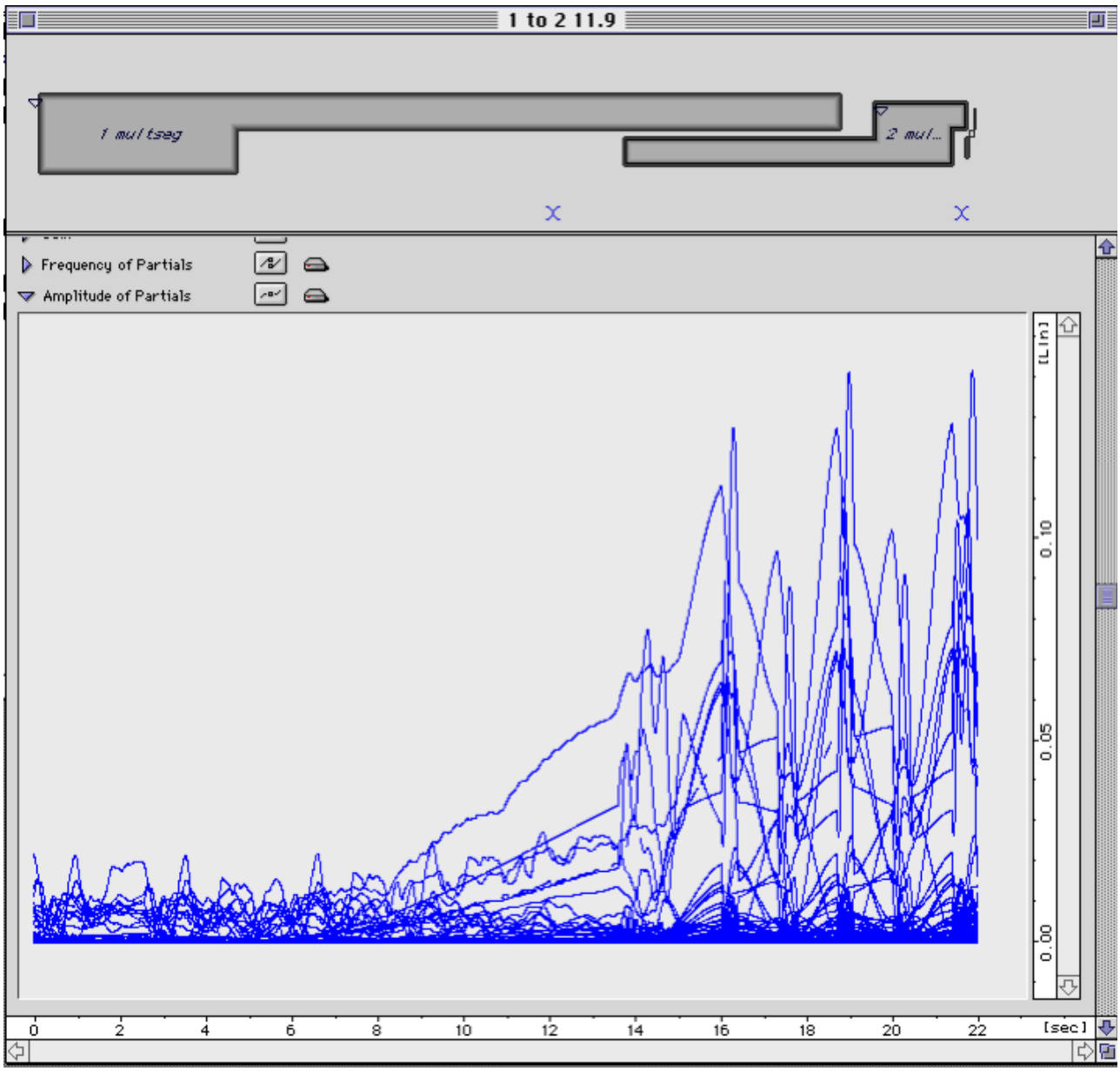


FIGURE 6A. LARGE AND DRAMATIC GLISSANDI BETWEEN TWO COMPLEX PIANO CHORDS IN DIPHONE.

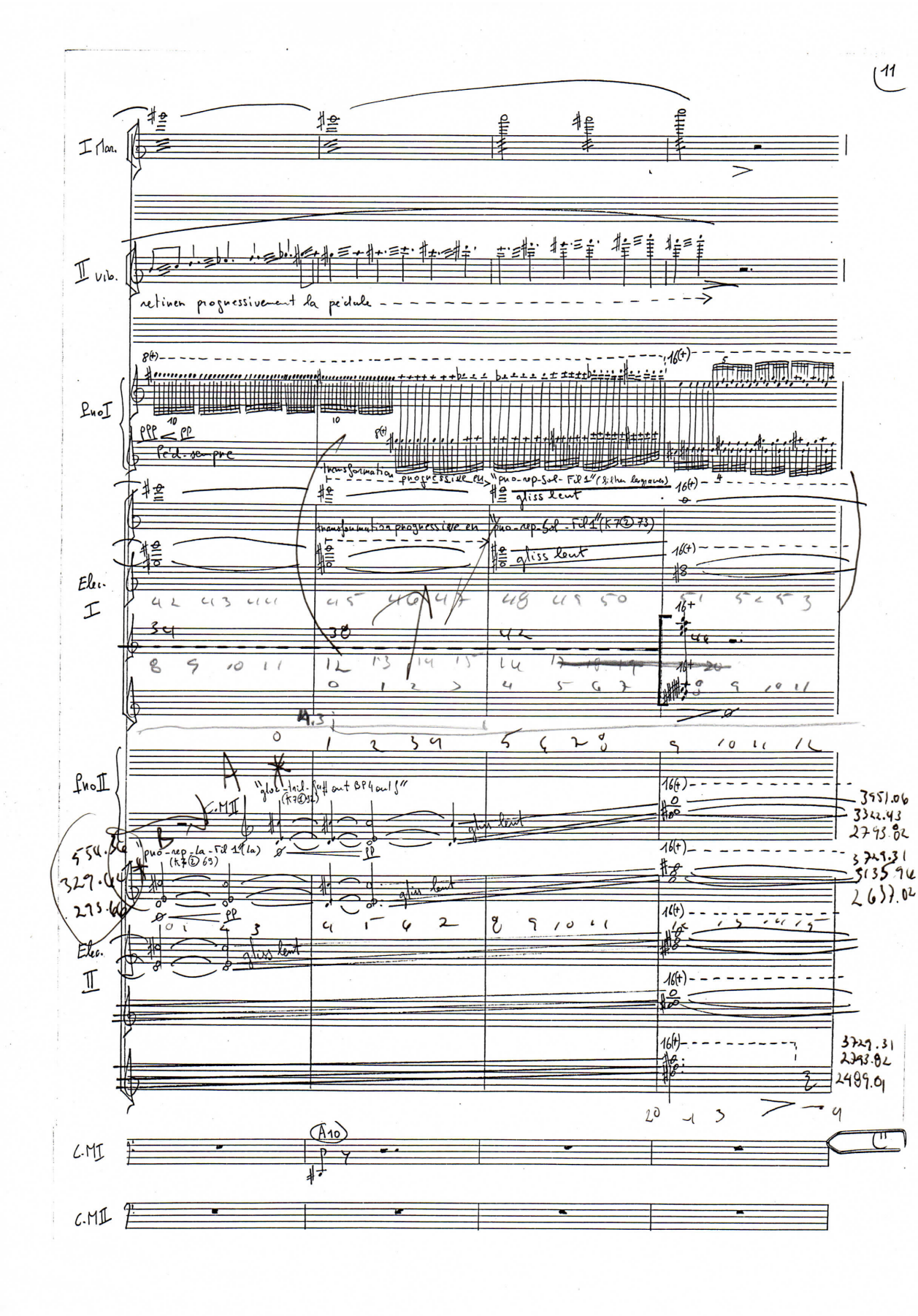


FIGURE 6B. *M* **SCORE PAGE 11 SHOWING THE END OF THE GLISSANDI INTERPOLATION FROM 6A.**

2.1.2.2 Creating the Concert Patch

The studio work may be more or less important on any project. That might appear unusual, but it has to do with the final form the project will take. There are projects where creating the audio is the major aspect of the project, while creating a way to perform the work in concert is relatively straightforward (e.g. a work for fixed media such as tape, Cd or DAW). Clearly, this was a studio-heavy project in which the sounds were very much at the centre of the collaboration. This would be one reason for having a sample-based work, as well as it was a preference of the composer: he wanted to remain as independent as possible form IRCAM. In other words, if we were using real-time NeXT-based workstations with three ISPW (IRCAM Signal Processing Workstation) cards, then he would be forever dependant on IRCAM to perform his piece (as with Boulez' *Répons* or Manoury's *Pluton*). Indeed, composers during the 1990s at IRCAM were generally wary of using live technology because of the technical difficulties and the resultant dependency on IRCAM for all future performances. This lead us, in the case of *M*, to the decision to work with sound files that, in theory, could be played by any sampler (much like tape pieces or mixed works from the repertoire but where we could trigger individual sounds and not be constrained by a fixed time line).

An important part of any project I undertook at IRCAM would be to propose and then prepare a concert version of the piece (there was always a concert and always a deadline to respect). Whatever theoretical, exploratory work we were doing in the studio behind closed doors, in the end we needed to have it done in time to rehearse and perform.

As mentioned above, the 1990s, especially the second half, were transitional. We were moving away from the NeXT machines and the ISPW cards to some new form of technology still being developed. It was decided to use a combination of the Max computer program and commercial samplers (AKAI S2000) to perform the piece. The reasons this was necessary were that there needed to be an easily coordinated setup for the two keyboard players to trigger the many sound files in the piece, and that it was practically impossible at that time to use only samplers to playback the sounds (this due to the limited RAM memory available to load the sounds). The final result was a performance patch that would pass on triggers of short sounds to the samplers while playing back the longer sounds from the hard disk of the computer. In some cases, the first few seconds of a sound would be played with the sampler while the longest part would fade in from the hard disk. An added benefit to having a Max patch at the centre of the performance setup meant that we could have a demo version of the work performed with a MIDI file for testing purposes. **Figure 7** shows a screenshot of the original Max patch used to perform the piece. Samples from the work may be found in the folder of examples in Appendix C.

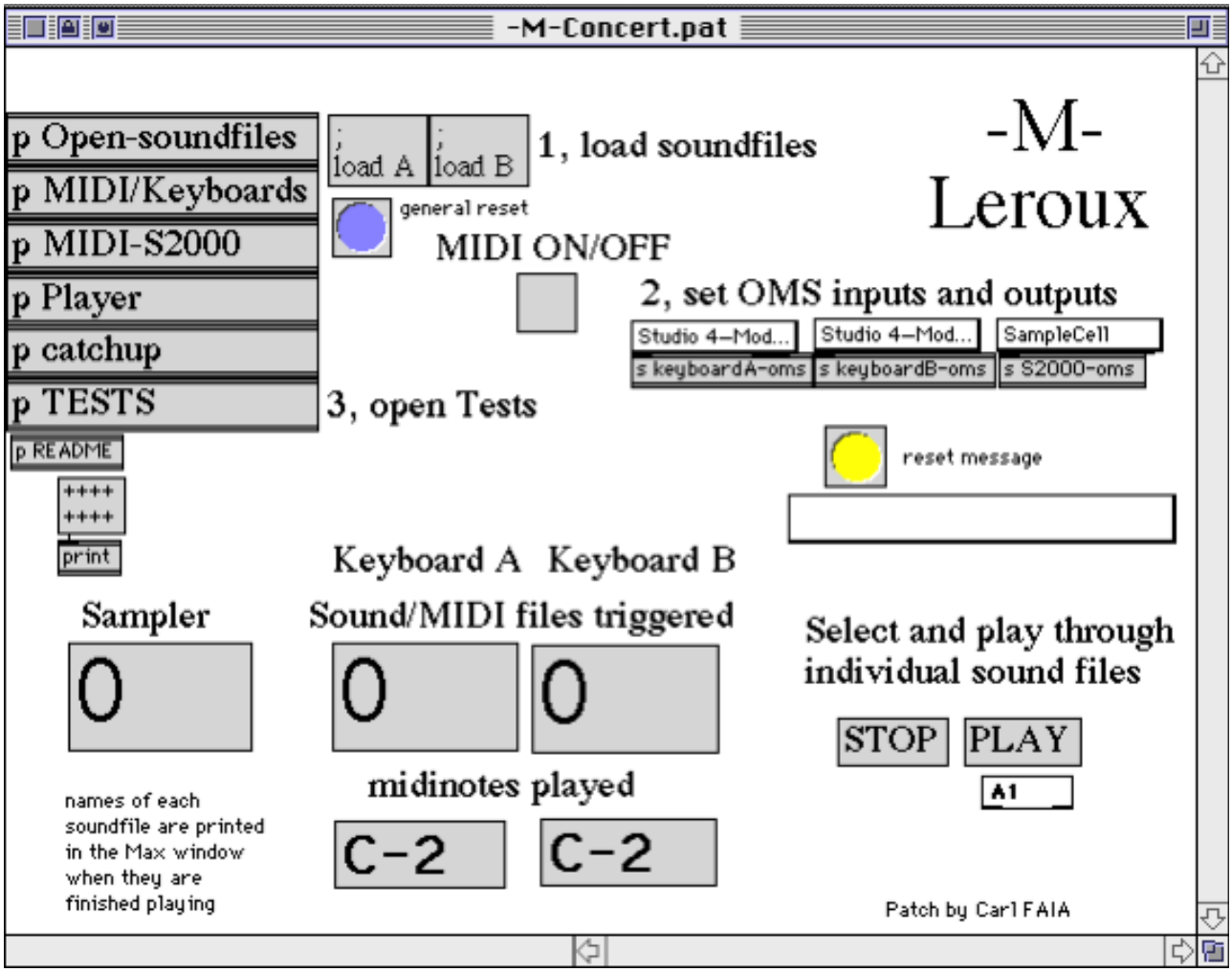


FIGURE 7. A SCREENSHOT OF THE ORIGINAL MAX PATCH USED TO PERFORM THE PIECE.

From the example in FIGURE 7 one might assume that there is a clearly defined design philosophy being applied. In the above example and the addition graphics and actual concert patch I have included in Appendix C, certain elements are deemed of great importance and thus organised in the most visible and accessible part of the programme I create for the project — the font most page when opening the patch. Other parts of the programme are organised into sub-patches easily accessible if needed (there are several examples in the graphics I have submitted). The most important aspect of my approach to designing the concert patch is equally aligned to my approach to working with the composer. I prefer to start with a blank page and progressively build up a coherent and organic work that is capable of performing the necessary tasks. I am careful with what I put on the table for the composer to use in his composition, just as I am careful to avoid contamination from other works by using preprogrammed Max patches for the concert. While this is never 100% the case, it is a principle I developed over time starting with this very first work.

In the process of creating the final outcome, there is often a number of back and forth discussions and arrangements in any new work (and in this particular case there were many). Between the creation and development of the sounds for concert, score development and how to write out the electronic part for both graphic accuracy and practical playing , how the final Max patch would be controlling the overall routing of triggers, and sometimes even whether or not to have electronics present in the composition would be discussed openly and freely. In the studio, there was no taboo. We would bounce ideas off of each other up to and through the premiere of the work. When I look at the score today, I see things that I had suggested to the composer and when I listen to some of the examples, I remember the comments the composer made to me as we sat listening to the work I was doing on the synthesised sounds. There existed a certain complicity that is difficult to imagine and even harder to explain to outsiders. It is a privileged complicity and has allowed me from this piece onward throughout my career to work with many composers and artists to create something unique, something that could exist only because there was this complicity and these two particular people working together in the studio in total confidence with each other. From the outside it might appear to be an awkward and uneven relationship. I don't believe this is the case, at least not during the work. I do see how the relationship changes once this creative period is over and we return to our respective spaces and social/professional "norms" take over. I will explain this process in more detail later in the thesis. But what should be clear from this point is that at no moment is there a situation in which the composer is dictating what he wants to hear in clear and defined terms. At best it is a common language, but usually it is a situation in which one of us is speaking Italian (metaphorically) and the other one is speaking something else. It is impossible to advance if there is not a common language. There is, by necessity, a give and take that is different but very real for every project as we work towards this common language.

2.2 Publication 2: Wood, J., (1998) Mountain Language

Duration: 25 minutes
Publisher: Edition composer
Commission: IRCAM-Centre Pompidou
Instrumentation: 1 alphorn, 1 cowbells (percussionist), 1 electronic keyboard / MIDI / synthesiser
Information on creating
Premiere: June 20, 1998, Espace de projection at IRCAM, Paris, by Benny Sluchin: alphorn, Vincent Bauer: percussion, James Wood: MIDI keyboard, direction: James Wood. (Wood, 1998)

2.2.1 Introduction to the work.

The following is an edited English translation of the program note, written for the premiere of the work by the composer, that may be found at the previously cited reference:

> I have always held a deep reverence for the mountains. The sense of oneness with the universe and the power of creation, the awareness of space, the purity of the air and the inexorable force of all the elements can often be overwhelming. It is hardly surprising that so many of the great Biblical and mythological dramas are set there - the Transfiguration, the Psalms, the Bacchae.... And yet with all the sense of vastness comes also an acute sense of identity - each bird, each animal, each stone and each stream has its own spirit, and its own particular place in the cosmos. Communication between all these spirits seems constantly alive and immediate.
>
> In seeking to explore these phenomena in *Mountain Language* I decided to base as many elements as possible on natural models - these include all the elements of rhythm, melody, harmony, intensity, texture and form, the especially crucial element of spatialisation - and, of course, sound itself.
>
> All the sounds in *Mountain Language* are derived from sounds which are indigenous to the mountains, and which are designed to transmit signals over large distances - cowbells, church bells, alphorn, and the elemental sounds of wind and rain. These sounds are deployed by the two live performers (alphorn and cowbells), two samplers (triggered by the cowbells themselves) and a computer, triggered by a keyboard player who acts as a conductor/co-ordinator. Thus the 'language' implied by the title does not merely refer to the visible dialogue between the live performers, but much more to the complex network of signals, responses, echoes and other dramatic interactions between the live musicians and the multitude of invisible, spatialised sounds.
>
> The melodic models in *Mountain Language* are from birdsong. In analysing over a hundred birdsongs for their melodic, rhythmic and intensity data it was possible to apply this data to both the sounds and the harmonic scheme already described...
>
> But the models are used also for all the alphorn material. By taking a small fragment (even two or three notes) of birdsong, slowing it down, applying it to the alphorn spectrum and then transposing it down the degrees of that spectrum, the song begins to resemble a typical alpine horn

> call. Thus, whilst the horn calls heard at the opening, for instance, may sound like archetypal horn calls, as they move up the spectrum, getting longer and faster, they gradually reveal themselves to be fragments of birdsong. In this way all the melodic material is unified by a common model, and can move up and down in register without technically 'transposing'.
>
> The spatialisation in *Mountain Language* has been modelled on the geographical location of eighty-nine peaks surrounding a central reference point, the village of Ishgl, Paznauntal, Tirol. These eighty-nine points provide 'platforms' for the work's principal polyphonic discourse of 'Responses' and 'Echoes', as well as for the many elemental sounds. In addition to the eighty-nine peaks, there are three other important locations following the line of the valley - these are the churches of three neighbouring villages - that of Ishgl in the centre, and those of Kappl and Galtür at opposite perimeters of the area.The form of *Mountain Language* follows the progress of a single day-cycle which could roughly be described as follows: Night - dawn - church bells announce the morning Mass - dawn chorus - morning - light rain eventually develops into a storm in the afternoon - much activity in the late afternoon - evening chorus - dusk - church bells announce Evening Prayer - sunset - night.

As can be seen from the program note, there are many aspects of the work that required a great deal of studio time, especially using the analysis and re-synthesis techniques I had developed in previous projects. A new element for me would be in the development of complex and sophisticated system of audio spatialisation based, in large part, on B-format Ambisonics (the first time that this process would be used in the context of the Spat library developed at IRCAM). Another major element would be in the form of an IRCAM developed sensor box that was being customised for the cowbell instrument of this piece, but which would not be done it time for the first performance. This in itself would be an intensely arduous experience providing insight not only into the process of hardware development and the unexpected difficulties associated with this endeavour, but also the political and sociological workings of IRCAM (and, by extrapolation, of other institutionalised settings in France).

An important aspect of this production which sets it apart form earlier experiences would be that James Wood had tangible studio experience and was actively performing concerts with electronics of his own music as well as other composers including major works of Karlheinz Stockhausen. The form of this collaboration would then be, theoretically, equal in terms of studio experience and activity. At the time of this collaboration I would be, in some aspects, the novice.

2.2.2 Research topics and major aspects of the work

Analysis and re-synthesis are prominent aspects in this work. The major addition is the use of analysis data, especially from the bird song, that we catalogued in its many forms and used as source material for audio and rhythmic aspects of the work. This was the first time, to my knowledge, that such a systematic cataloguing of birdsong had been undertaken. There are also many examples of morphing from alphorn to various English church bells (all these samples had already been recorded by Wood before arriving at IRCAM) using techniques developed with the Leroux project. A concurrent development of a sensor box with engineer Patrice Pierrot (later leading to what became the Eobody) (Wanderley et al., 1998) would be undertaken for the cowbell instrument. The development of a performance patch as well as a studio-based spatialisation tool (in Max) were also created.

2.2.2.1 Birdsong to Alphorn through AudioSculpt and Patchwork

Recordings of birdsong were digitised from cassette tapes, analysed in AudioSculpt in much the way that I had done in Leroux's work, then the data was imported to a customised Patchwork program I made to manipulate and visualise the data as seen in **Figure 8**. Once analysed and filtered in this patch, the data is filtered and normalised to create melodic scales and rhythmic forms for each birdsong. **Figure 9** is the result of a Bullfinch sample taken from the Patchwork patch as seen in **Figure 8**. Break-point-functions (BPF) were used to visualise the melodic/rhythmic quality of each sample. As part of the basic output, I created the classic Original, retrograde, inverted and retrograde inverted forms of each melodic line. These were then printed out and saved into a catalogue for the composer to reference. I also exported the various forms of the melody in MIDI files (**Figure 10**) used for triggering hardware samplers as well as for raw musical source material for the composition. The original audio sample of the Bullfinch can be heard in Audio Example 2.

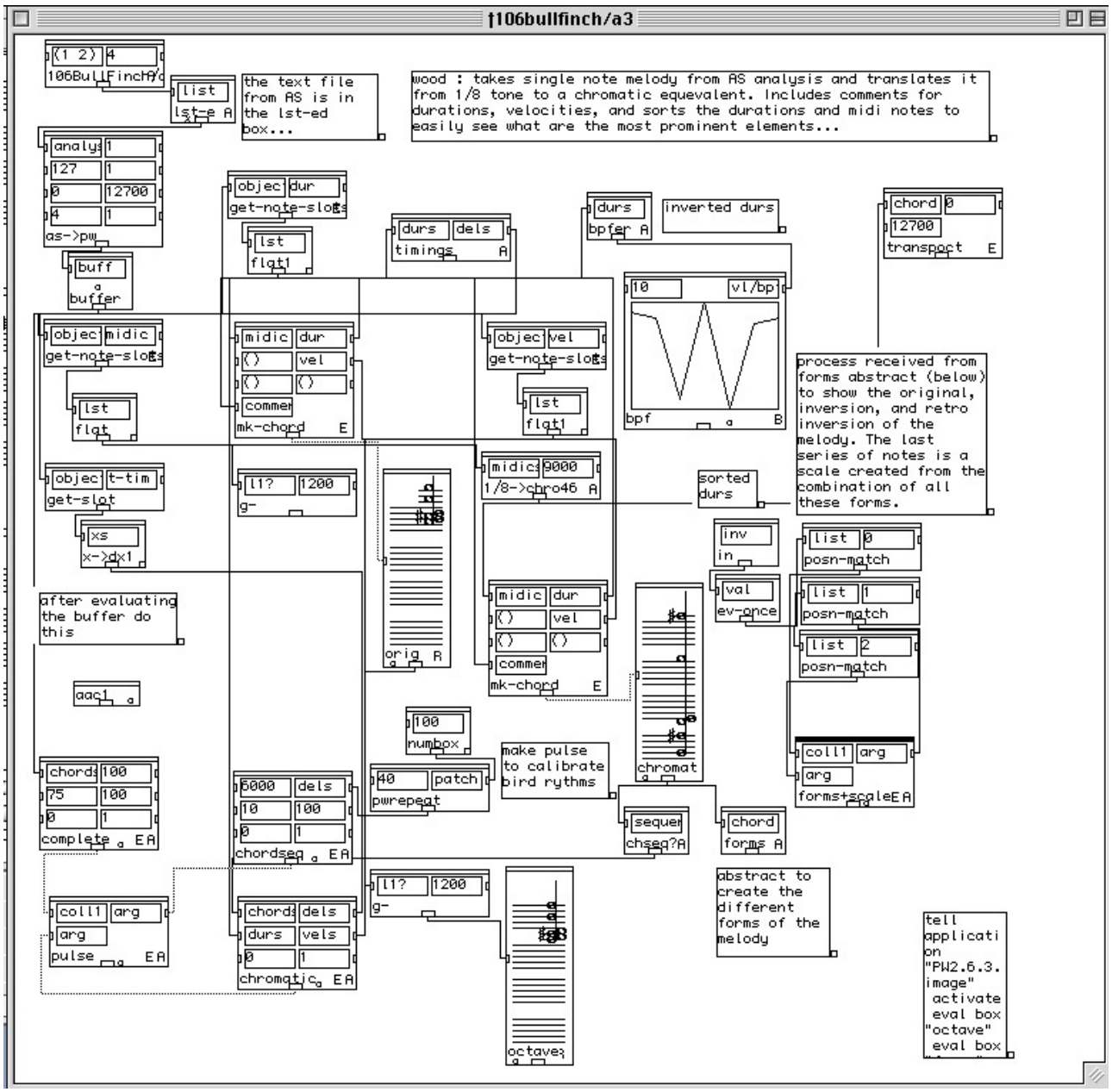


FIGURE 8. PATCHWORK PATCH CREATED TO DEVELOP AND MANIPULATE RAW DATA TAKEN FROM SPECTRAL ANALYSIS OF BIRDSONG

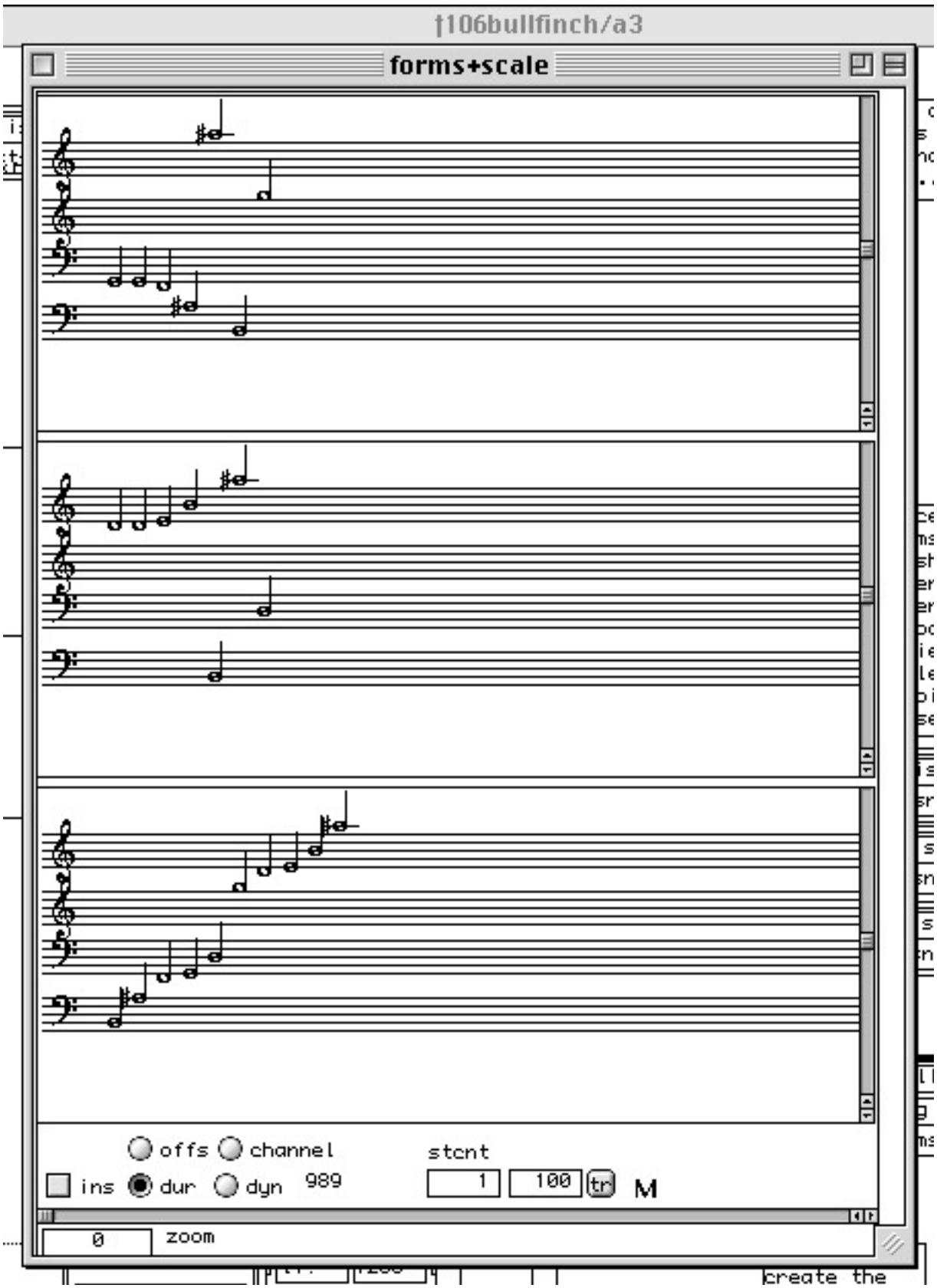


FIGURE 9. DATA IS FILTERED AND NORMALISED TO CREATE MELODIC SCALES AND RHYTHMIC FORMS FOR EACH BIRDSONG (THE ABOVE IS AN EXAMPLE OF A BULLFINCH TAKEN FROM THE PATCHWORK PATCH IN FIGURE 8)

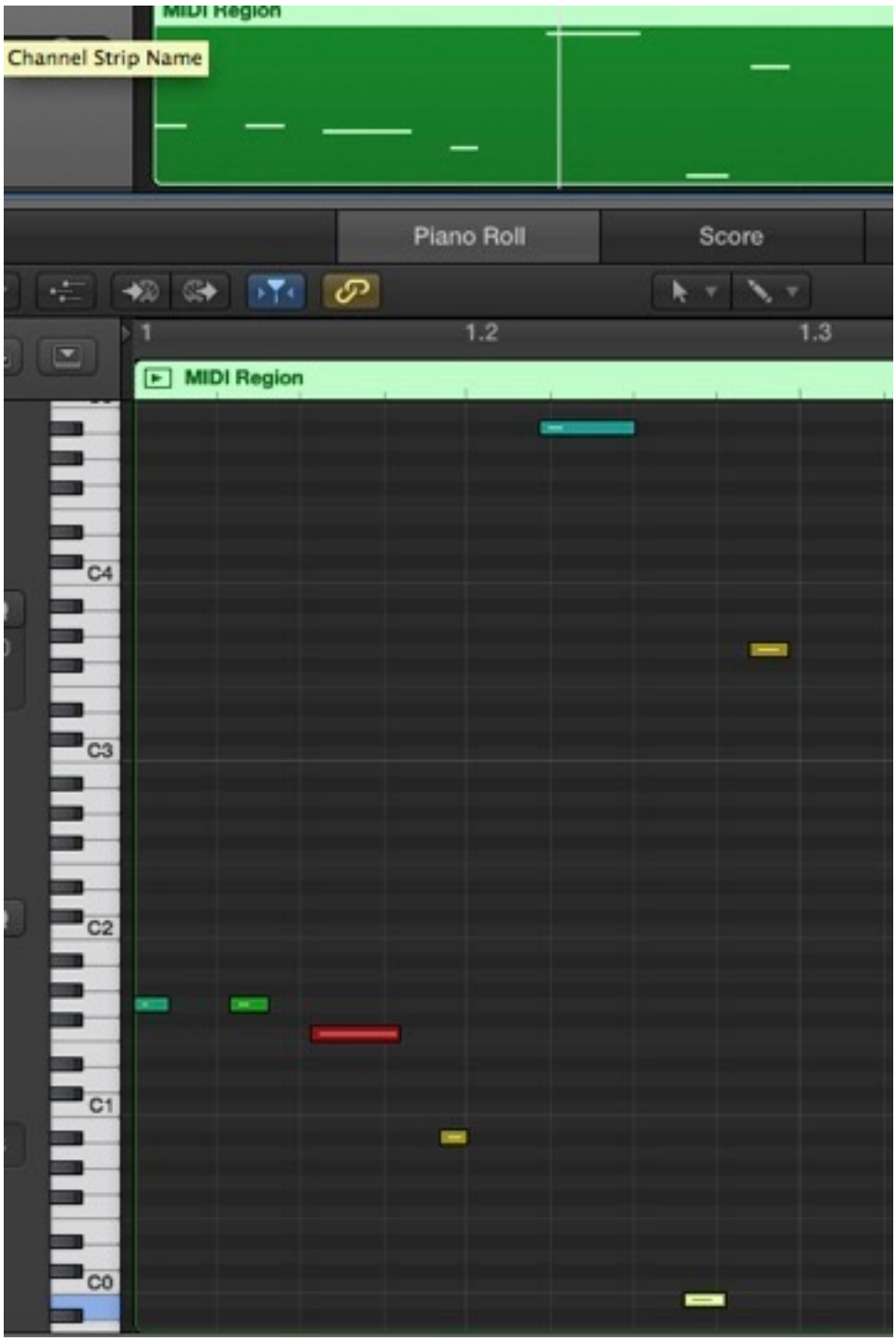


FIGURE 10. QUANTISED MIDI DATA OF THE BULLFINCH SAMPLE TAKEN FROM THE PATCHWORK PATCH IN FIGURE 8

While this was time intensive and a major part of the studio work, a number of unique sounds were created with similar morphing techniques as described in the Leroux project: church bell to alphorn (Audio Example 3), alphorn to shakuhachi (Audio Example 4), a hybrid alphorn/Bicester church bell (Audio Example 5) and a "bass" shakuhachi (Audio Example 6). These were all made through various manipulations of analysis and re-synthesis between AudioSculpt and Diphone.

2.2.2.2 Mountain Language through Ambisonics

Another important aspect of the work would be the advanced form of audio spatialisation needed to project the sources within the space. **Figure 11** shows an idealised map of the mountain peaks as described by Wood in his program note (this is from an early version of the original score). We needed a system that would control the sound in space not only in a circle but diagonally though the various points in any given combination of points (or peaks). At that time in IRCAM the Spat was being developed by researchers Jean-Marc Jot and Olivier Warusfel. A number of innovative parameters were available to play with as this form of spatialisation was meant to be open and at once practical/classical (pan-pot volume technique) as well as psychoacoustically relevant (reverberation times based on distances, perceptual EQ, reflection and radiation parameters to control finely tuned filters) some of which can be seen in **Figure 12**. The development had originally been on the NeXT computer system running Max under FTS, but was being ported over to Max on the Macintosh and I had an early version of the control interface that could be used to manipulate the audio DSP on the NeXT computer through MIDI protocols. While this was awkward, it allowed for some interesting work to be done in the studio.

As this was a new technology, a lot of time was spent in development of a viable method to take advantage of the resources. One problem involved a simple method to send sound from any point to any other point directly (without necessarily moving along the circumference). This was actually more complicated (at that time) than at first imagined. Jean-Marc Jot developed a method to do this specifically for this project (a version of this is shown in **Figure 13**), and I have used it ever since then on many other projects.

Parameters to control trajectories with azimuth, distance and even elevation were theoretically all available to use. I created a shorthand language for sending the Spat the parameters that Wood could manipulate himself (see Appendix C/Wood/Max development patches/**Space-Control-Wood* and the folders *Text data for SPAT* and *Text data for SPAT coded for Max* for raw data). Once the system was validated, we could synchronise sound playback and spatialisation, and record the spatialised sound on multiple tracks. At that time, multitrack recording was very much limited to the rather expensive hardware needed to interface the audio and to record to hard disk. Moreover, a real limitation became apparent during a concert situation when hard disk access time would be critical. And playing one or more freely triggered multi-channel audio files would be impossible. A solution came from the technique of spatialisation we would use.

James Wood had been exposed to Ambisonics through his work with UK-based sound engineer John Whiting who had used a hardware solution for recording and playback of spatialised sound. We had talked about this technique as one possible solution for the method

of spatialisation to be used and it was Jean-Marc Jot who revealed that they were developing Ambisonics coding and decoding modules for the Spat. Ambisonics is coded through source direction as opposed to speaker placement and it has a specific parameter for elevation (and some would say that it represents elevation rather realistically). This was reason enough for us to work with the technique. Another interesting aspect of the technique is the way that spatialised sound is coded onto three channels (front, side, elevation). The decoding process will automatically take into account any number of speakers from four upwards and then decode the spatialised sound for that configuration. We recorded the coded sound in three channel B-format to decode everything live in concert. This resulted in a non-negligible gain in performance with the playback systems as well as providing future flexibility of the piece to be performed with varying speaker configurations (there was one problem solved by an incredulous David Zicarelli when I asked him to fix the sfplayer~ object so that it would play three channel sound files, he did and it still works today). Many of the Max patches I developed for this process may be found in Appendix C/Wood/Max development patches. The first cue of the work, reduced to a stereo format, can be heard in Appendix C/Wood/Audio Examples/07 Wood Mountain Language ML01. In the same folder will be found examples of the Bullfinch birdsong, the Bicester church bell to alphorn morphing, the alphorn to shakuhachi morphing, the pitch shifted Bicester church bell, as well as the transposed shakuhachi all being transformed by me with Diphone. All the 3 channel Ambisonics format audio files to be spatialised in real-time during the concert are included in the concert patch folder - *Mountain Language 2000 Concert Max patch*.

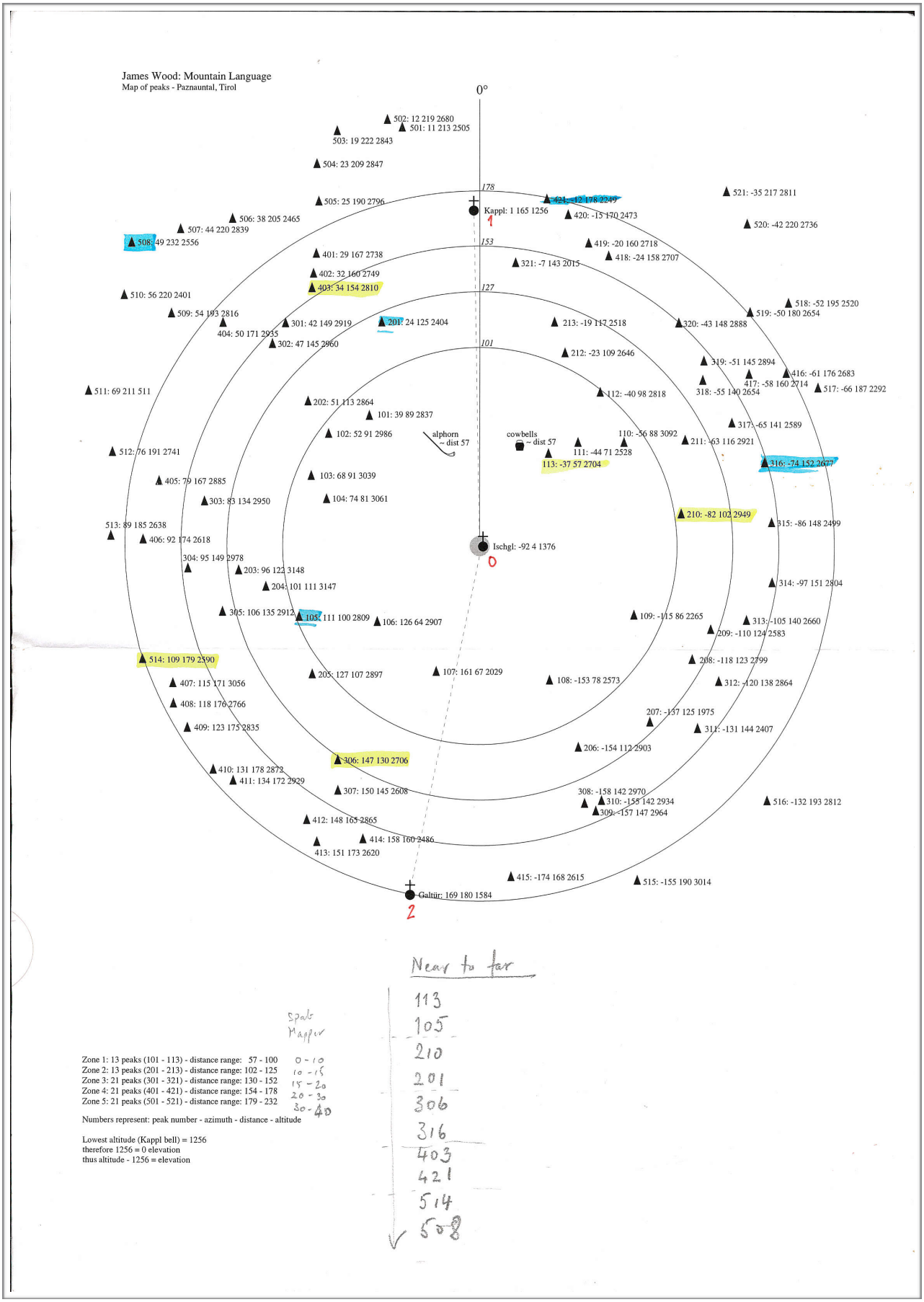


FIGURE 11. IDEALISED MAP OF MOUNTAIN PEAKS AS ARRANGED AROUND THE PERFORMERS. NOTE THAT THERE ARE NO INDICATIONS FOR SPEAKERS IN THIS DIAGRAM.

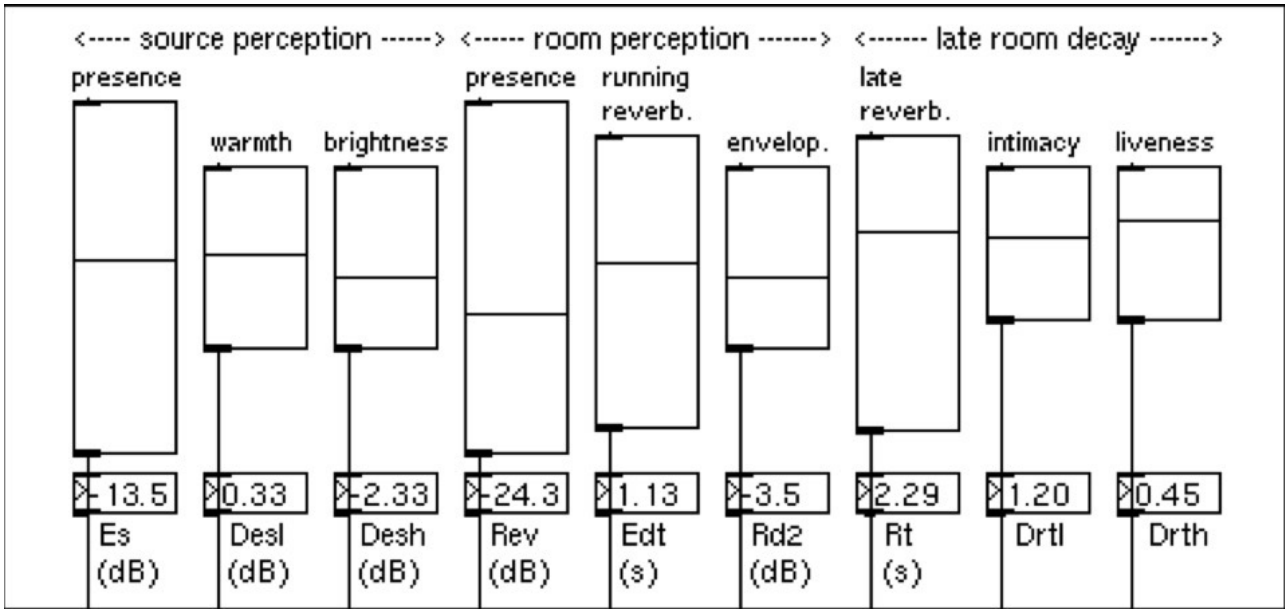


FIGURE 12. PERCEPTUAL PARAMETERS AVAILABLE IN THE SPAT AS DEVELOPED AT IRCAM DURING THE WOOD PROJECT.

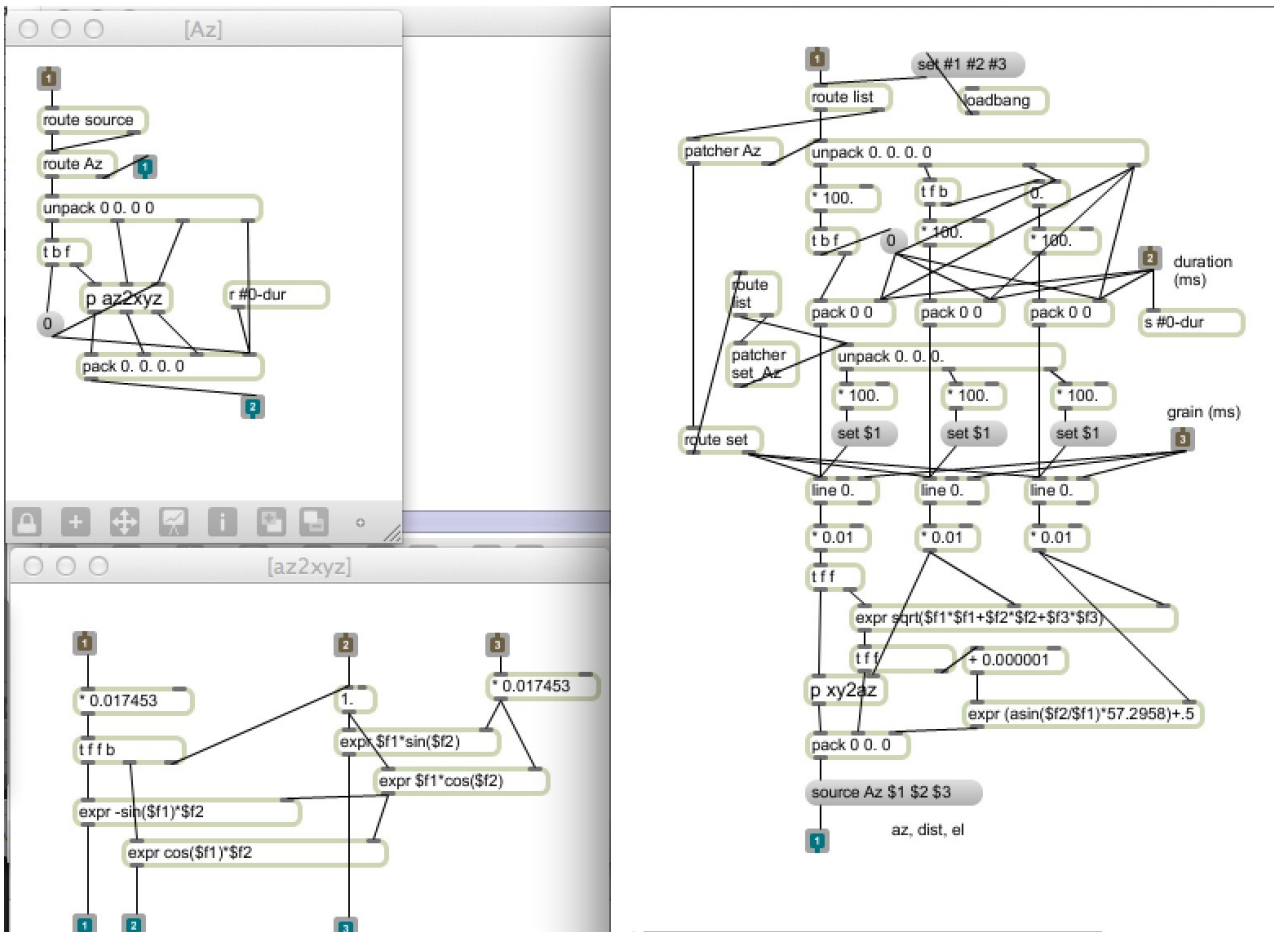


FIGURE 13. SPAT-LINE DEVELOPED TO PRECISELY CONTROL TRAJECTORIES THROUGH SPACE OVER A GIVEN TIME REGARDLESS OF THE NATURE OF THE PARAMETERS SENT TO THE METHOD (CARTESIAN OR POLAR WITH TIME IN MILLISECONDS). THE ORIGINAL PATCH MAY BE FOUND IN APPENDIX C UNDER WOOD/SPAT THE SPAT_LINE.

2.2.2.3 Making new instruments: The cowbell-o-phone

James Wood, as percussionist, was already experienced in customising unique percussion instruments. He brought with him 27 cowbells to create an instrument that resembled a vibraphone, but with cowbells (as seen in **Figure 14)**. Visually and aurally striking (and endlessly fascinating for audio treatments) we wanted to push this further and make a MIDI version of the instrument in which each of the cowbells could send out pitch/velocity pairs when struck, much like a MIDI keyboard. These triggers would be used to control external samplers during the performance. Existing solutions were deemed unreliable or unusable due to latency problems. The first idea was to develop this in-house as there was a general interest in having a reliable and flexible system for gestural triggering. We turned to IRCAM engineer Patrice Pierrot, with all the proper production permission, to develop a custom made interface capable of taking 27 sensor inputs. There were many technical and internal/political difficulties in this project. While some of the metaphysical problems revolved around events prior to my

arrival at IRCAM, I was quickly caught up in a serious imbroglio in which I learned as much about the functioning of cultural institutions in France as I did about the problems of latency and clock speed needed to constantly monitor 27 inputs. As mentioned above, an important part of this work would be found in further IRCAM-based projects and eventually become the basis for the commercially available Eobody, however, we never did get to use the IRCAM-based system (regardless of what is written in the notice of the score as seen in **Figure 15**).

An important learning episode for me centred around the importance of deciding when to end the research and ensure that the work would be performable for the deadline. While IRCAM is a research-based institute, the creative/production side is well developed and necessary for the life of the institution. By the time I had arrived at IRCAM, there existed a well experienced team of production personal, including the director of production, stage managers and recording engineers. Part of my responsibility as the in-house Computer Music Designer was to liaise regularly with this side of the operation. When we were a few weeks from the premiere of *Mountain Language*, and there was still no sign of this interface being finished in time, the head sound engineer brought in three Alesis DM5 Drum Modules (commercially available since 1995). We needed three as each had only 12 inputs. These modules were originally intended for electronic drums that would trigger internal samples, something we were not interested in, but they also had a MIDI out, and that we used. Being equipment meant for a large public and not an experimental project, the parameters are contrained, but this provided a certain comfort in having a manual and the assurance that, if configured well, it would work every time.

Finally, it was not easy to find the correct spot on each cowbell to place the piezo sensors (also commercially available form Yamaha). We needed to find the node for each very different object, and the tape/glue would also effect the sound. We eventually opted for breaking the plastic case around the sensor and using the bare metal on the cowbell. This was as much for reasons of placement as for mass and resonance damping.

The instrument did work in the end and has worked for further performances. I was also able to reuse the DM5s in future projects and they were used by others for many years after this project.

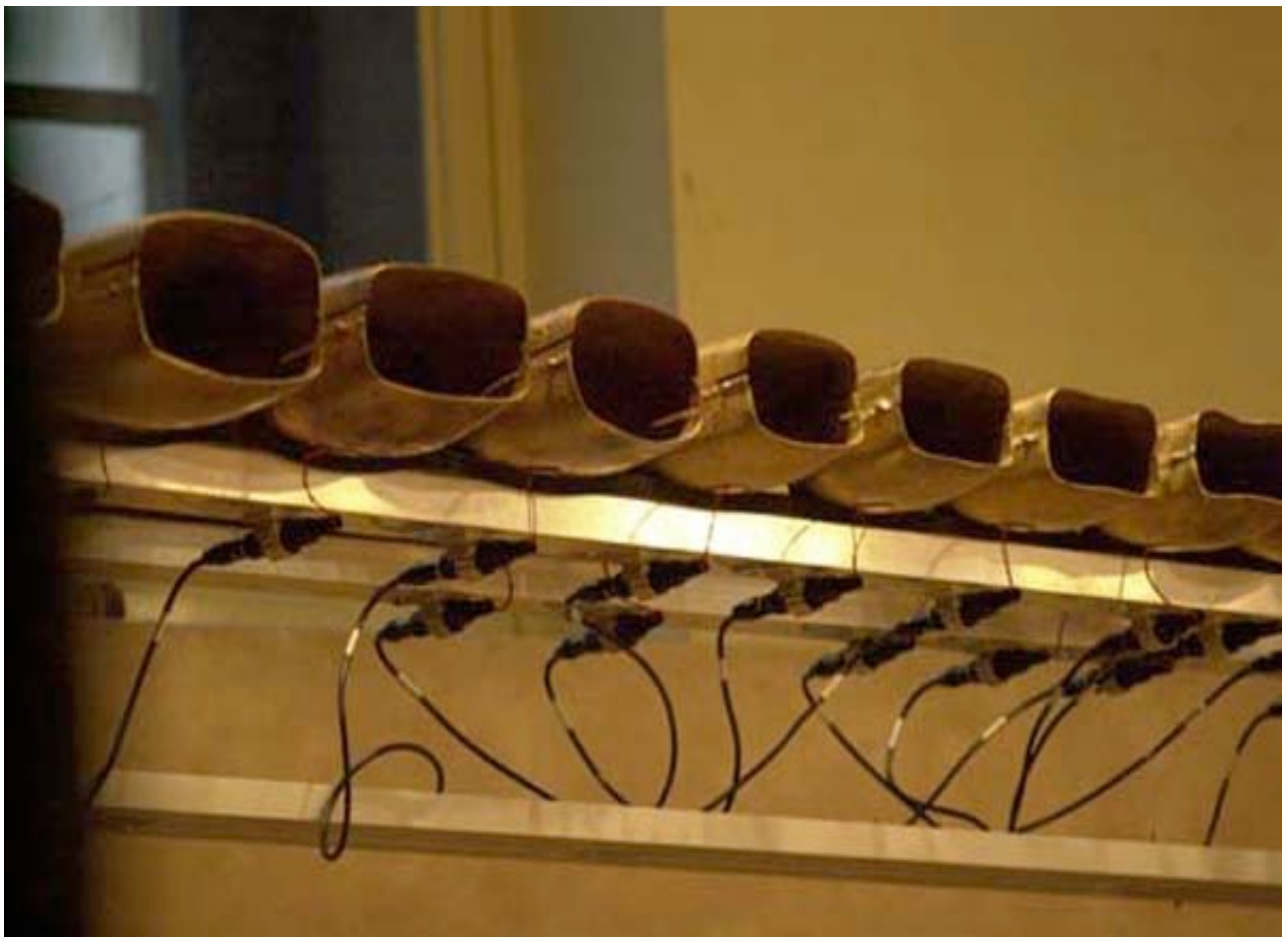


FIGURE 14. DETAIL OF COWBELL INSTRUMENT WITH PIEZO SENSORS ATTACHED.

James Wood

Mountain Language (1996 - 98)

Commissioned by IRCAM
Musical Assistant: Carl Faia

Instrumentation:
Alphorn (in F)
Cowbells (and rainstick)
Electronics (triggered from a keyboard by the director)

Duration: 25 minutes approx.

First performance: Académie d'Eté, IRCAM, 20 June, 1998
Solistes de l'EIC -
Benny Sluchin (alphorn); Michel Cerutti (cowbells) - directed by the composer

Acknowledgements

I am grateful to John Kenny, who recorded the alphorn samples which provided the basis for all the alphorn resyntheses used in the work, and for his help and advice regarding alphorn technique.
My thanks are also due to Patrice Pierrot, who developed and built the MIDI interface for the cowbells.
Finally I would like to thank Carl Faia for his work and sustained help throughout the eighteen months of production and realization of Mountain Language.

Principal electronic requirements

MIDI-interface for cowbells (27 inputs - 1 output) (IRCAM design)
2 EMU e-64 Samplers, each with 64Mbytes RAM, and each with its own media storage device (Jaz, Zip or MO Drive)
Power Mac with multi-channel Sound Card/Interface (eg Pro Tools III or Korg 1212I/O) - 4 outs needed
Max MSP Software
KX88 Master Keyboard (used to trigger Max, preferably by the director)
Max Patch and Sampler Disks available from the composer, together with the performing material

Amplification

4 microphones for cowbells
1 microphone for alphorn (optional)
1 microphone for rainstick (optional)
Possible Lexicon reverb unit for alphorn (depending on the acoustic)
8 Loudspeakers with appropriate amplifiers
2 Bass Bins

Mixing Desk

Inputs:	2 from e-64.1 (from e64 Main Outputs) 8 from e-64.2 (from e64 Main and Sub Outputs) 4 from computer 4 from cowbells 1 from alphorn (optional) 1 from rainstick (optional)
Total:	20 inputs maximum
Outputs:	8 to loudspeakers

Possible mixed-down foldback for performers

MIDI Lighting Desk

The lighting is controlled from the keyboard (via MIDI) as an integral part of the Max patch.
However the work can be performed without lighting if necessary.

FIGURE 15. NOTICE FROM THE SCORE OF *MOUNTAIN LANGUAGE*.

2.2.2.4 Creating the Concert Patch

The final step in most productions is the concert patch. While not really a final step as this needs to be carefully considered from the beginning of the production, it is where all the work will be funnelled through in the end. As this project used sound files to be triggered by the director (in this case, the composer) according to the score, a triggering system would need to be created to playback the sounds whenever triggered. As these sounds needed to be decoded into an 8 channel surround sound format, I needed to include these modules as well as the player specially developed by David Zicarelli for this piece. A click track was added and, for the first performance, a MIDI signal was used to trigger a pre-programmed DMX lighting board used to control dynamic lighting effects during the performance. The Max patch used for the performance can be seen in **Figure 16**. The sub-patch to playback and decode the files can be seen as well as the rather complicated system of preloaded sound files necessary at that time to avoid latency.

It should be noted that the project, like many at that time, was at the limit of what was professionally possible in terms of technology. We were the first to use Ambisonics like this, the first to have a large MIDI cowbell instrument that was truly playable, and it was rare to be able to walk into a hall and assure everyone that this would actually work. A lot of time and care went into every aspect of the work, but most especially the performance side of the project. We have all seen presentations ruined by technical problems and concerts cancelled or delayed because of uncooperative technology. The professional aspect of working at IRCAM meant, in large part, keeping this kind of incident to a minimum. That this could still happen even at IRCAM with all the resources available only points to the tenuous viability of live electronics creation.

As part of my growing understanding and experience of taking works from studio to concert, I began to develop a more draconian attitude towards testing. This has progressed to the point that I might consider it an aspect of design philosophy both at the technical level and the performative level. Part of this testing process involves the validation of a theory, such as the use of Ambisonics in both studio and concert environments. Several stages of Max patches may be seen in Appendix C dealing with the coding and decoding of this format: *Spat patches for coding Ambisonics files*. Preparing the work for concert and testing the viability of equipment to perform correctly under stress would be an important aspect of the development, in which faulty links in interfaces or software need to be found and corrected or rejected. This is waht allowed me to finally accept the use of a preexisting piece of equipment for the MIDI cowbell triggers (there is no harm in using something that already exists if it does what needs to be done). One final note on testing, and something not as prevalent as I think it should be, is

preparing a series of tests for rehearsals and concert. I make a special patch or subpatch (see the subpatch in the Wood concert patch, *ML2000-8spclik.maxpat*) to test MIDI inputs and outputs, audio inputs and outputs with a focus on routings when working with multichannel surround, and any other equipment that may be connected to the computer. This allows me to setup and test to my satisfaction. It also allows me and my colleagues to quickly find problems when they appear.

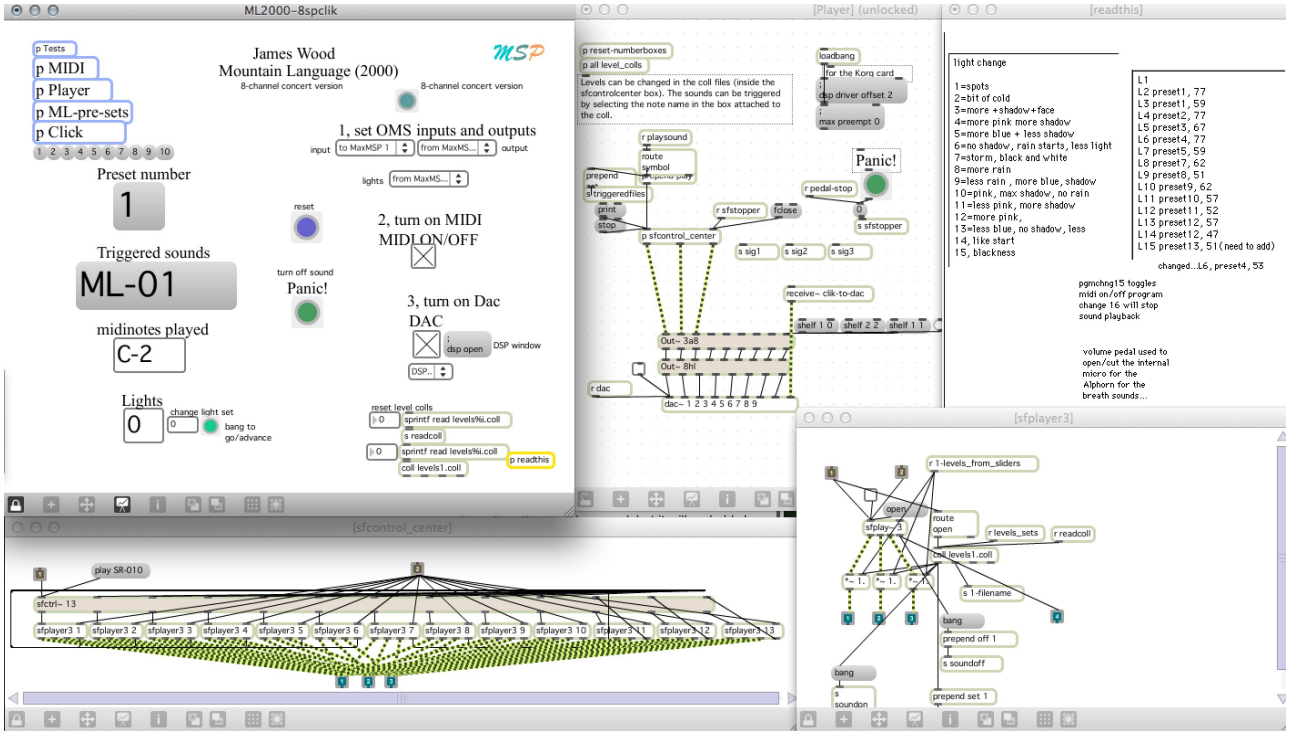


FIGURE 16. FINAL MAX CONCERT PATCH WITH SUB-PATCHES CREATED FOR THE PROJECT.

As previously stated, I create each Max patch from scratch, rarely recycling whole patches from one piece to the next. This is a time consuming process, but provides a certain uniqueness that is impossible, for me, to imagine with prefabricated methods in front of me. I believe that each piece is unique (part of defining creation). Forcing myself to start with a blank page is helpful in keeping with the spirit of each project. There is often a resemblance in methods used, though I will modify and develop one thing or another from work to work and this may or may not be noticeable form the outside. Indeed, the formal creation of a patch, the end result that will be the graphical interface used to control the patch, may also have certain similarities to previous patches. This has as much to do with habit, preferences, and a sort of "common practice" learned at IRCAM. In any event, the patches are created by me, though they are rarely protected from copying.

There is a promiscuity of ideas in the work that is being done with programs like Max or Supercollider or Csound. Who the author/creator is can sometimes be questioned. While I have a method of citing the name or source of a piece of code I use in a patch, this is not at all

a common thing to do. It is a situation that still needs to be clarified. This kind of blurred line comes as much from a collaborative activity as it does from a sense of hierarchical superiority, I believe. A simple response to this is to put the work that I do with someone else in the same domain as an author: in which case my work would then be copyright protected as a co-creator. But this, too, causes problems at the very least with administrative complications and, strangely even more complicated, with the author already recognised as author (in this case the composer). This is not a new problem and is as much tied to historical habit (the composer is often the only name in the program) as it is to institutional status-quo. The question has both a moral and ethical aspect that needs to be resolved. I will present one possible solution when I present the work done with Jonathan Harvey.

3. Advanced forms of collaboration and the end of IRCAM

I worked with many composers and performers during the five year period I was officially working for IRCAM. It is possible to divide the composers into two general groups concerning their relationship to technology. The first group would be those who were more or less incapable of creating on their own anything with technology (in whatever form), much like Phillippe Leroux. The second group of composers were capable of creating for themselves works with technology. They were invited to IRCAM and to work with me because they wanted to use some experimental technology being developed at IRCAM or the work itself was so complex that having a collaborator would be necessary, much like the work I did with James Wood or later with Alejandro Viñao. My experience since then confirms this general grouping of composers. I mention this because it does bear on the collaborative relationship I would have with the composer. Everything from explaining or presenting a technique or topic in relation to the work, or accepting a role as "programmer only" or advising on feasibility or tutoring composers are just some examples of how the collaboration might develop according to the experience and willingness of the composer.

As part of the duties of the IRCAM assistant (RIM, Computer Music Designer), we had weekly meetings to discuss projects, problems and schedules. From my very first days at IRCAM, there were also meetings with the direction (notably Laurent Bayle) concerning the status of the assistants. I went from just listening to my colleagues complain about the lack of recognition received for the work done, the amount of salary versus the number of hours worked, and the increasing demands to do more with less and do it faster, to becoming vocal and demanding as I became more experienced and understood the importance of the role we played in the structure of the institution. Briefly, these demands included a better and clearer name of our role (at that time we were called musical assistants), to have our names always associated with the works on which we collaborated (this would mean, in some cases, that it would be a contractual stipulation for composers or publishers), to have our biography in the back of the program along with the composer or performer, and to have a salary more in line with the role and the time that this role demanded.

In short, the direction pointed out the difficulty of dealing with composers and publishers if we were given official recognition as co-creators in any form (indeed, there was no clear precedent or existing job description for defining what we were doing in the studio), but they would make an effort to put our names in the program book and to add our professional biography (this would take years to become systematic) and they agreed that there should be a consultation to find a new name for the role itself. There was also a minor raise in salary.

It was during this moment that I had started work with James Dillon. We had met and started working on some ideas for what was to be the final work of a large cycle he had been working on for more than a decade. It would be a major piece, even by IRCAM standards. But during the last meeting I had with the production director, I resigned from my post in protest to what had been proposed. I was immediately hired back as a freelance artist to finish the work with Dillon. In the process, I gained the official status of musical artist in an uniquely French system created to protect and nurture cultural activity in the country.

3.1 Publication 3: Dillon, J. (1999-2000) La Coupure

Duration: 1 hour
Publisher: Peters, London
Cycle: *Nine rivers* V
Commission: IRCAM-Centre Pompidou, Ars Musica Festival (Brussels) and Archipelago Festival (Geneva)
Instrumentation: percussionist- multi-instruments, live video, live electronics
Premiere: March 11, 2000, Espace de projection at IRCAM, Paris, by Steven Schick.
Recording available via YouTube: https://www.youtube.com/watch?v=_g9R1-2I27Q

3.1.1 Introduction to the work.

James Dillon had been at IRCAM some ten years earlier working in the studios with Zack Settel for the creation of *Introitus for strings and electronics (1989-90)*. This piece, the eighth piece in the *Nine Rivers* cycle, used techniques and effects I would later incorporate in one form or another in the final work. A four track tape (noise-based with variations related to parameters based on pulsar data) and the live instruments are passed though a system of simple pan-pot type spatialisation by volume control itself controlled in realtime by the output of the logistic (chaos) equation. The hardware for the spatialisation at that time was the Matrix 32 (illustrious companion of the 4X of *Répons*). Control parameters were sent from a Max patch to control the Matrix in realtime. Also used were Yamaha effects like the SY99. I would later port this piece, and other pieces using less technology of the *Nine Rivers* cycle during the world premiere of the cycle at Glasgow City Halls in November of 2010.

The following is from the program note for a 2010 performance of *La Coupure* written by percussionist and dedicatee of the work, Steven Schick. The note is quoted in full for two reasons: firstly, it is a clearly detailed introduction to the work and its genesis and, secondly, there is no mention of me in the text (nor anywhere else in the program, for that matter).

> The etymology of the word river (in English) in fact contains a double and apparently contradictory history deriving from the French for both 'flow' and 'sever (or cut)'

River: [ME. – (O)Fr. Riviere] 1. A copious stream of water flowing in a channel towards the sea or ocean, a lake or another stream.

A copious stream or flow of (something).

Used euphemistically for the boundary between life and death 1790

River: [f. Rive] 2. One who rives–who tears apart, or in pieces, who severs, divides, or cleaves. To rend by means of shock, violent impact, or pressure. (Shorter Oxford Dictionary)

La Coupure, literally "the cut," is the central movement of James Dillon's massive Nine Rivers project, and precisely imitates the above 'double' image of the word river. Or to borrow from the epigrams of Heraclitus, it is a piece that is "united as opposites." The work flows seamlessly through time as a set of extrusions from a rich sonic substrate, and in every case the sounding of a percussion instrument interrupts, in essence cuts, the flow of sound and time.

The work is composed of nineteen precisely notated modules composed for a diverse set of percussion instruments. In a collaborative process involving the percussion soloist, composer, sound and video designers, these short set pieces are arranged in sequence and placed, much like rocks in a river, within the flow of the piece. Further cutting the flow are large bass drum events that trigger grand waves of sound, and a set of "collages." The collages are spontaneously combined excerpts from the modules. They are not improvisations, but rather instantaneously chosen cuts from the far-flung moments within piece. Since the collages often involve radical re-scorings--a cut from a vibraphone module suddenly comes to life on a set of junk metal instruments, or a drum moment might be heard on marimba--the soloist must be able to play any part of the music on any instrument. Therefore the piece must be memorised. The composer writes, "I go back to the 'conceptuality' of the word 'the cut' of the title, which not only cuts into the acoustic sound world with electronics but also cuts into the act of interpretation in a radical manner--interpretation is displaced by interpenetration."

The first performance of *La Coupure* took place at IRCAM in Paris in March of 2000 and toured briefly in Europe at that time. For various reasons the work has not been played since. With the obsolescence of the original technology over the course of years it became necessary to re-engineer the piece. In 2008 a team was assembled at UC San Diego, including the sound artists William Brent and Jaime Oliver, and video artist Ross Karre in order to re-conceive the substantial audio and video processing required by *La Coupure*. I am grateful to them as well as to my friend and valued collaborator James Dillon, for bringing *La Coupure* back to life.{Schick:2010wx}

This is a pertinent and informative program note. It does mention IRCAM, but not the person responsible for the sounds and the underlying technology used to develop, perform and validate the work itself. It does mention the "sound artists" involved in re-engineering the obsolete technology for the "new" version. But it does not mention me. As if all the hours spent, the creative energy given, the small and large battles fought – necessary in any creation –

and won, the endless small changes after each rehearsal or performance and the absolute trust given to allow this all to happen were for naught. More consternating still, I was also necessary for the development of this new version with the insight needed as to how or why something had been done within the work itself.

This, the lack of recognition, happens again and again because there are no rules for clearly acknowledging the work that we do in the context of a collaboration. It is also true that ego could play a role as might personality, but all that would be moot once an official status comes into being and the work is recognised officially for what it is: an integral part of a work that contributes to its originality.

3.1.2 Research topics and major aspects of the work

At its most basic, this is a work for solo percussion and live electronics. The context of the work, however, dictated that there would be more than instruments and effects. There were many extramusical influences starting with the Heraclitus fragments mentioned above, and including chaos equations, how a soliton wave moves in a concert space, role playing and gestural following. The spatialisation of the sound was also an important aspect to be developed as was the form and function of the stage setup. All this in the context of a work that was the centre of the cycle (number 5 of 9) and the first piece to use electronics in the cycle, thus creating a break (cut) with the previous works. The importance of this central and pivotal role would also be reflected in its length of nearly an hour.

Part of working with Dillon (more than other composers with whom I have worked) is being ready and willing to improvise and experiment (sometimes to total physical and mental exhaustion) with ideas until a consensus can be found. This was the case not only for the sounds created for the piece, the effects chosen, or the technology used, but also in the way the stage would be set up or the use of lights. I would liken this to a performer working with a composer until they play something the composer will eventually use in their work. Understanding what he was looking for could be difficult not because there was no communication but because the method of definition and the leeway given to "find" the sound, image or speaker placement was, I believe, vague and/or contradictory and done purposely for the sake of what might be "accidentally" discovered and subsequently used in the work.

Many of the experiments I did in the studio with the composer are used in the concert and may be found in Appendix C/Dillon/- La coupure 2000 Concert Max patch/Dillon-sound. The samples sources were recorded at IRCAM (res-wind-voice-8ch, jinglebells-8ch, soliton-8-spat), or sent by Steve Schick (Bull-roar-looped), or I found on the internet (at the 2:20 mark in the jinglebells-8ch file). Max patches for some of these sounds can be found in the *Audio experiments with Max* folder.

In any event, a lot of time was spent experimenting with every aspect of the work including video tracking (in a very primitive form at that time), spatialisation with speakers placed in non-equidistant positions, complex and unique sound sources needing to be carefully shaped, live video projection with multiple sources, gestural triggering from the performer, video screen placement and even the items we used for light projection in the work (there was an old cracked transparent projector stored in the corner of the studio that was used in the performance because of the cracked lightning-like shadow the projector provided on the back wall of the stage... It was necessary to commandeer and then store this projector for future performances). **Figure 17**, **Figure 18** and **Figure 19** show the original stage setup with details of screen placement, lights, speakers and cameras for the premiere. **Figure 20** is the original technical setup for the sound.

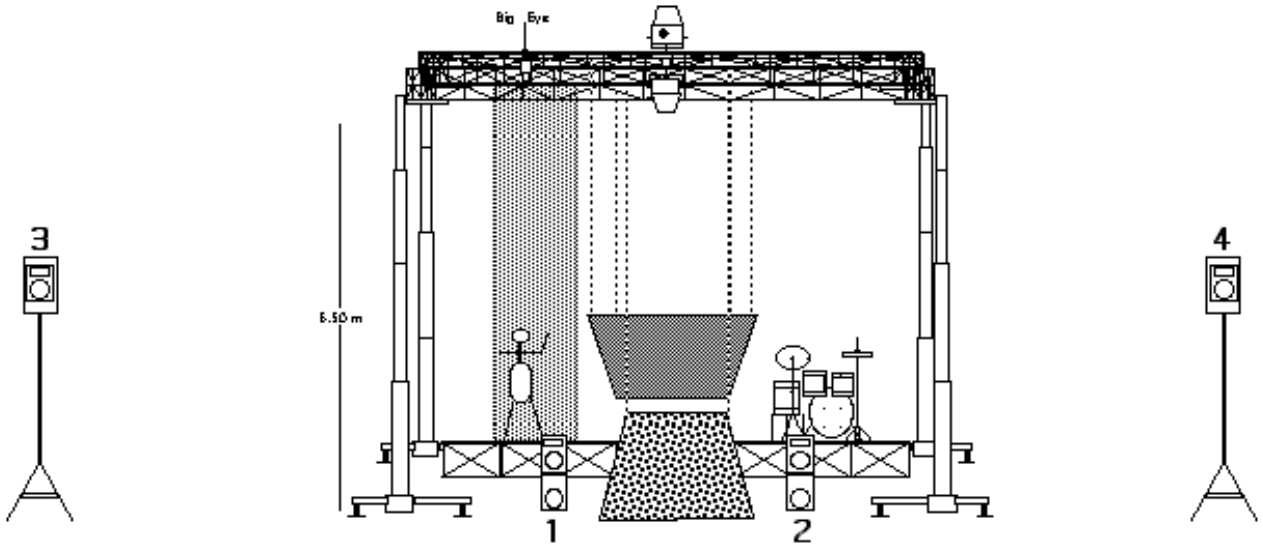


FIGURE 17. FRONTAL VIEW FROM FLOOR LEVEL SHOWING SPEAKERS AND VIDEO SCREENS AND PROJECTORS.

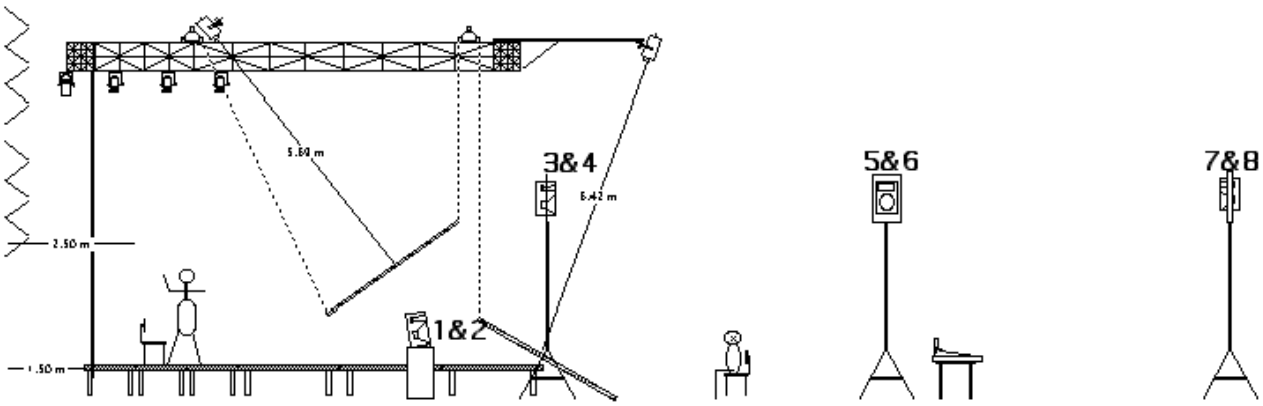


FIGURE 18. SIDE VIEW SHOWING DEPTH OF STAGE, PROJECTOR ANGLES, RIGGING AND SPEAKER PLACEMENT.

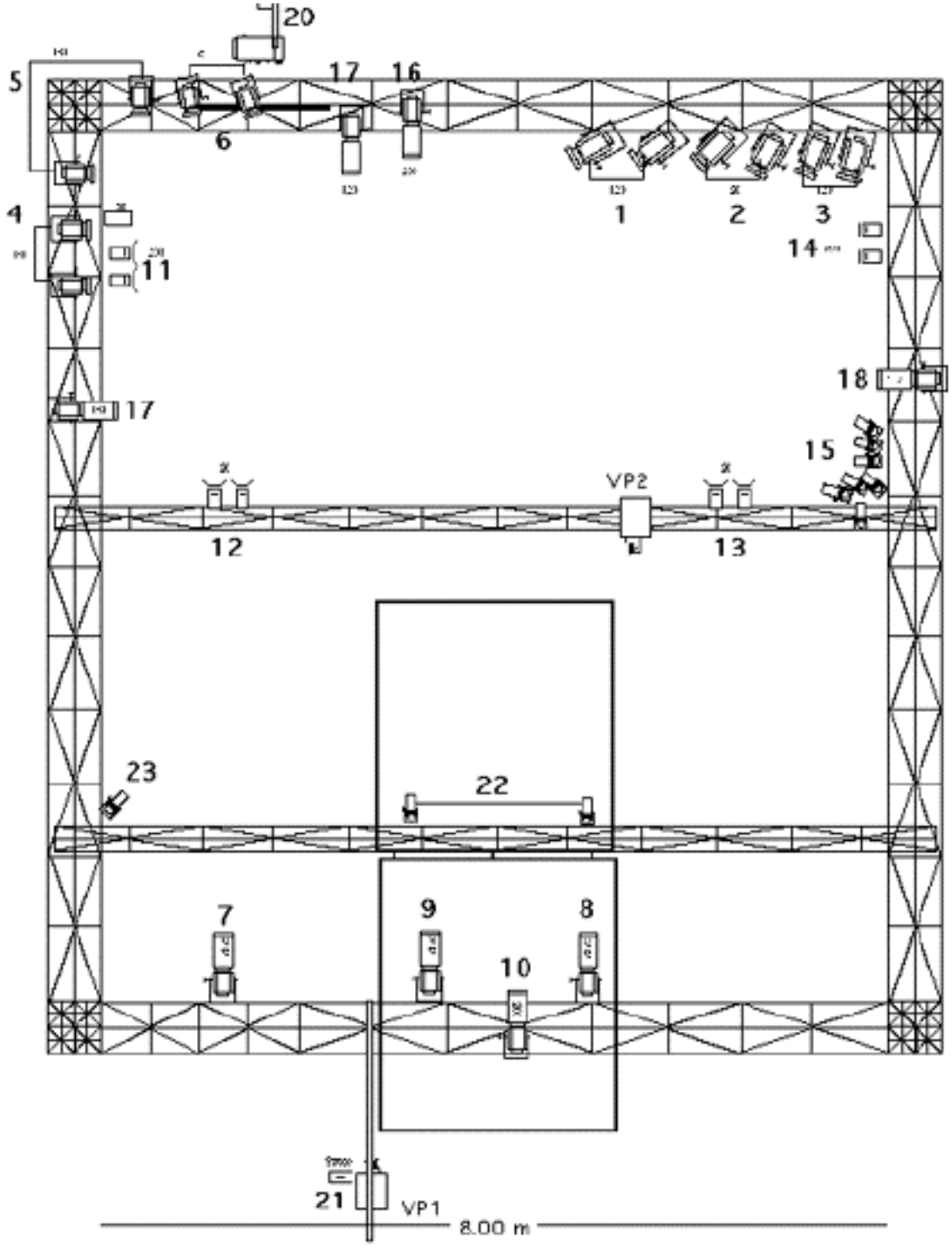


FIGURE 19. OVERHEAD VIEW OF RIGGING SHOWING LIGHT AND VIDEO PLACEMENT.

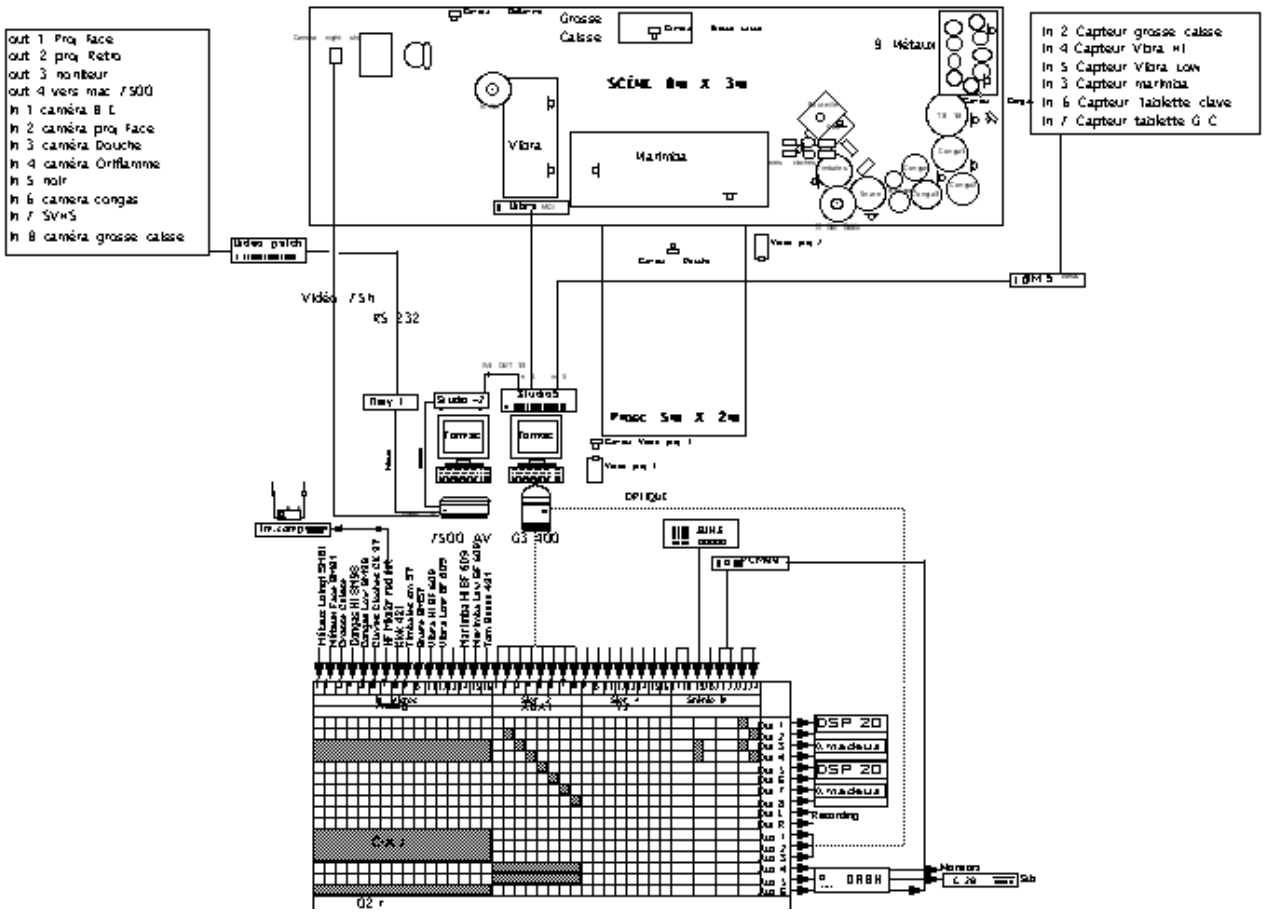


FIGURE 20. TECHNICAL SETUP FOR COMPUTERS, SENSORS, AUDIO AND VIDEO ROUTING.

3.1.2.1 Chaos and other formulae

There was a lot of discussion on the subject of chaos and non linear dynamic equations and how we might incorporate these in the work. *Introitus* had used the logistic equation

$$x_{n+1} = rx_n(1 - x_n)$$

running in realtime to control various parameters for effects and spatialisation in the work. We experimented with this equation and many others with special attention given to the general Navier-Stokes equation

$$\rho\left(\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla \mathbf{v}\right) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}$$

describing the dynamic motion of fluids or turbulent flow. The relation to water here is clear and unambiguous even though neither of us understood the actual implications of the math. It was possible, however, to experiment with various equations and parameters that in the end provided a number of important elements including MIDI files used to trigger samples in the course of creating larger and more complex sounds, defining triggers for a multilayer clock used to trigger various sounds and effects during the performance, as well as inspiration from the visual representation of the result from the equation itself. These manipulations and

visualisations were created in a Patchwork patch I made for the purpose as seen in **Figure 21**. Another version of the Navier-Stokes algorithm may be found in Appendix C/Dillon/ Collected Max patches (archival purposes)/my chaos-navier-stokes.maxpat.

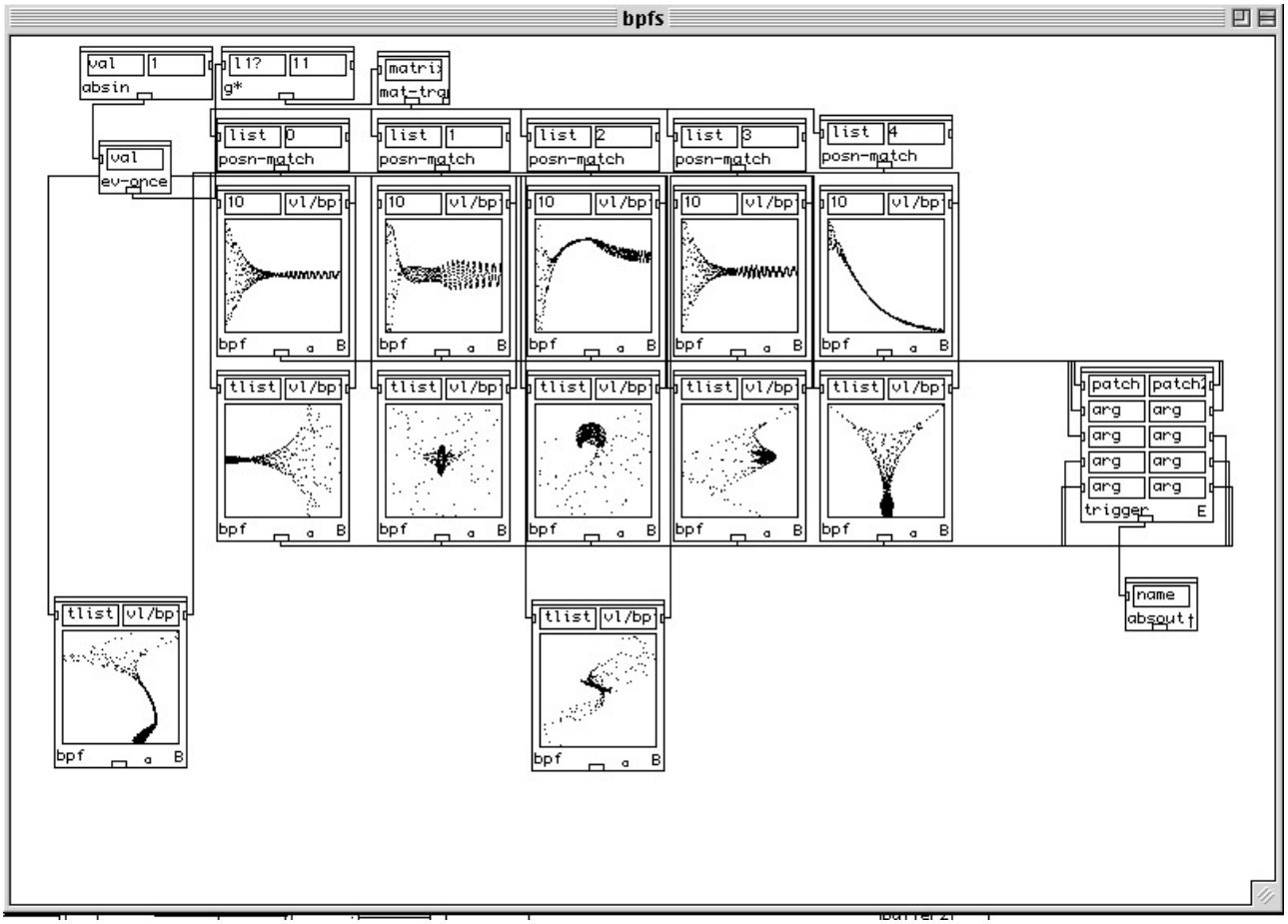


FIGURE 21. A TYPICAL GRAPHIC REPRESENTATION OF THE VARIOUS OUTPUTS FROM THE NAVIER-STOKES EQUATION.

3.1.2.2 Advanced spatialisation

It would be necessary to control the audio space of the concert hall. There were sounds flying though the space randomly (or chaotically), sounds that needed to move from front to back or back to front, and there was a need to surround the public with sound that would be near the threshold of acceptable. Experimenting with various kinds of spatialisation lead me to try a new technique developed by Ville Pulkki: VBAP (Vector Based Amplitude Panning) (Pulkki, 1997). The team working on the Spat at IRCAM were also developing an implementation of this technique to be used in the Spat environment. We were the first to use, and validate, these new modules in real-world concert situations.

While it was possible to move the sound around the space as I had with *Mountain Language*, I could also send various parameters randomly to control the elevation parameter, thus affecting the perception of the sound in space and creating a trajectory nearly impossible to imagine as it moves on a virtual sphere through what we would define as virtual speakers.

The basic tenant of VBAP spatialisation is that one defines the place of each speaker in the space. The VBAP algorithm is then used to calculate the correct loudness within a defined triangulation of any three speakers. Having the freedom to define the speaker placement - as well as the freedom to change these places at any time as long as one changed the correct parameters to the algorithm - allowed for the placement of the speakers in unorthodox positions (not in the typical circle, or square as is often the case). One interesting benefit of using this arrangement is that one may define as many speakers as theoretically necessary for the space. Thus, if the physical location of the speakers will limit the movement of a sound or create awkward trajectories, such as having a source move from left to right above the public when there is no physical speaker in that place, then it is possible to define a virtual speaker setup that will create a virtual triangulation used to calculate the trajectory using the available physical speakers able to create the illusion that the sound actually travelled overhead. While the VBAP method essentially calculates relative amplitudes, albeit in a sophisticated algorithm, my experience with the SPAT and the inclusion of VBAP technique in this environment allowed me to take advantage of the psychoacoustic parameters concerning reverberation, the simulation of distance, EQ of the source and the hall, as well as the more or less complex audio trajectories. A number of Max patches dealing with the development of this technique are available in Appendix C under Dillon/Spat development material (for archival purposes)/ Spat work.

This setup also permitted a large number of special spatial effects including moving from high in back to low in front or having independent sources moving in localised spaces in the front and the back of the space simultaneously. Another benefit of having realtime spatialisation is combining gesture to sound production (the action of the performer controls the amplitude of the trajectories, for example) and that at anytime during the rehearsal period, I could fine-tune or completely change the way the Spat would react to the player. While there were many sounds or gestures with defined movement relating to the composition of the work itself, there were also moments when the sound could be spatialised without any predefined movement. Again, I could do this easily and quickly with more or less elaborate detail in the concert patch created for the piece.

3.1.2.3 Video tracking (the early days)

There was a certain amount of research around some way to track the performer on stage with the possible result of triggering events or changing the patch though the movements of the percussionist. At that time there were not many viable solutions to this. Some work had been done with creating a controlled space with a combination of infrared sensors but this was limited and not reliable. Military-grade virtual reality systems were also researched, though

expense and feasibility ruled out their use. I finally decided on using the BigEye system developed at STEIM in Amsterdam. This was one of the earliest realtime video tracking systems available. Through various experiments, it was decided to use this system in a very limited capacity where the performer would play a "game" with objects on a black mat setup stage-right on the periphery of the concert stage. The camera used for tracking was attached to the truss overhead. The game worked by placing the objects in certain spaces, thus triggering samples according to the space. The system allowed the performer a certain freedom to act and react to the sounds being triggered and then to develop a mode of playing that appeared organic within the context.

BigEye used a camera (Sony with NightShot for infrared capabilities) to film the performer, transfer the image to the program for processing allowing me to capture data and use this to trigger sounds in an independent Max patch created for this purpose. I could also route this image to the projectors providing an overhead view of the performer on stage as he played this game. As a result of using BigEye as well as a number of other small cameras to provide a live feed, a separate computer was used to control the video from BigEye as well as the video matrix used to switch between sources: VHS prerecorded tape, BigEye camera, and several small cameras placed on stage and triggered through either a random algorithm, a predefined clock of triggers or by hand to capture a particular moment on stage. Some of the complexity of this setup can be seen in **Figure 20**. Big-Eye no longer exists, some of the Max patch experiments I did with the program prior to integrating it into the concert patch environment may be found in Appendix C/Dillon/Collected Max patches (archival purposes)/ BigEye control experiments.

3.1.2.4 Creating the Concert Patch

There were many complex sounds created in the studio for live triggering. Sources included a ProTools session sent by the percussionist of various personal instruments, a recording of Japanese girls murmuring, field-type recordings we had done of ice, die being thrown, and wind (actually coming through the doors of Studio 5) as well as a series of low piano harmonics from a Bösendorfer we had access to in the studio. Other sounds included small bells and low quality recordings from a bank of shortwave radio calls I had access to at that time (this came from Dillon's request of a live shortwave radio feed to be used in concert (judged impossible to accomplish in the context of the production, but may be heard at the 2:20 mark in the jinglebells-8ch file). I mixed each of these audio files in studio and then created multiple versions with the same Spat system that would be used in concert. The sounds, then, would travel though the space correctly as they had been recorded with the same system.

All of these sounds may be found in Appendix C/Dillon/- La coupure 2000 Concert Max patch/Dillon-sound.

Apart from these multi-channel audio files to trigger in concert, there were many other elements to account for in the concert patch. A number of effects were being used for the acoustic percussion instruments, notably delay and feedback effects, and a custom-made granular synthesis effect I had been working on since arriving at IRCAM. An interesting twist to this particular effect came in the form of a MIDI vibraphone placed at our disposal for the production (indeed, it was the only vibraphone available at the time). Apart from treatment and the spatialisation of the sound of the instrument, I could also use the MIDI data sent by the player (pitch and velocity pairs) to trigger live granular synthesis of a previously recorded section of the work recorded and loaded in a buffer and used as source material.

Figure 22 shows the concert patch as well as the multilayered clock used to trigger various elements within the piece at various times. The concert patch would be used to control the second computer through MIDI triggers (OSC was not yet there). The patch is interfaced with both MIDI and audio interfaces and an Alesis DM5 (one used previously for the Wood project) would also be used here. Triggers for the DM5 were placed throughout the stage for the performer to play at particular times in the piece (triggering the soliton sound by banging on the bass drum hanging from a truss at the rear of the stage for example) or randomly triggering a sample when he was improvising. The patch would also control the spatialisation of live and sampled sounds. For more detail on the architecture of the patch please see Appendix C/Dillon/- La coupure 2000 Concert Max patch. There are also graphics available in the *Dillon La coupure graphics* folder. One note on the continuing development of my design philosophy ay be found it the sub-patch initialisations. The ability to quickly reset and put everything back to an initial state becomes more important when a work has so many moveable parts, as does this one. A "panic" button to stop everything (sound/MIDI/video) is used here as is a collection of level (volume) controllers for the gain of each effect and output (upper right hand corner in Figure 22). This becomes more present in my programming to the point that I will often have an external controller in mind for manipulating internal parameters when I start working on a patch.

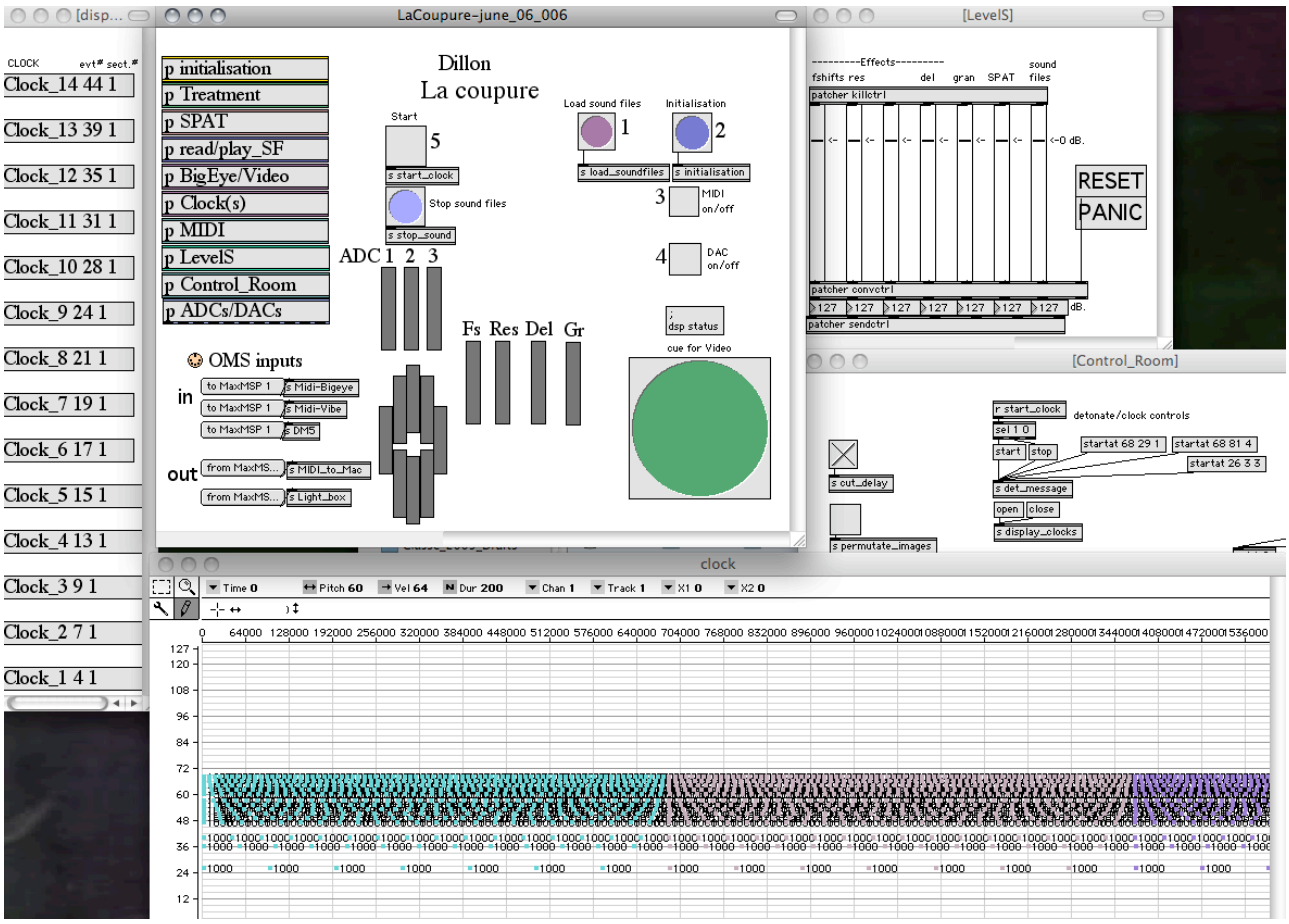


FIGURE 22. FINAL CONCERT PATCH FOR *LA COUPURE*.

3.2 Publication 4: Stockhausen, K. (1965/1999*) Solo

Duration: 15 minutes
Commission: Art Zoyd Studios
Instrumentation: basset horn with live electronics
Premiere: May 19, 1999, Espace de projection at IRCAM, Paris, by Benny Sluchin: Trombone
* New version with my Max program and score realised by Benny Sluchin. (Sluchin, 2000)
Commercial recording of later version with Serge Bertocchi on alto saxophone: Impossible records, 2010. (Ensemble Itinéraire, 2010)

3.2.1 Introduction to the work.

Among the varied activities of a Computer Music Designer, one might find porting (transcribing or translating or updating) works created with outdated equipment or techniques to contemporary technology. This might primarily concern work done by themselves using

computer music programs that have become obsolete or impracticable or when pieces required outdated hardware equipment, such as the Yamaha SY99 used in many pieces from the 1990s, as a source of audio treatment. I have done this kind of work many times over the years with my own work as well as others. One of the first experiences I had was in porting Luigi Nono's *A Pierre. Dell'Azzurro silenzio, inquietum* (1985) for bass flute, contrabass clarinet and electronics to MaxMSP in 1998/99 (Battier, 2001). The work relied heavily on analogue hardware filters with a special colour and steepness, and these were costly to travel with and hard to find. As the technique for the effects was extremely well detailed in the note to the score, it was possible to design filters of similar qualities, through a system of analysis and comparison, using digital technology. It is now possible to perform this work, with relatively simple technology.

In the same period, I was asked by *Ensemble Intercontemporain*'s trombonist Benny Sluchin to update a version of Stockhausen's *Solo for a Melody Instrument with Feedback (1965-1966)*. Porting or realising the work had began with Cort Lippe on the NeXT computer equipped with the ISPW cards, but had not been completed. There were still a number of technical barriers, not least of which included the minimum amount of memory (for feedback) necessary to mimic the length of tape necessary to perform the piece. (Sluchin, 2000)

The original work requires a custom made tape machine capable of six different delay times and necessitates several assistants to perform the piece (as well as the instrumentalist playing the work) as can be seen in **Figure 23**. The score and instructions are extremely well detailed as is the formal aspect of the technical requirements. As was common for the composer at that time, there are also elements left to interpretation and randomness. It would be necessary to port the work now to the new version of Max with audio on the Macintosh and complete the programming to include the random fading required in the score's instruction as well as effects also required in the score.

FIGURE 23. *WEST SQUARE ELECTRONIC MUSIC ENSEMBLE* **AT ST. JOHN'S, SMITH SQUARE, LONDON, OCTOBER 1981. (FROM LEFT TO RIGHT, BACKGROUND: JONTY HARRISON, JOHN WHITING, BARRY ANDERSON, MARCIO MATTOS; MIDDLEGROUND: STEPHEN MONTAGUE, CHRIS STUBBS; FOREGROUND: PETER WALTON); IN THE FOREGROUND CAN BE SEEN PART OF THE VARIABLE MULTI-DELAY TABLE BUILT FOR STOCKHAUSEN'S** *SOLO*. **(***PHOTO: NARESH SOHAL***)** (Emmerson, 1991).

3.2.2 Creating the Concert Patch

Working with the performer in close collaboration, we made choices on how to realise the score as well as how to implement the different effects and the various random actions called for in the score. While memory was still extensive and limited, we were able to have the 45 seconds required in the FORM 3 of the work. **Figure 24** is the section we performed for the premiere of this piece at IRCAM. Other versions would later be realised with the same patch for various instruments including oboe, saxophone and most recently ondes Martenot. An excerpt of the version for trombone can be heard in Audio Example 9 and one for saxophone in Audio Example 10 (played here by Serge Bertocchi). The patch as used by the performer can be seen in **Figure 25**. There are two versions of this patch in Appendix C/

Stockhausen/Stockhausen Benny. One is for trombone and the other for oboe.While the patch architecture is similar, the details are different. This idea of controlling the motor of the patch (in this case the system of recording and playback) while varying details of timing, routing and the addition of arbitrary effects is one I have much appreciation for in developing my work. For comparison, a newer version of this patch is available in Stockhausen-Solo-Ondes folder. The interface is simplified and the addition of an external controller for starting and stopping and controlling gain levels allows for more independence of the performer. Again, an important aspect of my design philosophy. An audio example may be heard of this work in Appendix C/Stockhausen/09 Stockhausen Solo (excerpt)-Benny Sluchin.

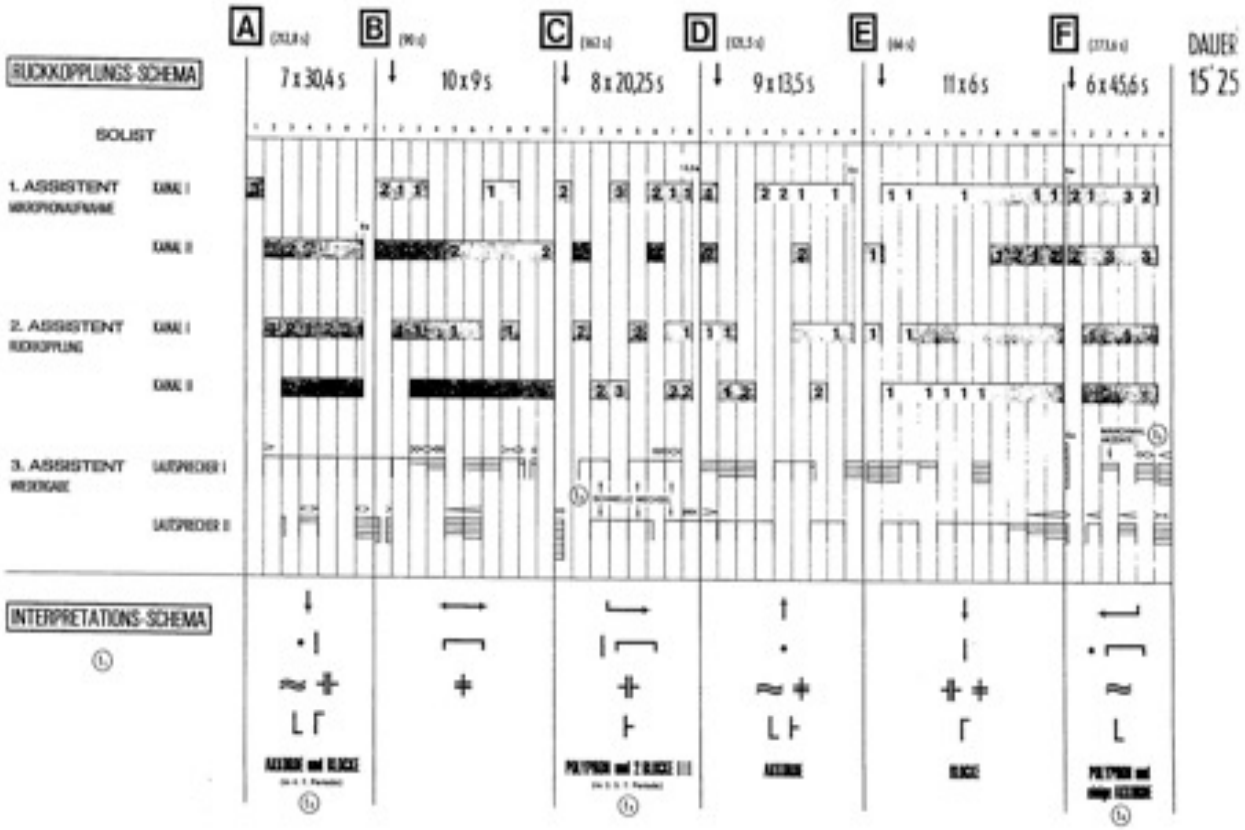


FIGURE 24. PLAN FOR FORM 3 FROM STOCKHAUSEN'S *SOLO*.

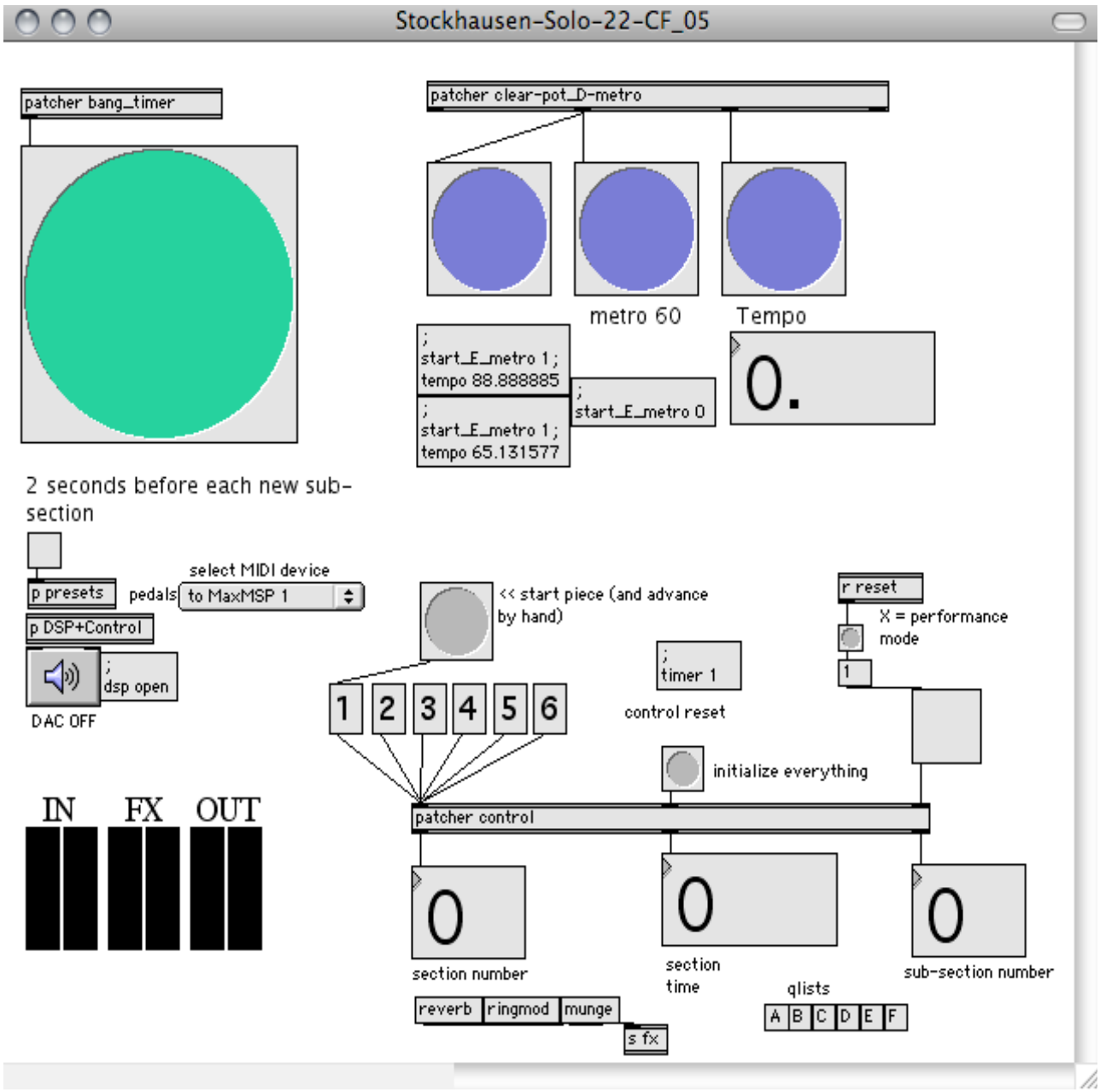


FIGURE 25. CONCERT PATCH FOR *SOLO*.

4. CIRM to Freelancing

4.1 Publication 5: Harvey, J. (2001) The Summer Cloud's Awakening

Duration: 32 minutes
Publisher: Faber Music
Commission: New London Chamber Choir and Oxford Contemporary Music for the 20th anniversary of the choir.
Text: Richard Wagner, Shakyamuni
Instrumentation: 4 voice mixed choir [SATB], flute, cello, electronic keyboard / MIDI / synthesiser [with two technicians]
Premiere: April 12, 2002, Sheldonian Theatre, Oxford, United Kingdom, by the New London Chamber Choir and members of the Critical Band, directed by: James Wood.
Commercial recording: Hyperion, 2011. (Harvey, 2011)

4.1.1 Introduction to the work.

I first met Jonathan Harvey at IRCAM while he was teaching a course in the pedagogy department in 1997/98. We kept in contact and when I was named studio manager for the CIRM (Centre International de Recherche Musicale) in Nice (one of the few studios labelled Centre National de Création Musicale by the state), I suggested we do something together. The opportunity presented itself through a commission by the New London Chamber Choir and its leader, James Wood, the following year. We began work on the project in early September of 2001. The following program note, written by Harvey, is found in the notes to the score and is to be used for each performance of this piece.

> Commissioned by the New London Chamber Choir and Oxford Contemporary Music to mark the Choir's 20th Anniversary and funded jointly by the New London Chamber Choir and Southern Arts. The work was made possible by the co-production of CIRM (Centre National de Creation Musicale) and the association Art de la Napoule Realisation technologique CIRM. Asked to contribute a major new piece (it's about half an hour long) to the New London Chamber Choir's twentieth anniversary year, I was delighted that James Wood was very keen that I have the opportunity to incorporate sophisticated electronics, even arranging for me to work at CIRM in Nice with the brilliant sound designer and composer Carl Faia. My debt to them both is great indeed, as it is also to François Paris and the Studio. The electronics are, as a result, an elaborate part of the argument, with dramatic 8-channel spatialisation of the recorded sounds, choir and instruments (which are flute and cello). The sound is chopped up at speed and flung around and above the listener, often in canonic formations. Huge clusters of sound ('clouds' and 'mists') are created from the voices and instruments. Some sounds are recorded, but many are created in real time. Everything is based on the relationship of a brief phrase from Wagner's Tristan

> and Isolde to the Buddhist vision of reality. The Wagner phrase is stretched out from 12 seconds to 5 minutes - the 'longing' of the Wagnerian phrase so achingly long that it seems almost motionless. The text is 'Must the day waken Tristan?' Much of the music is based on notes from Wagner's phrase, and there are enigmatic human dramas enacted in response. The Buddhist texts are from the Buddha and the Buddhist text, the Diamond Sutra: they aim to awaken man from the dream through which he views the world. The fleeting, impermanent self and objects we grasp at as reality are like 'a flash of lightning in a summer cloud', 'a flickering lamp' or 'a bubble in a stream'. The work has a ritualistic form, demarcated by Buddhist temple instruments, played by the singers. The cellist plays an extra instrument as well: 'prepared' cello. This has two each of the bottom two strings: two G-strings and two C-strings - all tuned an octave down, giving a deep, strange, hieratic sound. (Harvey, 2002)

While this is at once an informative program note and explanation of the impetus behind the work, it is also notable in that it mentions me by name. A signal and an important moment in my professional experience that has had a lasting effect. The fact that this note is part of the package that goes along with the score entails that I am also part of the concert experience and, at minimum, mentioned in the program note. In other words, it is relatively difficult to disassociate my work with the piece itself in the public's eye. Something quite different than experienced with other composers as I've noted above. This recognition is a necessary step, I believe, in the path to correctly acknowledging the role exercised by the Computer Music Designer in a collaboration.

4.1.2 Research topics and major aspects of the work

While it was not possible for him to do much of what would actually be heard in the electronic music of the work, Jonathan Harvey's deep curiosity and closeness to the subject allowed him to influence the creation of electronic elements unlike any composer I had worked with up to this point. The working relationship that developed between us carried with it a strong professional and personal rapport. I would, at times, be performing a patch (such as running though some live granular synthesis program I had made) and he would listen carefully, suggest a minor variation or ask if something would be possible, I would record the output and he would use this as part of the final work.

Concerning studio sessions, I developed a way of working with Harvey that has continued to influence my activity in collaboration. Because of his curiosity and willingness to improvise with live electronics, I created several independent patches for him to use alone in the studio (with simple parameters to manipulate and a method to record the output) and he could spend as much time with the program as he needed. The result would then be kept, thrown away or edited into a more complex whole for the final work. This working method

that we continued together with later collaborations is part of an approach that I have developed and attempt to implement for almost every production.

Several aspects of the work required theoretical and empiric research including the different types of spatialisation, the live granular synthesis technique developed for this piece, the use of granular synthesis to control a unique form of spatialisation, cross-synthesis techniques, as well as the use of harmonic clusters created with a bank of realtime harmonisers I programmed in the final patch. Advanced analysis techniques were used on samples Harvey had brought with him of various choir voices. Some of this data would be used by Harvey, after filtering and normalisation of the harmonic and rhythmic data (as in the work I had done with Leroux), as source material for the composition.

The opening of the work is based on the dilated sample of a Wagnerian melody that Harvey had recorded with the choir. Techniques at that time were being developed for extreme time-stretching, but nothing would allow for a result that kept the richness of the original sound after dilation. I would use AudioSculpt in an empirical (and brute) fashion to analyse and re-synthesise the extreme time-stretched sound. The end result was then analysed again for harmonic and rhythmic content used by Harvey to compose the first five minutes of the piece. The resulting sound was then mixed with other sounds, spatialised and recorded in studio to an 8-channel pre-spatialised sound file triggered at the beginning of the piece, and can be heard in Appensix C/Harvey/01-opening-s8+rev.

4.1.2.1 Tools for composers

As a result of our discussions and the interest Harvey had in experimenting with the techniques I presented, I started to makes small independent Max patches for the composer to "play" and to record the outcome. These patches were created based on ideas coming out of our work together. This seemed at once a practical and organic method to proceed. Harvey was comfortable with these new "composing tools" and I could continue creating the concert patch or mixing and editing sounds used in the final work as he composed in the adjacent studio.

This particular method of working, making small modular patches with an intuitive GUI for the composer to use independently, became a general working method for me. A close collaboration allowed for a working method where all the various elements of the work coalesce into a final object impossible to dissect into respective authorships. This, for me, is the most rewarding of collaborations. While both parties have clearly defined territories (composing the work or creating the program to perform the electronics), a more or less large part of the final work will carry traces of each participant. The musical notes written and the final form of the score will be influenced by the preparation and progression of the work in the studio, adapting to and influenced by impossibilities or transforming as chance discoveries

are encountered. The needs of the score will define, in part, the form of the final patch integral to the presentation of the work. The opposite may also be true – the patch will define the presentation/composition of the work. .

Examples of the patches designed for Harvey to use in creating some of the source files to be mixed and played back along with the live sound can be seen in **Figures 26-28**, while an independent multi-channel mixer can be seen in **Figure 29** (at that time, it was easier to make 8-channel sound files in Max and simply mix them in realtime than it was to create a multitude of independent tracks for bouncing in a sequencer program). The IRCAM Spat is used in one of these examples and a simplified interface for the composer can be seen in **Figure 28**. A collection of these patches and others used by us in the studio may be found in Appendix C/ Harvey/Max Patches.

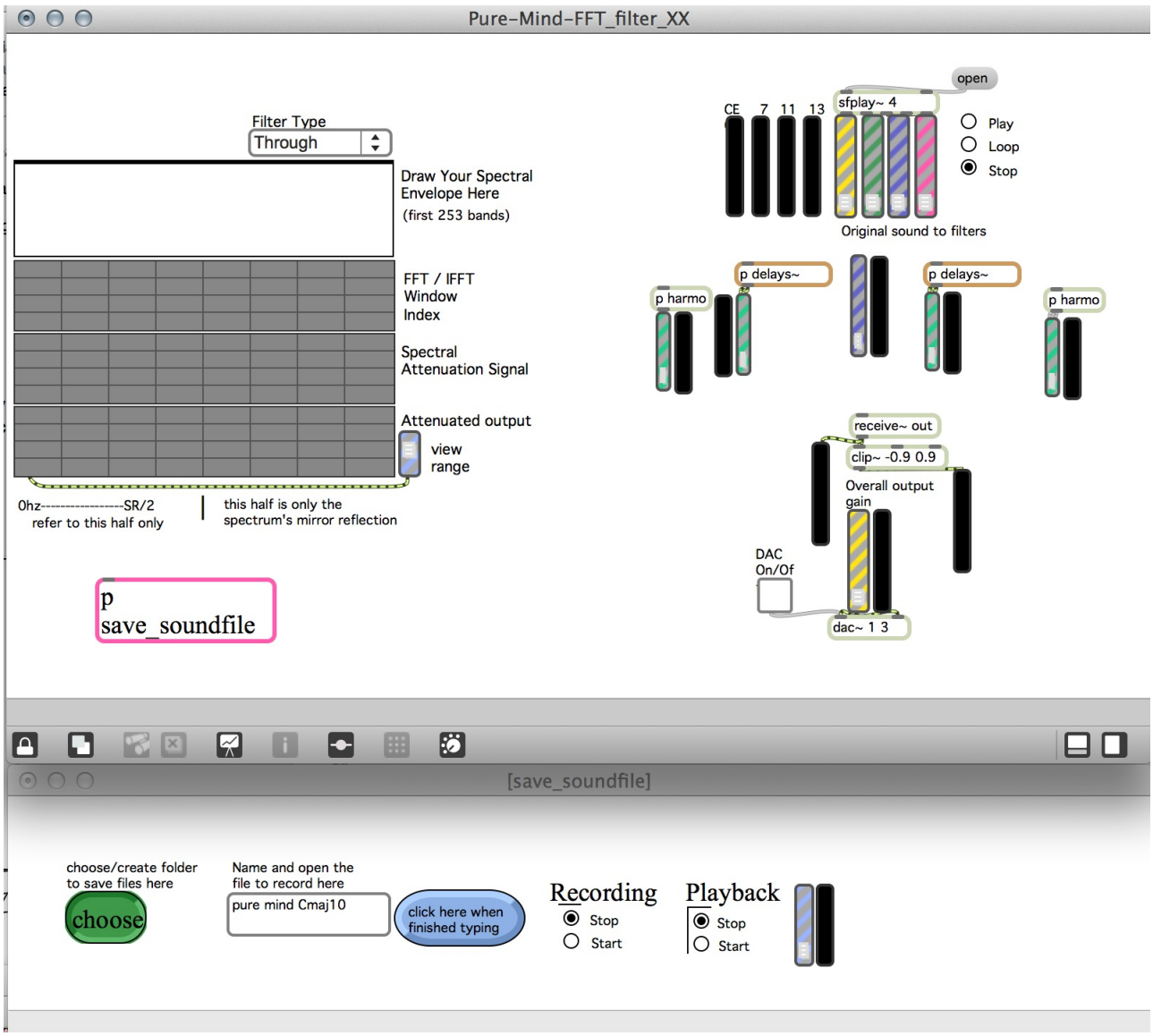


FIGURE 26. INDEPENDENT PATCH CREATED FOR THE COMPOSER TO EXPERIMENT WITH AN ADVANCED FORM OF FFT ANALYSIS AND RE-SYNTHESIS WITH VERY FINE-TUNED FILTERS CONTROLLED INTUITIVELY ONSCREEN (BASED ON A PATCH IN THE MAX PACKAGE).

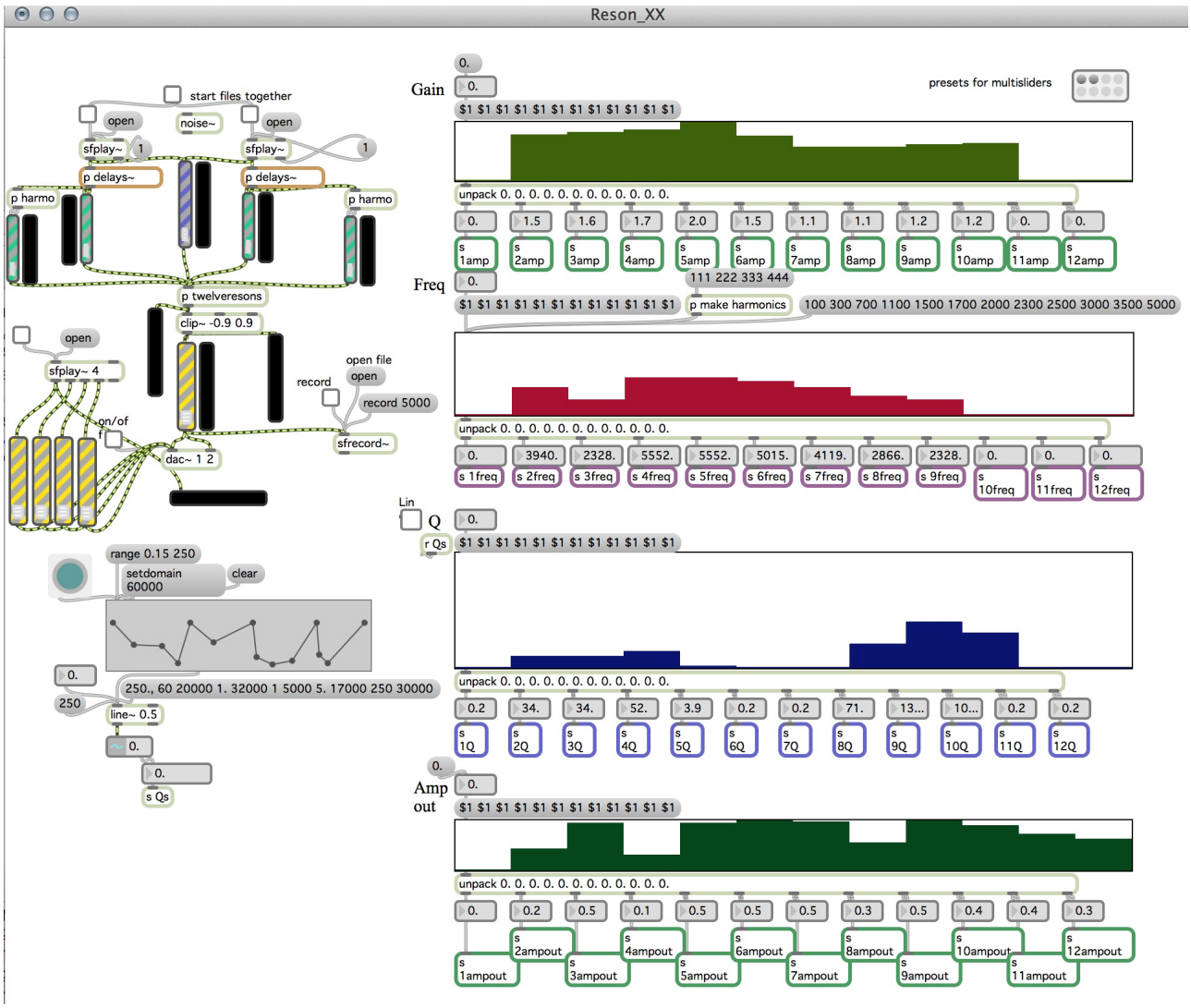


FIGURE 27. INDEPENDENT PATCH CREATED FOR THE COMPOSER TO EXPERIMENT WITH BANKS OF RESONANT FILTERS AND ASSOCIATED PARAMETERS INTUITIVELY WITH ONSCREEN GRAPHICS.

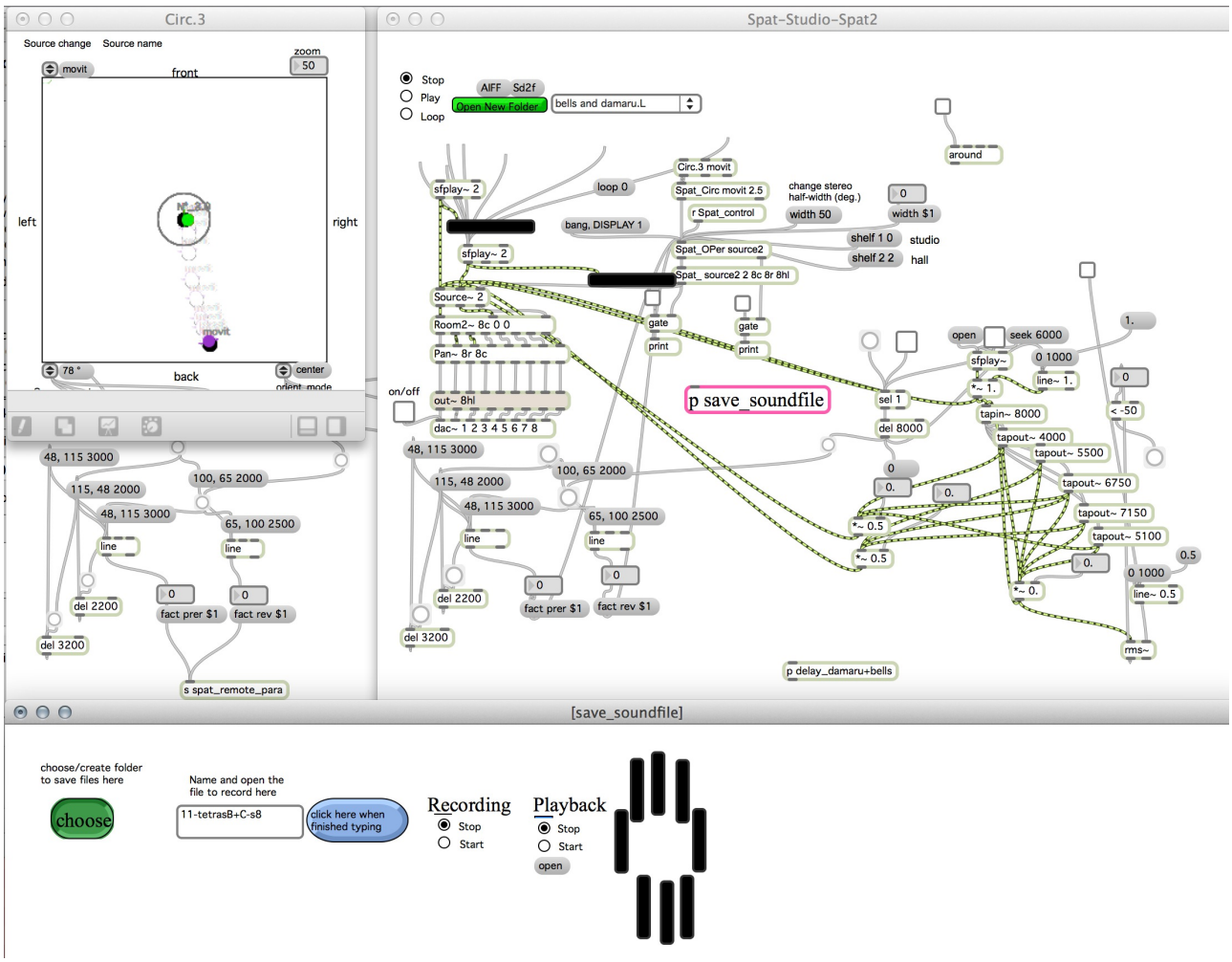


FIGURE 28. INDEPENDENT PATCH CREATED FOR THE COMPOSER TO EXPERIMENT WITH THE IRCAM SPAT.

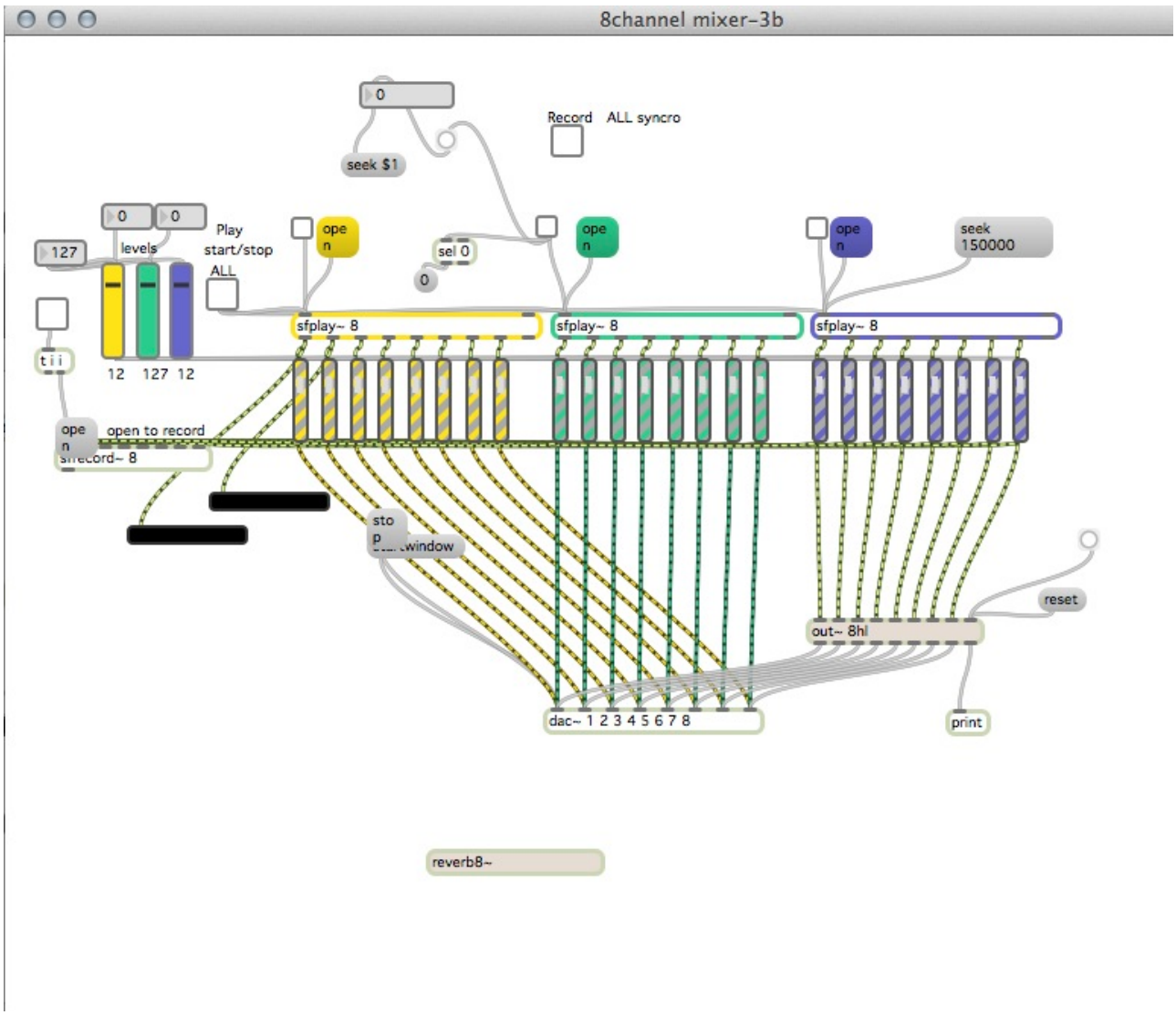


FIGURE 29. PATCH CREATED TO MIX MULTIPLE 8-CHANNEL SOUND FILES CREATED WITH THE SPAT IN CONTROLLED STUDIO CONDITIONS TO SINGLE 8-CHANNEL FILES TO BE USED IN THE FINAL PIECE.

4.1.2.2 Studio collaboration and 9/11

Collaborating in the studio with a composer is an activity that requires a certain amount of trust and availability. I might have devoted as many hours in discussion with composers in and out of the studio as I have actually spent working on and producing the final piece. It is a necessary aspect, I believe, in getting to know the artist as well as the person. I'm not sure I would understand what is meant by a "cold blue sound" a "spinning mandala" a "soliton in space" or "pure mind spectra" and "awakening of a summer cloud" if I was not entering, at least partly, into the world of that person. It is probably the same in the other direction, where the person entering the studio needs to know who I am, my expressions and vocabulary and also feel that I can be trusted to know something about their own creative process.

The period of working with Jonathan Harvey was particularly active one for me in both my personal and professional lives. Apart from the responsibility of running a studio and

planning for the yearly MANCA Festival in my new home town of Nice, I was also at odds with the working methods of the state-subsidised studio system in France. These concerns would also be part of our daily conversations with Harvey. As would the event that occurred while we were working in the studio on September 11. Sound engineer and studio assistant Gerard d'Elia would first inform us and then keep us apprised of the events as they were relayed by the French radio. The day would mark us both, and I am convinced that something from that day found its way into the piece.

4.1.2.3 Creating the Concert Patch

Part of our working method consisted of detailing the different manipulations possible in what would become the final concert patch: spatialisation by Spat or grain (something we would call the "cutter" that could be run at different tempi and with customised wave forms), harmonisation, delay, reverb, and realtime convolution (cross-synthesis). All this in a Cartesian grid of relationships in which any output can be sent to any input through a matrix setup perfected through several productions. **Figure 30A** shows part of the sub-patch and event cues used to control the piece during the performance (a benefit of this technique is the ability to change and adjust the parameters for different spaces or even to experiment quickly with a different parameter through simply changing a number in the list). The patch would also include a sophisticated system of controlling all the parameters through an external MIDI keyboard triggering system. There would also be a need to control details of the patch and the various levels of each effect and the overall output with an external MIDI fader controller. Spatialisation was controlled by a system of presets we had worked on in the studio. These presets controlled speed of trajectory, start and stop times, reverberation parameters as well as psychoacoustic parameters (notably "source presence" and "liveliness").

In the final stretches of the production before the first performance, I sent a complete list of all these parameters and their possible combination to Harvey. He would then cut them out of a printed sheet and tape them into the original score before it was copied by the publisher. In this way, we had the exact parameter/effect at each of the changes directly noted in the score, shown in **Figure 30B**.

The patch uses an external MIDI keyboard played by a performer on stage following the conductor. This is the most reliable system I have found for running this kind of setup. The patch is controlled by me and the composer so that if something is missed by the performer the patch may be advanced through onscreen or MIDI control. Volume levels and the balance between the different effects and sound files can also be controlled externally or within the patch according to the needs of the performance. It is a realtime environment, well tested through not only the first performance but many later ones. Little has changed internally

to the patch, and while some work has been done to rectify certain difficult passages and to take advantage of more powerful machines, the patch itself remains the same. The most recent version of the performance patch can be seen in **Figure 31**. Appendix C/Harvey/Harvey-Concert-summer_cloud_faber contains the most recent concert patch and the sounds used in the concert. There is a clearly defined development for performing in this patch with all the important levels to effects being controllable through an external controller (this varies, and may include a specially designed TouchOSC interface). There are two version of a stretched Wagner phrase as sung by the choir. I used AudioSculpt to create these files and then a version of this would be included in the opening of the work, though spatialised and with live voices and instruments: *P_tristan-sepmixou*t and *P_tristan-sepmixout2*. The folder, *Wagner-last-spect*, contains versions of instruments and voices after passing through the Reson-spectra-XX patch I created (found in the *Max Patches* folder) . Harvey would use these files and these harmonises in the composition of the work.

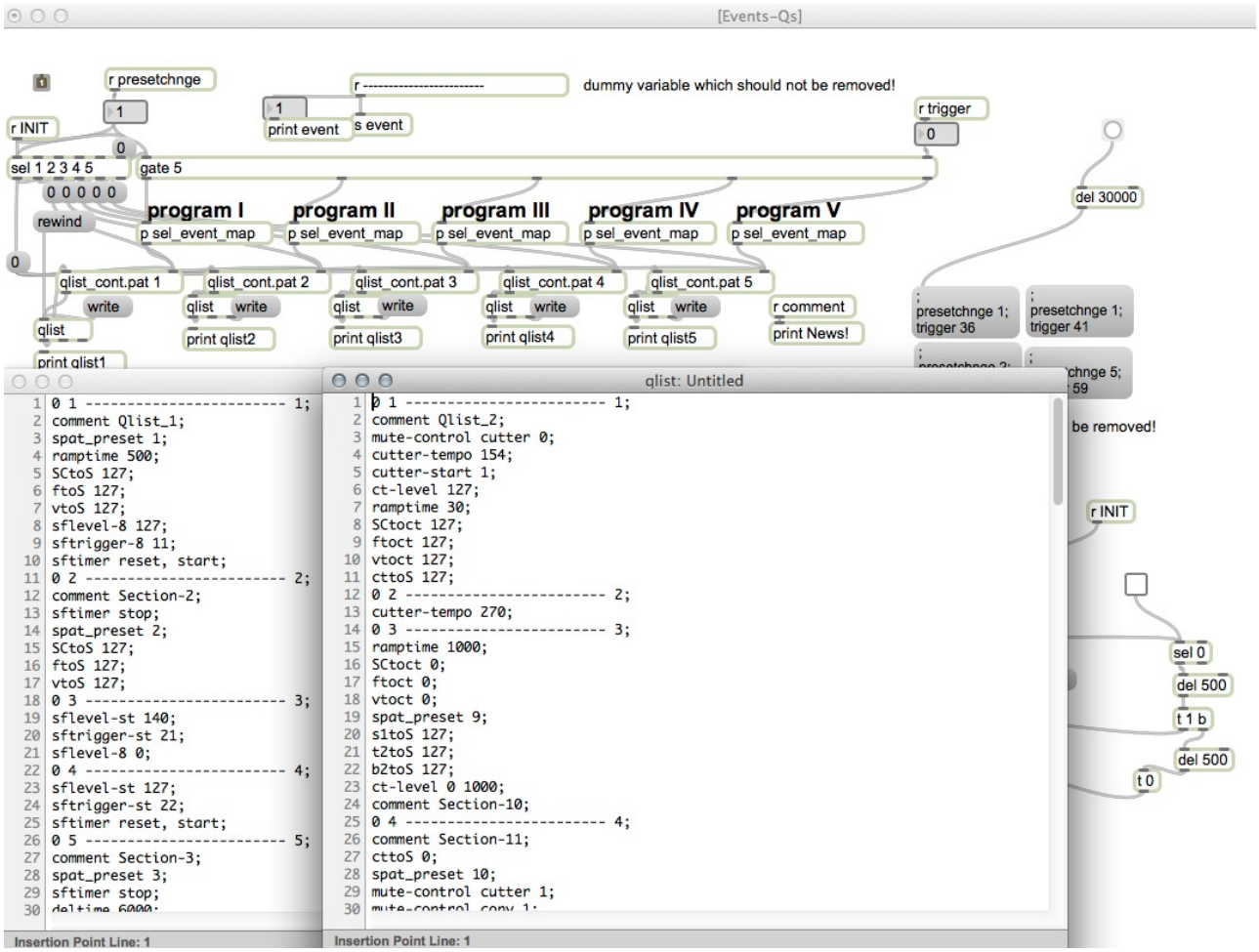


FIGURE 30A. SUB-PATCH CONTAINING THE CODED LISTS USED TO CHANGE THE PARAMETERS OF EVERYTHING WITHIN THE PATCH THOUGH EXTERNAL MIDI KEYBOARD TRIGGERS.

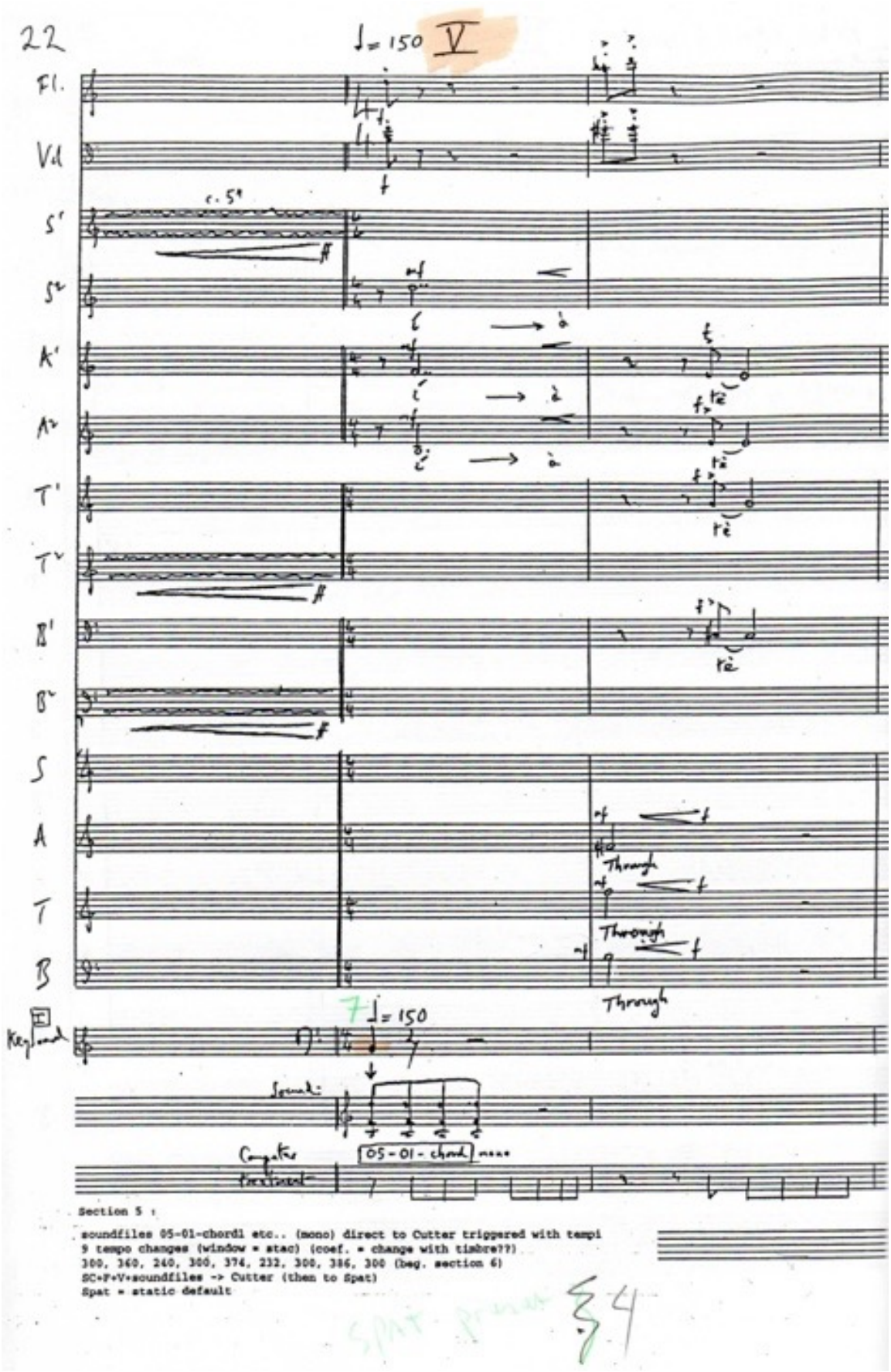


FIGURE 30B. PAGE 22 OF ORIGINAL SCORE SHOWING THE CUT AND PASTE EFFECTS TO BE TRIGGERED BY THE KEYBOARD.

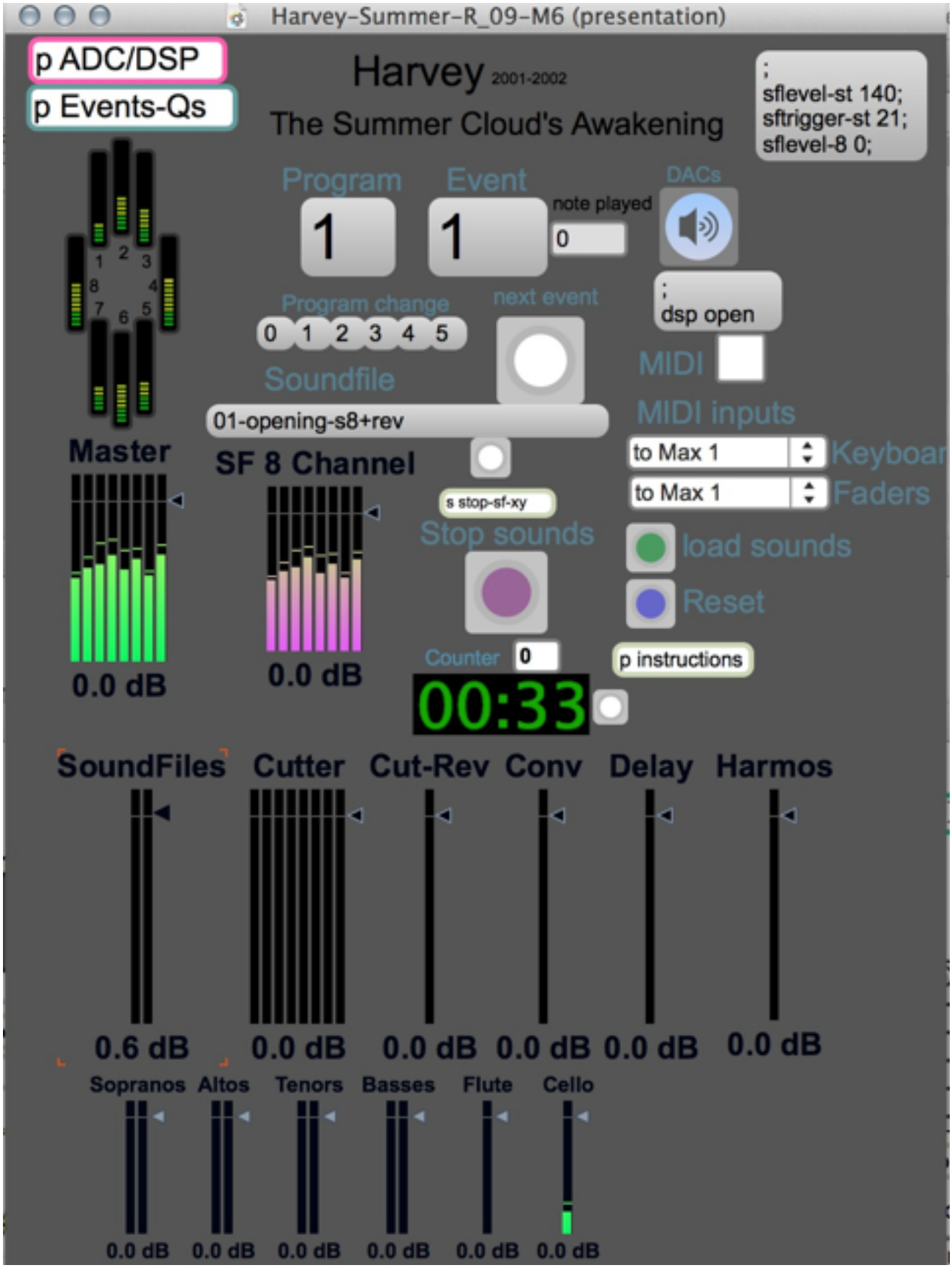


FIGURE 31. MOST RECENT VERSION OF THE PERFORMANCE PATCH USED IN CONCERT FOR *THE SUMMER CLOUD'S AWAKENING.*

4.2 Publication 6: Robinson, C. (2008) Laima

Duration: 21 minutes
Commission: Art Zoyd Studios
Instrumentation: basset horn with live electronics
Premiere: May 26, 2008, Les Beaux Arts de Valenciennes, France
Video available via Youtube: https://www.youtube.com/watch?v=KnANLLySEEM
Commercial recording: In-possible records, 2010. (Ensemble Itinéraire, 2010)

4.2.1 Introduction to the work.

I resigned from the post at the CIRM studios in December of 2002 after having collaborated with composers including Fausto Romitelli, Ed Campion, Florence Baschet and Giovanni Verrando. I continued to develop the method of including the composer as much as possible in the electronics creation and would carry this over into my freelance work. This freedom allowed me to collaborate in many varied situations including a multimedia circus show in the Tuileries Garden in Paris and with the Forum Neues Musiktheater in Stuttgart under the direction of Andreas Breitscheid. Working in the theatre and with composers in music theatre is, I found, a natural medium for the rich and malleable sound world conceived by the Computer Music Designer. This and other collaborations led to developing systems for instrumentalists/improvisers/composers to perform independently of any technical assistance, as well as to "program" their own works with a custom-made patch and command language created for their particular needs. This would allow a certain independence and creativity (sometimes quite surprising to me) as well as provide a solution for replacing heavy and ageing analogue equipment.

One such project involved Carol Robinson during a residency in Art Zoyd Studios starting in 2005. The clarinetist/composer/improviser was accustomed to working with tape electronics and editing sound herself with an audio sequencer, but had an idea for a realtime piece she wanted to compose. Necessity dictated that we would not have much time to work together and that she would need a lot of time to compose the piece with the electronics. It would be three years before the piece was finally premiered, but in that time we developed not only a method of working that allowed her to develop her ideas alone in the studio, but also a strong professional relationship that has included later works based on this initial research.

4.2.2 Research topics and major aspects of the work

We were working with some basic effects in unorthodox combinations: a transposition combined with precise delay/feedback and panning combinations to create three independent (virtual) basset horn players, an envelope follower used to trigger various effects and advance the live score according to the amplitude of the incoming sound, a unique implementation of

the arpeggio parameter of the third party granular-type object, munger~, from the Percolate Library of physical modelling objects and a control method by which the performer could change presets in the patch without using her hands.

This all needed to be accessible by Robinson while she was composing the piece and it needed to be simple to setup for performances. She would tour with her instrument, the computer, an interface, her microphones and the necessary cables. It would be relatively light and mobile and, just as important, budget-conscious festival producer and concert organisers would not need to hire someone special just for her piece.

4.2.2.1 Working with the composer/instrumentalist/improviser

I created a command language for the composer to employ that would allow for changes in nearly every parameter. **Figure 32** shows the commands for the delay/ transposition/panning effect and **Figure 33** is list of commands as created and combined by the composer for first section of the piece. While not obvious, it should be noted that this kind of work, using symbolic and highly condensed code to command an effect is not necessarily a natural or intuitive act. In fact, there was a certain adjustment period for learning the language and the effects that changing these parameters would have on the sound. There would also be a certain amount of trial and error on my part in perfecting the method. While not foolproof it has become a very usable and richly varying environment for the composer (she would use the same patch, with variations, on future pieces). The openness of the environment allows for errors (and there would be many), but that is in-itself an interesting and often fruitful byproduct.

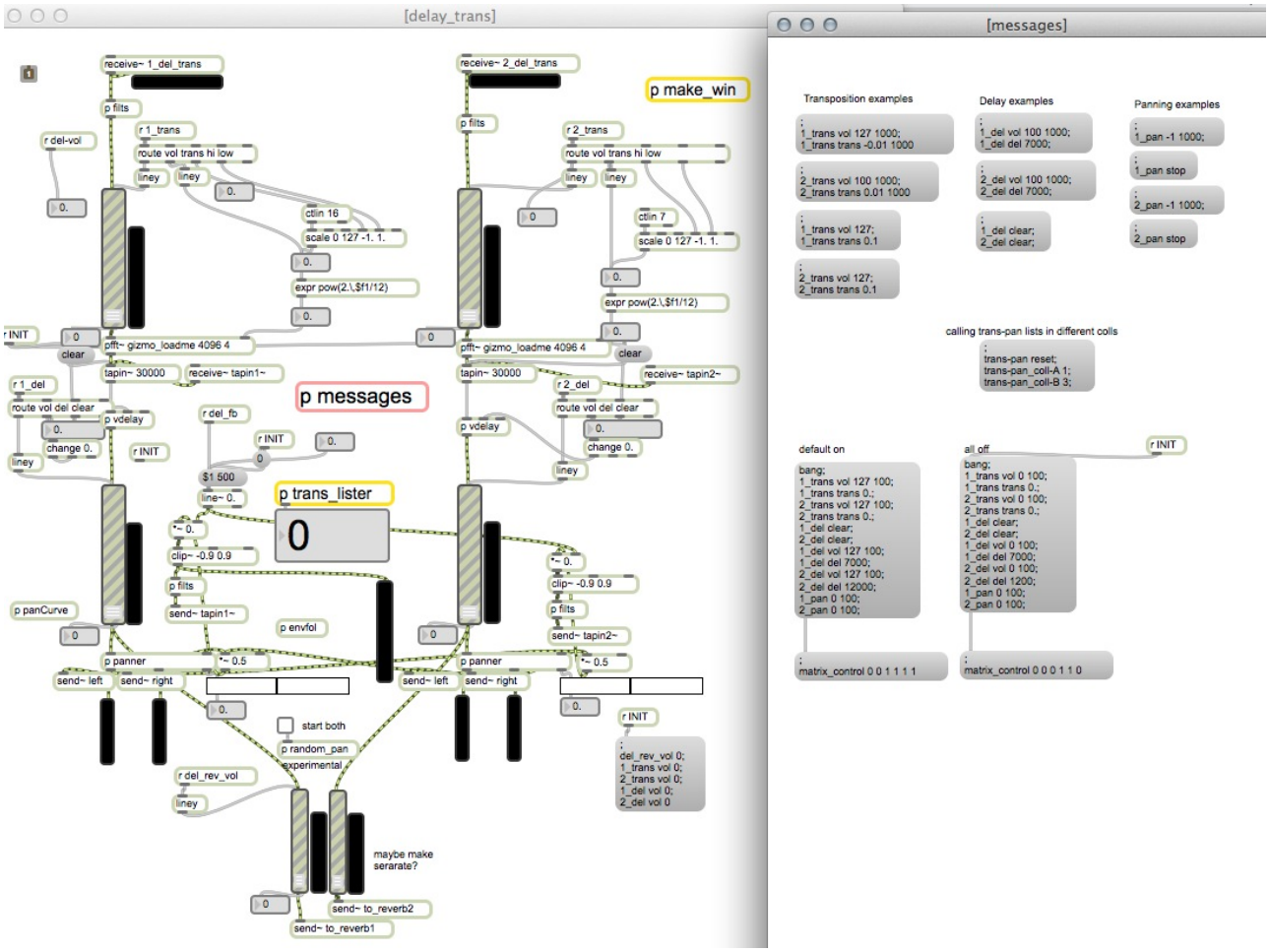


FIGURE 32. MAX PROGRAMMING FOR THE CUSTOMISABLE TRANSPOSITION/ DELAY/PANNING EFFECTS AND THE BASIC LANGUAGE USED TO CONTROL THE VARIOUS PARAMETERS.

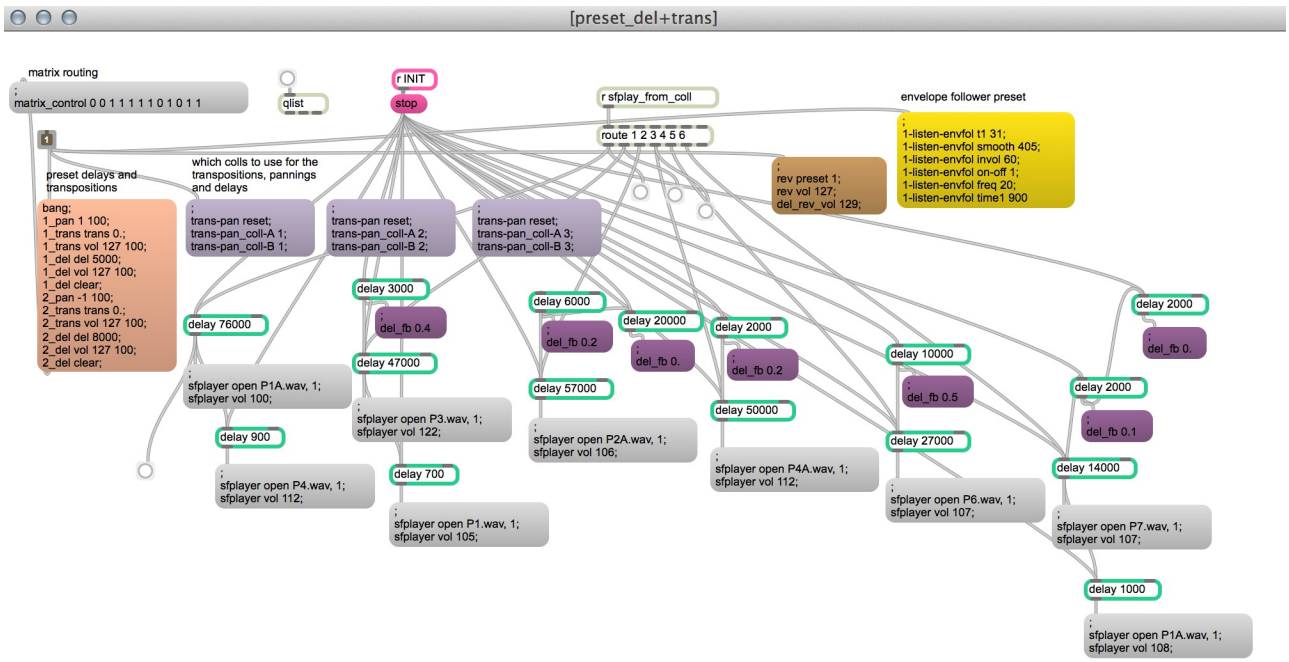


FIGURE 33. THE FIRST SECTION OF *LAIMA* EFFECTS USING THE CUSTOMISED LANGUAGE SHOWN HERE IN A LINEAR REPRESENTATION.

4.2.2.2 Creating independence for the performer

As mentioned above, one aim of the collaboration was to provide an independence for the performer from the programmer. An important aspect of any specialist is a need to concentrate and constantly hone their speciality, particularly so for a world-class soloist. Asking the performer to understand the details of a variable delay (and why it is theoretically impossible without artefacts) is not a reasonable expectation. Nor is it creatively viable to simplify sophistication to the point of nonexistence with an on/off button. Finding the common ground is a large part of what I do, after which providing the most useful method to control the program, or the newly created "instrument" (like a modern luthier), is a matter of application.

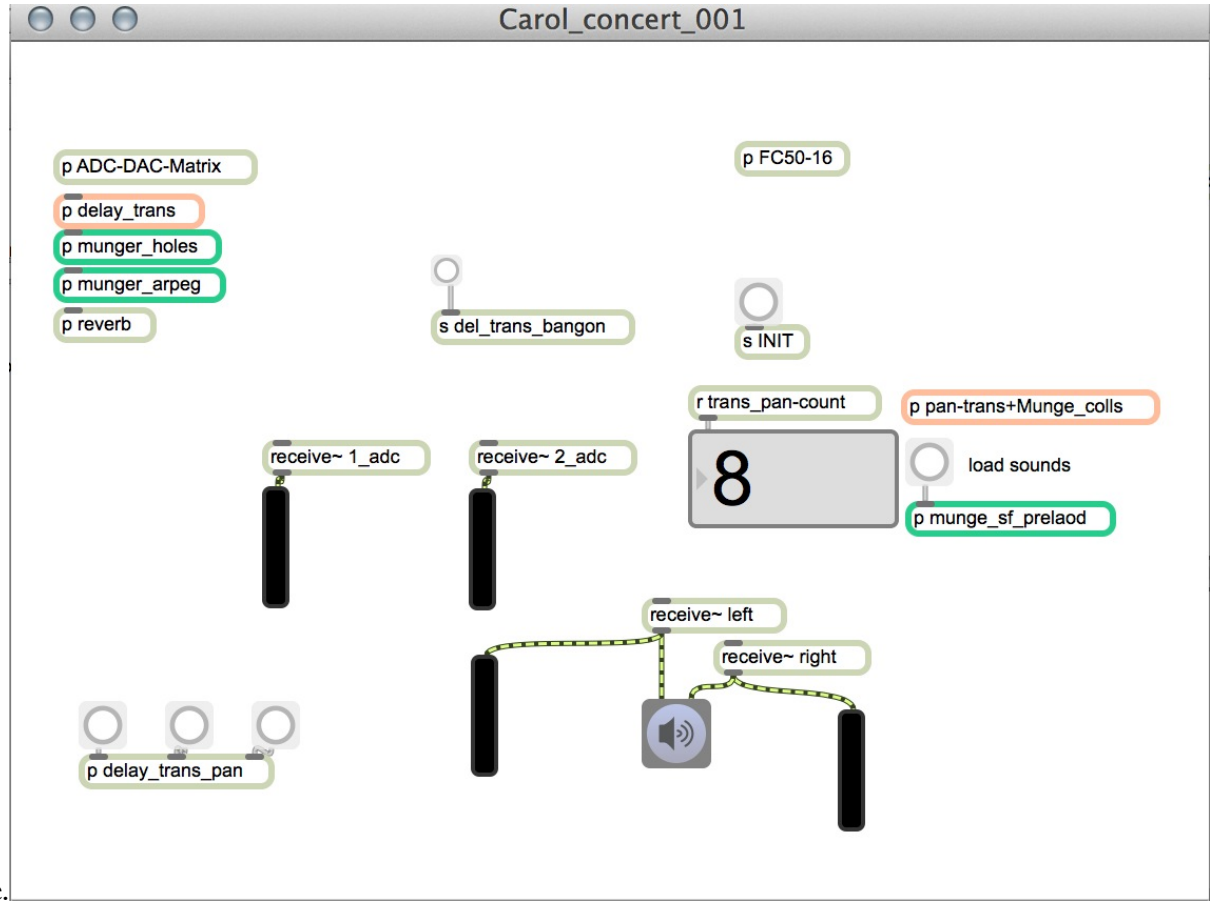
Interestingly, as a consequence of this project, a number of new works from the same patch (with variations), as well as further developments from the combined research of Robinson and myself led to the development of new patches for performances in dance and theatre. Each time with Robinson on her own. This is, for me, a satisfying and surprising validation of our work together. I may be among a limited subset, but I enjoy when a piece of mine is performable when I'm not there to supervise and watch over it.

4.2.2.3 Creating the Concert Patch

The concert patch would take on many forms over the production period and eventually be completed by Robinson herself according to the composition and her ability to program the available elements (one of the benefits of working with Max even at a limited level). The process would be a long one with many steps until we arrived at the final version. From the blank page we arrived module by module to the final version. **Figures 34-36** show some of the stages in development of the final concert patch while **Figure 37** shows the finalised patch and **Figure 38** is a further customised version of the GUI as modified by the composer.

Combining all the elements into a workable and stable environment that would be used by a "neophyte" would require a certain amount of experimentation. This was a useful exercise in programming through constant "debugging" of both engine and interface, but it also needed to be approached slightly differently, with the overriding premise that I would not be present to control the patch. The process, in fact, would demand as much experimentation for the performer/composer as for me. The end result is an independent patch that the end user can rely upon for both creation (composition) and performance. The problems that do occur are usually the result of the interface used and points of contact with the hosting organisation

(cables or live level problems). An excerpt of a live performance can be viewed by clicking the link at the head of this section. The concert patch is available in Appendix C/Robinson/ Carol_R_patches. The folder, *z old patches,* contains a history of the development of the patch from version 1 and step by step overview of how a typical concert patch will be developed over the course of a project.



e.

FIGURE 34. AN EARLY VERSION OF THE CONCERT PATCH FOR *LAIMA.*

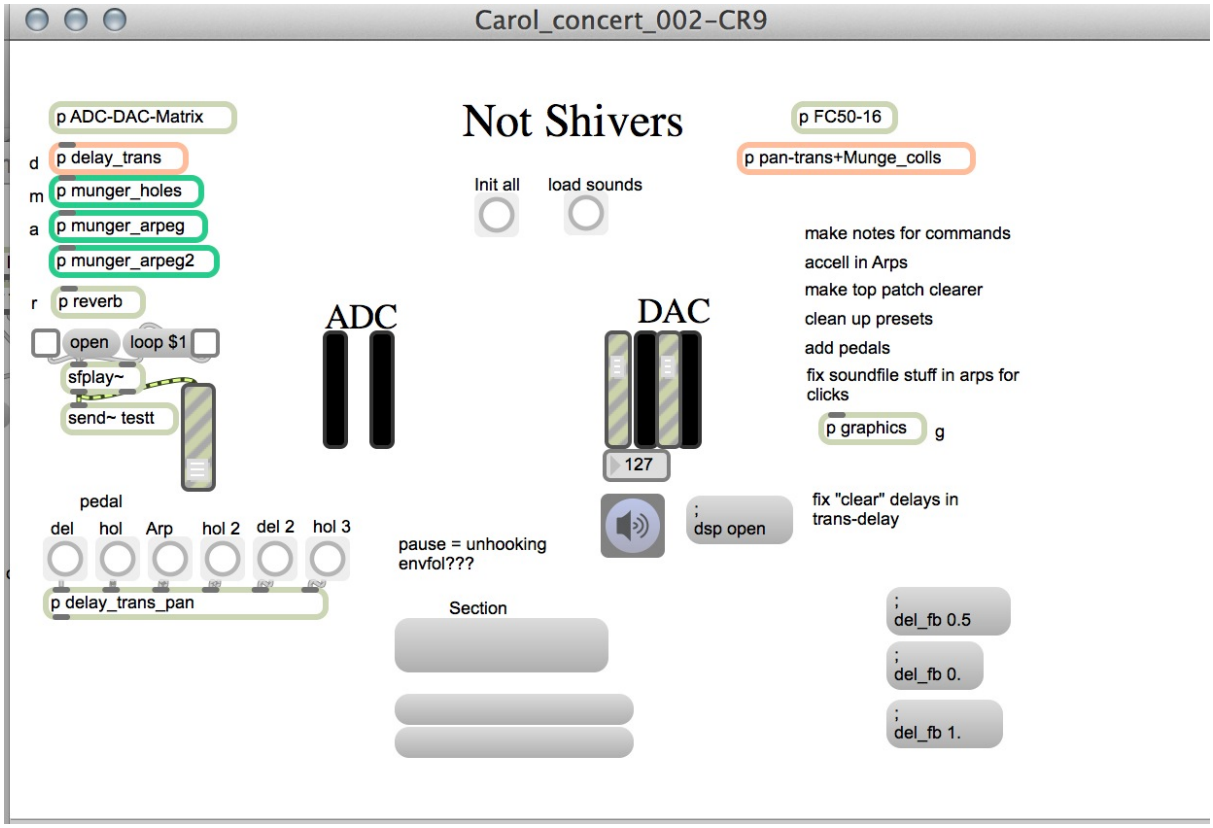


FIGURE 35. STILL EARLY, BUT MORE DEFINED EARLY VERSION OF THE CONCERT PATCH FOR *LAIMA*.

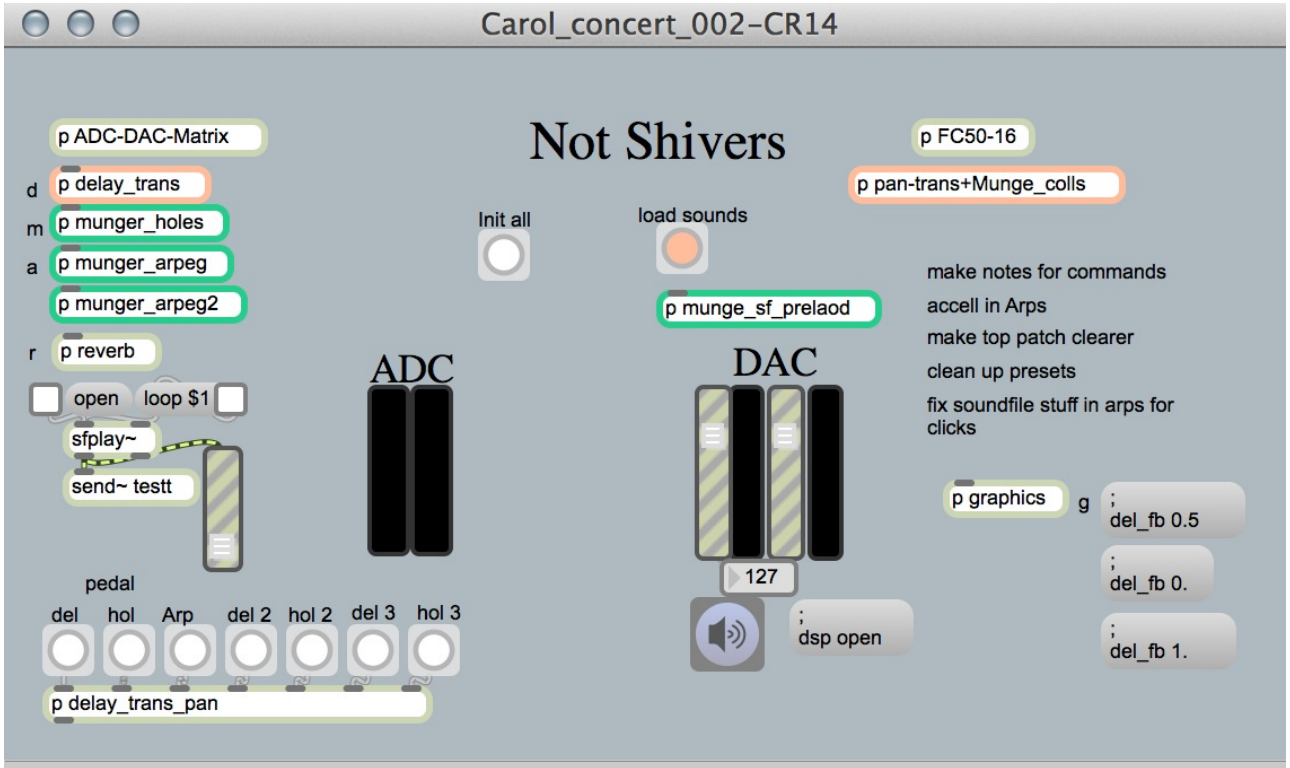


FIGURE 36. A MORE COMPLETED VERSION WITH SOME ELEMENTS OF THE GUI MORE PROMINENT IN THE CONCERT PATCH FOR *LAIMA*.

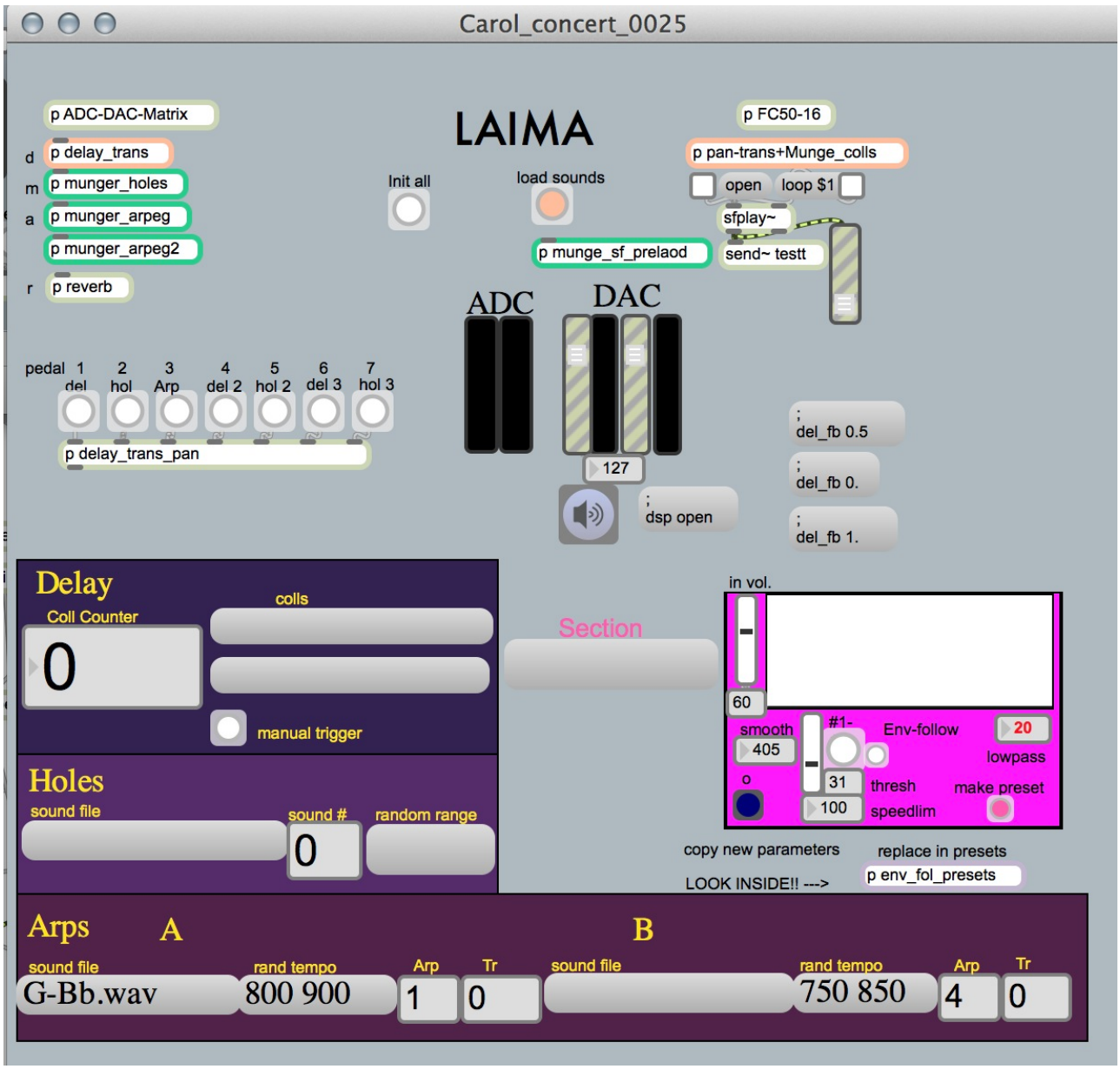


FIGURE 37. A COMPLETED VERSION OF THE PATCH WITH MOST OF THE ELEMENTS OF THE GUI PRESENT IN THE CONCERT PATCH FOR *LAIMA*.

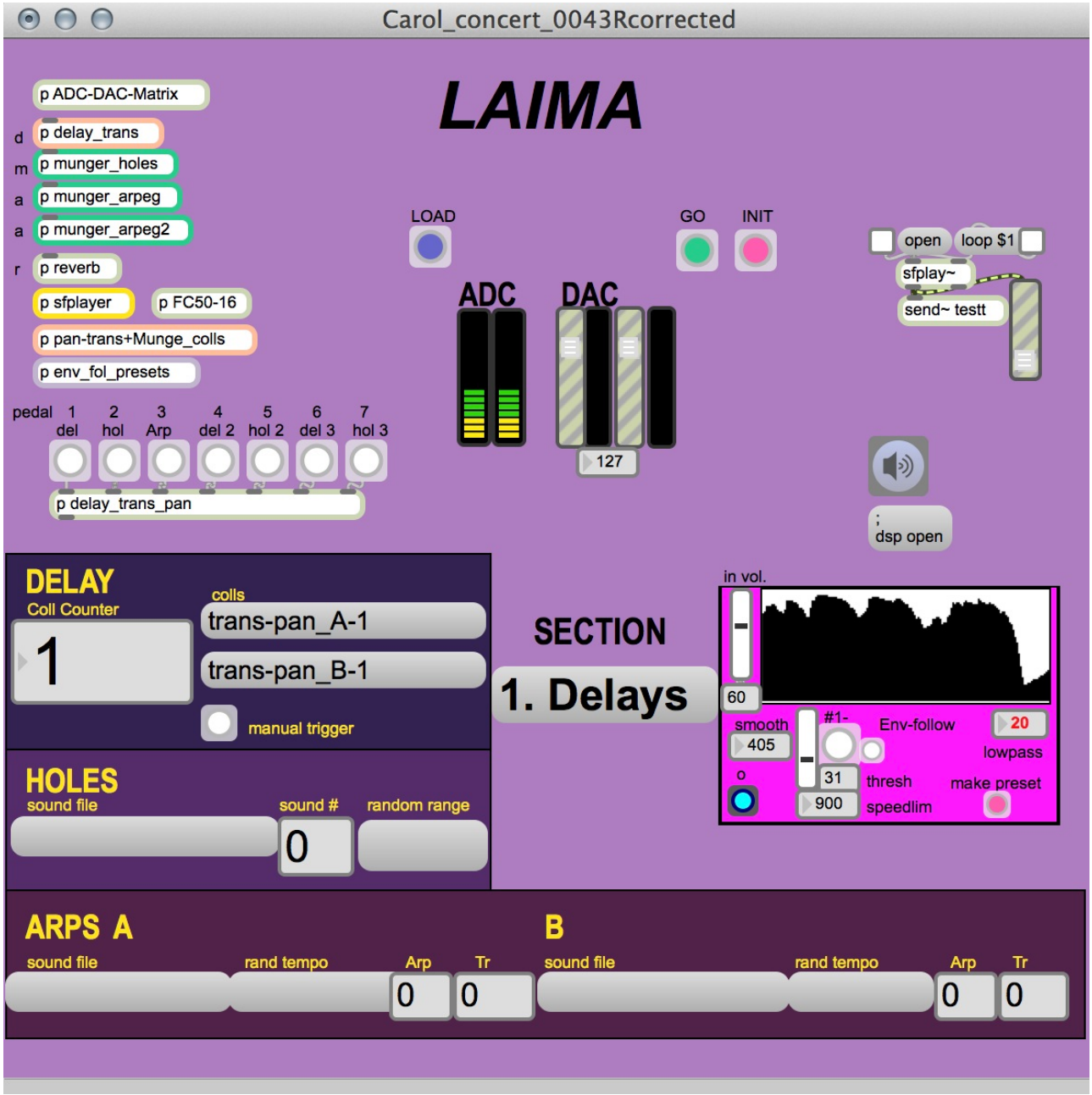


FIGURE 38. A LATER VERSION OF THE PATCH WITH MODIFIED GRAPHICS BY THE COMPOSER.

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5. Conclusions

...working in an electronic studio has been of great importance to me, because there you're dealing with the material first hand.

But presumably you work with a technician?

Yes, though the technician's only the performer.

Harrison Birtwistle responding to Paul Griffiths (Griffiths, 1985, p. 190)

The technician/performer referred to in this case was in fact the New Zealand-born composer Barry Anderson (1935-1987). The work they were collaborating on at the time was *The Mask of Orpheus*[4] and they had done this at IRCAM where the director Nicolas Snowman had suggested the collaboration (Cross, 2009, p. 36). As Jonathan Cross writes:

> Anderson was engaged jointly by ENO and IRCAM, and the two composers spent six months together in Paris in February–July 1982 developing the exciting sounds that would play such an important and integral part in the final production. The first informal airing of their collaboration took place at IRCAM in 1983; Anderson continued to work on the materials right up to the premiere (with occasional visits from Birtwistle), and he was also responsible for co-ordinating the complex sound diffusion during the performances... Indeed one of the most striking, aspects about the creation of *The Mask of Orpheus* is just how much it was the product of a collaboration of creative partners... the innovative sonic world of the electronics belonged as much to Anderson as it did to Birtwistle...(Cross, 2009, p. 37)

It is appreciable, this way of presenting the work of Anderson. There is a certain "justness" to the way his work is represented. In fact, Cross goes into great detail in describing the various collaborative partners on this work and refers to Birtwistle as a producer/director, bringing together individual talents "of many artists to serve his artistic vision", while making it clear that the work remains Birtwistle's. I would agree with this assessment and it is one of the reasons why I take exception with the name that IRCAM has assigned to the in-house collaborators. To refer to them as *réalisateur* seems wrong in the context of the way the word is used within the French film domain. It seems to me, in a similar situation, that the invited composer acting as a *réalisateur*.

The Mask of Orpheus was premiered in May 1986. Harrison Birtwistle would win the prestigious $150,000 *Grawemeyer Award* for the opera in March 1987 ("Grawemeyer Award - 1987," 1987). Barry Anderson died of a heart attack one year after the premiere of the work. Stephen Montague attempts to set the record straight in an article from *Tempo* in 1988:

4 There is an interesting footnote (17) about Anderson to be found in David Beard's book on Birtwistle's operas. Yes, a footnote {Beard:2012ti pp84-85}

> BARRY ANDERSON died in Paris on 27 May 1987, a few hours after the first performance of his new chamber work, *ARC*. His hectic life-style with its incessant demands had burned him out. The immediate cause of death was heart failure, but the real cause was exhaustion from years of overwork as a composer, teacher, concert organiser, 'ghost' writer, and pioneer in the dissemination of electro-acoustic music in this country... Harrison Birtwistle approached Anderson to work on the integral electronic sound elements for his opera, *The Mask of Orpheus*. This was essential as Birtwistle had no experience in dealing first-hand with the complex world of computer music, so it was vital that he collaborate with a composer who did if an electronic component of the opera were to be realised. For the next four years Anderson spent the better part of his time working on this massive project in Paris at IRCAM... The collaboration with Birtwistle was a watershed for Anderson, however. It represented the culmination, and the end, of over a decade of working with composers with little or no skill in electronic music, and a role often not properly acknowledged by the media or even by some of the composers he had helped... Anderson found it frustrating that the vital collaborative/compositional/technical role he played in the creation of *The Mask of Orpheus* was not properly acknowledged in the opera's subsequent success, nor in the citation of the Grawemeyer Award. (Montague, 1988)

While I understand the frustration and the reaction that some may have concerning both this particular situation and the current state of affairs at IRCAM concerning the RIM, I do not believe that it is a simple matter to resolve. It has been my experience that even when the composer attempts to credit the computer music designer, there is often a real difficulty in the practical process. This difficulty comes from institutional habits as well as simple logistical questions as to where to put the collaborator's name on a program and who is responsible for gathering this information. I feel it is the responsibility of all concerned: composer, computer music designer, institutions small and large (performing rights associations come to mind) and those responsible for communications.

5.1 Final Notes on an Emerging Metier

I was hired in 2009 as lecturer in "digital programmes" at Brunel University. It was then that I discovered that a degree program existed in Sonic Arts. While familiar with the term, I had never imagined that there could be a degree available with the subject. Indeed, the course as constructed at Brunel is designed along the lines of what I have practiced my entire professional life: making music with technology. There might be a confusion about what is meant by the term "Sonic Arts" and I have seen the confusion first hand with students expecting something more along the lines of a sound engineering course, others expecting to

learn how to get that "jittery melody" sound and be the next hot producer and still others with classical music backgrounds impatient to expand horizons and embrace their time. I was, and am, in agreement with the definition of the term Sonic Art given by Trevor Wishart in *On Sonic Art,* that it is something inclusive of music and electro-acoustic music and an art of organising sound but most especially that "all these areas fall within the category I call 'music'." (Wishart, 1996, p. 4)

There are many facets exploitable in the realm of technology (computers and everything related), but the goal is the same. I don't think it a stretch to present the piano as an example of advanced and complex technology with specialised "technicians" (pianists) and people who want to exploit these wonderful machines (composer or composer/performer). In this case, as with many cases of instrumentalist and composer relationships, a collaboration is expected and normal. There might even exist examples where the composer will copy exactly what the performer has offered, much to the latter's consternation when the former is credited as the de-facto creator. We should all be technicians in a sense, the Computer Music Designer, like the composer (even Birtwistle) are technicians with our unique expertise and talents. The lines are often blurred in a creation: how much does the teacher have to do with the quality of the young composer's work? What influence did the performer have on the creation of the new work that relies heavily on the special fingering researched and perfected by the performer or advanced playing techniques and particular talents of a performer? I believe this is a natural part of creative activity: exchange and intense collaboration are often necessary for any piece of music to be successful.

The performer has a defined role and that can not be taken away. The composer has come to represent a role that may or may not be as accurate, but which is enshrined in occidental culture. The Computer Music Designer is somewhere between the two. While the role will, by nature, be of a variable definition, I believe that the metier has been and will continue to be validated and recognised as independent and integral as any other more established callings. One important step is the public recognition. This is as important as peer recognition because it helps to place the metier in a protected space. Once the public understands the importance of the role (as much as they understand that of the composer or director or performer), then it will be natural for all (including peers) to openly acknowledge co-creation.

5.2 Research Questions and Answers

1. What is the role of the assistant in the studio, generally, and my role particularly?

There are many possible roles available for the collaborator, or, for want of a better name, the assistant. There is the role of the guide, the mentor, and the liaison between available technology and the composer unfamiliar with these techniques. There is also the role of the

instigator, presenting a challenging new technology that needs to be mastered. The assistant is the one that ties all the many aspects of a work together: the liaison of the institution or studio with the craft to develop a technical, creative and performative environment for the project. The role is also actively choose what will be used in a project (deciding what to present to the composer and what to leave out may be one of the most important early in the development process), but also the decisions concerned with feasibility in terms of time, required and available technology, as well as budget constraints. These choices will inevitable influence and shape the final work, creating an emphasis on the importance of these very early decisions.

My role in particular has been varied, as seen by the selection of works presented above. While there is little in terms of "common practice" for the moment, I do feel that there is a certain number of principles that may be defined for my role (and, thus, "the role"): responsibility to the project and the practical realisation of the outcome is very high on the requirements of this role. The willingness to create outside of common boundaries (for example, the composer vs. performer assumed roles) is also part of my activity, as is an openness needed to sometimes redefine the language used to communicate at different levels of knowledge and experience (in same cases, developing a language or terminology specific to a composer or a work).

Another aspect of growing importance is the development of a design philosophy that is proper to my approach to technology and performance, but may be discerned in the work of others practicing the same role. While a Max patch created for a studio experiment might be sloppy and incoherent outside of a given context and time (in my case), the concert patch should be clear, transparent and easy to understand, as well as easy to perform if that is the need of the final project. The interface has always been an important aspect of what I do when making a final concert Max patch. I look for simplicity in programming. My training and on the job experience has lead me to develop methods of performance that allow for interpretative input while avoiding unnecessary risks. This can be seen in the work with Dillon and Harvey but more so with other works including Robinson and projects not referred to in this thesis.

One final note "on the role" and "my role": it is important to leave as much room as possible for creative development. The blank page is where I prefer to start a project, even a project hat may have some pre-existing impetus. If at all possible, I will stay away from available plug-ins, commercial programmes and trending technologies. This might mean that I will hide something from the composer to avoid a from of creative contamination. I might also make a variation on the commercial effect or technology before acquiescing to its incorporation. Starting from a blank page allows a certain freedom to exist in the process before we must start resolving problems for deadlines. That said, if there is a technique or piece of equipment that will achieve a necessary practical need (like the use of the DM5 as a MIDI trigger in place of a homemade MIDI trigger), I will use this to save time for other aspects of the project.

2. What are the changing needs in the education and training of composers within the context of the development of computer music and technology?

My experience in the studio as both collaborator and composer leads me to the realisation that all composers should have basic training in technology. While my particular experience is biased, the creative technologies available today require composers to have a certain experience with this technology. This training and experience should be at the same level of concern as reading music. The forces available for the composer are formidable and should be learned as

part of the composer's craft. Afterwards, the choice is, of course, up to each individual as to whether or not to pursue this further. Achieving the understanding to describe or recognise the technology requirements in the studio or concert seems, to me, to be a basic and necessary skill to acquire.

How might one clarify the apparently ambiguous role of the collaborator?

The response to this question is simple, the realisation is another matter. Clearly, it is the responsibility of all concerned to define the role in terms of the activity and the recognition of work done. A clearly defined contract between the partners (composer, computer music designer, institution if involved) should clearly describe the role and the required legal mentions in programmes of concerts or presentation that follow. Publishers could also be instrumental in bringing about change by promoting and crediting the collaborator in legal contracts and publicity. Promoters and concert organisers could create a simple template that allows for the computer music designer to be mentioned and a biography and photo added easily to the programme note. This is something that IRCAM has started to do in recent years, but it is not yet common practice. The role of those responsible for marketing and communications should not be underestimated. While I'm not an expert in this domain, I do understand its importance especially in public appreciation aspects.

What are some possible implications of the normalisation of the RIM?

In the event that the collaboration of the computer music designer would be clearly recognised, the legitimisation and banalisation of the role might occur, to the point that this "normal" activity would then lead to a more open atmosphere in which to work and develop projects without the common frustration or confusion present during and after the project. This is already often the case in the contained world of IRCAM, but quickly disappears once the creation has taken place and the work moves into the repertoire of the composer, which is another reason for a clear contract defining credit in all future presentations of the work. As it is today, there are many confusing aspects of the role that remain.

In this kind of close collaboration, who is the author and how might this be recognised?

As mentioned above, the co-authorship or co-creator in a work with a composer is a complicated matter in both practical and legal terms. I do not have a clear answer to this question. The contracts I've signed with Faber Music concerning my work with Jonathan Harvey may very well be a step in the right direction, but this is not yet common practice. Moreover, there is not a clearly defined title (such as orchestrator, arranger or lyricist). This lack of a recognised title is, unlikely as it might seem, a major obstacle to the recognition and the normalisation of the role. I would put forward the official title of Computer Music Designer for the English version and créateur (ice) informatique musicale for the French version (thus; avoiding the connotations of the term "réalisateur"), for example:

Carl Faia, Computer Music Designer

Computer Music Design by Carl Faia

Carl Faia, Créateur Informatique Musicale

Création informatique musicale par Carl Faia.

4. Is intense collaboration an essential activity to advance the art of music with computers and technology

One might argue over the definition of music being a collaborative activity, the current description of the activity, in the way that I intend it, is impossible to imagine without a certain level of collaboration. In each of the works I have presented above, intense collaboration has led to what is, arguably, an advancement in the art of music with computers. A simple acoustic analogy, and one that I hear of more and more, is the composer working with a performer or ensemble in the creation of a new piece. The performer provides invaluable insight and experience in technique, repertoire and current tendencies to the composer. The composer uses this information to create a new work that would be difficult to imagine without the performer's input or collaboration.

One could also argue over the meaning of "advance the art" and "essential activity." I believe that the close, and intense, collaboration between scientists/researchers, composers and computer music designers has helped achieve an extremely sophisticated level in the art of computer music, developing a form of virtuosity that is advancing the boundary of both the art and the craft we need to create the art. Because of the many moving parts of this high level creative activity involving scientific research, cutting-edge technological developments, and constantly evolving creative tendencies, the solo action of an individual creator will always be at a disadvantage in an undertaking that I have come to understand as essentially a collaborative activity between experts in their respective fields. Moreover, building and maintaining the intense activity required to move these boundaries is, in my experience, well suited to the multiplied energies I have found in collaborative activity (and, inversely, difficult to sustain at such a high level when alone).

5.3 Collaboration 101 or how to recognise your collaborator

Having worked in several counties, I have had the possibility to observe the varying degrees of recognition that a Computer Music Designer will receive.While some assistants might leave the activity to concentrate on other activities (teaching or composing), there are still a number of very experienced Computer Music Designers active in and out of IRCAM, collaborating in projects without proper recognition of their work, as evidenced by the present author and the above text.

The following comparison of the state of two past collaborations might provide an example of what could help the future of this possible metier. (Let me preface the following text by stating clearly that I do not blame anyone nor am I complaining about recognition due. As stated above, there are situations partly out of our control. It is this control that I wish to address.) One of my first projects at IRCAM was the collaboration with Philippe Leroux on *M*. This work has been released twice on CD. The latest release, the Nocturne Soupir Edition from 2004, has no mention of my name anywhere in the program or CD jacket. In fact, there is the name of another IRCAM assistant as the responsible party for the recording. The work is the

same with some minor modifications in the way the sounds are triggered, but everything else remains the same: the genesis of the work, the time in the studio, the sounds that I made are present in both recordings, the choices I made concerning what would be presented to the composer, and the structure of the performance patch that would itself influence the very form the piece would eventually take. All this work is in the piece. While it is possible, today, to find my name associated with the piece in the IRCAM catalogue, the general public will not know that the composer collaborated with someone else on this work and that a large part of what is heard is, in reality, the result of a very close collaboration between us. This is one example of many in the realm of what we call collaboration as a Computer Music Designer.

In contrast to this example, is the collaborative relationship as described above with Jonathan Harvey. As I have already noted, my name appears in the program note and is present in concert programs and on the commercially available CD. Harvey has gone further in recognising the work we did together: he arranged with his publisher, Faber Music, that I would be contractually bound to the piece and receive a percentage of fees and royalties of future performances of the work. A copy of the contract can be seen in **Figure 39**. Another email from the publisher concerning a later collaboration may be found in Appendix C/Various Documents/3. Jonathan Harvey Two Interludes for an Opera. It is a clear, unambiguous and permanent recognition of my collaboration as Computer Music Designer with Jonathan Harvey. That this be a common occurrence would be an important move in the right direction for all collaboration.

FABER MUSIC

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Carl Faia Harrison
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06300 Nice
FRANCE

23rd March 2010

Dear Carl,

SUMMER CLOUDS AWAKENING (Jonathan Harvey)

This is to set out our understanding regarding the above work ("the Work").

In consideration of your creative contribution to the electronic element of the work, and in consideration of your undertakings

(i) to supply us with a CD-Rom embodying this electronic element, and

(ii) to allow us to reproduce it and make it available to the public on sale or hire for the full period of copyright in the Work

Faber Music shall account to you the following royalties:

1. A 12.5% (twelve and one half per cent) share of all net fees received by us in respect of the hire of the said CD-Rom

2. A royalty of 7.5% (seven and one half per cent) on the net amounts received by us in respect of copies of the said CD-Rom sold by us for which we have received payment

We shall account these royalties to you semi-annually within 120 days after the end of March and September of each year, except that if the total amount due to you for any period is less than £25.00 (twenty-five pounds sterling) then no account shall be rendered and no remittance made and the amount due shall be carried forward to the next accounting date.

This agreement shall have retrospective effective from the date of the first performance of the Work and shall continue throughout your lifetime.

I would be grateful if you would indicate your acceptance of the above proposal by signing the duplicate of this letter and returning it to me.

Yours sincerely,

Bruce MacRae
Contracts & Licensing Manager

Signed and agreed

Carl Faia Harrison

Registered in England & Wales No. 867045

FIGURE 39. CONTRACT WITH FABER MUSIC.

Appendices

A. List of published works prior to 1997.

Harrison, Carl. *The City in the Sea for Soprano*, Violoncello and Viola. Saint Louis, MO: MMB Music, 1991. Musical score.

Harrison, Carl. *Across the Night: Capriccio Notturno for Clarinet, Viola, & Piano*. Saint Louis, MO: MMB Music, 1996. Musical score.

Harrison, Carl, and Robert L. Stevenson. *Songs from a Child's Garden*: Voice & Piano. Saint Louis, MO: MMB Music, 1989. Musical score.

Harrison, Carl. *An Angry Darkness*. St. Louis, MO: Norruth Music, 1991. Musical score.

Faia, Carl. *Sisyphus Sleeps: Pour Flûte Solo*. Paris: H. Lemoine, 1996. Musical score.

B. List of collaborative work from 1996.

	Collaboration with Composer/Creator	Year Start	Project Name	Type: R = real-time S = Studio C = combined P = portage	Associated studio
1	Leroux, P.	1996	M	C	IRCAM
2	Durieux, F.	1997	Devenir (1993)	P	IRCAM
3	Wood, J.	1997	Mountain Language	C	IRCAM
4	Cohen, D.	1998	Voile	C	IRCAM
5	Marcland, P.	1998	Le Jour d'avant	S	IRCAM
6	Dillon, J.	1999	La Coupure	C	IRCAM
7	Levallet, D.	1999	Carmi-1	C	IRCAM (ONJ)
8	Nono, L.	1999	A Pierre (1985)	P	IRCAM
9	Pauset, B.	1999	A, Passion profane	C	IRCAM
10	Stockhausen, K.	1999	Solo (1965)	C	IRCAM
11	Viñao, A.	1999	Epitafios	C	IRCAM
12	Harvey, J.	2001	The Summer Cloud's Awakening	C	CIRM, Nice
13	Romitelli, F.	2001	Amok Koma	C	CIRM, Nice
14	Verrando, G.	2001	Work in progress	S	CIRM, Nice (unfinished)
15	Baschet, F.	2002	Filastrocca	C	CIRM, Nice
16	Campion, E.	2002	Me	C	CIRM, Nice
17	Nova, R.	2003	Eleven	C	Art Zoyd
18	Ronchetti, L.	2003	Last Desire	C	FNM, Stuttgart
19	Serre-Milan, A.	2003	De Rerum Natura	S	Art Zoyd
20	Baltakas, V.	2004	Cantio	C	Munich Biennial
21	Dillon, J.	2004	Philomela	C	Freelance T&M (also video)

	Collaboration with Composer/Creator	Year Start	Project Name	Type: R = real-time S = Studio C = combined P = portage	Associated studio
22	Francesconi, L.	2004	Gesualdo	C	Holland Festival
23	Harvey, J.	2004	Two Interludes for an opera	C	Freelance
24	Mainka, J.	2004	Voyeur	C	FNM, Stuttgart
25	Phil Von	2005	Compass	C	Art Zoyd
26	Tutschku, H.	2005	Die Suesse unserer traurigen Kindheit	C	FNM, Stuttgart
27	Croft, J.	2006	Sonata	S	Freelance
28	Thomalla, H.	2006	FREMD	C	FNM, Stuttgart
29	Todoroff, T.	2006	Reminiscences	C	Art Zoyd
30	Wiegold, P.	2006	The Burden'd Air	C	Freelance
31	Wishart, S.	2006	Quartet Project	S	Freelance
32	Dailleau, L.	2007	EyeCatcher	S	Art Zoyd
33	Dallio, P.	2007	Le parvis des ondes	C	Art Zoyd
34	Friedl, R.	2007	Feedbag	C	Why Note/Art Zoyd
35	Kreiger, U.	2007	Performance Patch	S	Art Zoyd
36	Toeplitz, K.	2007	Eau Blanche	S	Art Zoyd
37	Knox, G.	2008	Beowulf, Part 1	C	Art Zoyd
38	Cifuentez, M.	2009	Mue	S	Art Zoyd
39	Dubois, K.	2009	Traversées	S	Art Zoyd
40	Nordin, J.	2009	Pendants	C	Art Zoyd
41	Bertocchi, S.	2010	Stockhausen/ Reich	S	Art Zoyd
42	Dallio, P.	2010	Stabat mater furiosa	C	Freelance

	Collaboration with Composer/Creator	Year Start	Project Name	Type: R = real-time S = Studio C = combined P = portage	Associated studio
43	Dillon, J.	2010	Nine Rivers	P	BBC Freelance/ various pieces with electronics
44	O'Malley, S.	2010	This Is How You Will Disappear - Gisèle Vienne	S	Art Zoyd
45	Robinson, C.	2010	Laima	C	Art Zoyd
46	Viñao, A.	2010	Chicos 21	S	Art Zoyd
47	Barrière, J.B.	2011	Crossing a Blind Forest	S	Art Zoyd
48	Breschand, H.	2011	Improvisational Max patch	S	Art Zoyd
49	Robinson, C.	2011	Billows	C	Freelance
50	Dallio, P.	2012	Dans la nuit la plus claire jamais rêvée	C	Freelance
51	Harvey, J.	2012	Ashes Dance Back	P	Faber Music
52	Lopez Lopez, J.	2012	Vibra Zoyd	C	Art Zoyd
53	Robinson, C.	2012	Titi	C	Freelance
54	Sikora, E.	2012	Happy Valenciennes	C	Art Zoyd
55	Wendling, W.	2012	Mûller Machine	S	Art Zoyd
56	Mariusse, L.	2013	Gagaku	C	Art Zoyd
57	Pape, G.	2013	Why Poets	C	Art Zoyd
58	Ratsimandresy, N.	2013	Année Zero	C	Art Zoyd
59	Dallio, P.	2014	In progress	S	CESARE, Freelance
60	Maïda, C.	2014	In progress	C	Art Zoyd
61	Pargas, PJ	2014	In progress	C	Art Zoyd

C. Contents of the folio of evidence

Temporary Dropbox link where all files are located:
https://www.dropbox.com/sh/ofy8v54slu41kqz/AAB3RLdBTwreN8FPGbEr_oBKa?dl=0

1. **Leroux**

-M- Concert Max patch: Folder containing Max patches and files for concert performance

-M- Concert Max patch graphics: Folder of screenshots and graphics of Max patch

Example of piano chord analysis resythesis and morphing (audio): Folder of one audio example made with Diphone processing

Example transformation of glockenspiel trill with Audiosculpt (audio): Folder of audio files

Examples of cross-synthesis between in Diphone (audio): Folder of audio files

Examples of DIPHONE_Sequences and Max patch (needs Diphone and Max): Folder of sequences and Max patches

Examples of sounds developed for M (audio): Folder of audio examples created during the preparation of the project

Experiments with various Diphone settings (audio): Folder of experimental audio morphine results with original file analysis separated and the morphed results

Graphics from programmes: Folder of screenshots of Diphone, AudioSculpt and Patch Work created during the course of the project

Leroux-M-IRCAM Notice.pdf: official IRCAM entry description of the work

2**. Wood**

- Mountain Language 2000 Concert Max patch: Folder containing Max patches and files for concert performance

Audio Examples: Folder of audio examples

Bell analysis for re-synthesis: audio analysis of instantaneous frequencies and amplitudes of 3 different bells in text format

Birdsongs original with Patchwork patches: a selection of original birdsong and the patchwork files used to extract melodic information and transformations

Bullfinch PW graphics: graphics taken from Patch Work program used to extract data used for the composition and concert

Max development patches: various Max patches used in the development of the spatialisation used in project

Spat patches for coding Ambisonics files: patches created to code the 3 channel B-format Ambisonics files to be decoded in concert

Spat spat_line: the original spat_line object (in patch format) created by Jean-Marc Jot for me

Text data for SPAT: original text data provided by the composer

Text data for SPAT coded for Max: recoded text data for use in the Spat

Wood Mountain Language score definitions.pdf: page from the original score with indications for performing the work

Wood Mountain Language score Spat plot.pdf: plot of the peaks used for spatial calculations in the piece

Wood-Mountain Language-IRCAM Notice.pdf: official IRCAM entry description of the work

3. Dillon

- La coupure 2000 Concert Max patch: Folder containing Max patches and files for concert performance
***Spat development material (for archival purposes)**: Max patches used in the development stage of the spatialisation for the project

Collected Max patches (archival purposes): Max patches used in creating the various effects and final sounds of the work

Dillon La coupure graphics: screenshots of the concert Max patch and sub-patches

Dillon La coupure short score 001.pdf: Page 1 of original short score for the work

Dillon La coupure short score 002.pdf: Page 2 of original short score for the work

Dillon-La coupure-IRCAM Notice.pdf: official IRCAM entry description of the work

Dillon-Nine Rivers BBC program note.pdf: program note from the first performance of the entire *Nine Rivers* cycle

4. Stockhausen

09 Stockhausen Solo (excerpt)-Benny Sluchin: audio example of early version of the work

Stockhausen Benny: Folder containing Max patches and files for concert performance of original version

Stockhausen-Solo-Ondes: Folder containing Max patches and files for concert performance of most recent version

5. Harvey

***Harvey-Concert-summer_cloud_faber**: Folder containing Max patches, graphics, and files for concert performance of most recent version created for Faber Music

Audio examples: audio examples of the opening sound file and 2 versions of dilated original sound files used to create the opening

Max Patches: Max patches I created and used in the studio and for the composer to create the sounds of the project

Wagner-last-spect: a collection of sounds created with Max patch (Reson-spectra-XX) used by the composer in the opening of the work

6. Robinson

Carol_R_patches: Folder containing Max patches and files for concert performance

LAIMA.mp4: a video recording of the performance by Carol Robinson

7. Various Documents

1. MusicalAssistant-Zattra-Survey.pdf: the original survey, concerning the musical assistant at IRCAM, created by Laura Zattra
2. M2 Musicologie RIM plaquette 2014-2015.pdf: a brochure for a new university Masters degree in Computer Music Design (RIM) available in Saint-Etienne, France
3. Jonathan Harvey Two Interludes for an Opera: email from Faber Musi concerning a contract for another work I collaborated on with Jonathan Harvey

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