Live electroacoustic music performance in the contemporary classical realm

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Abstract
This paper describes the development of a performance setup of both acoustic and electroacoustic instruments, blended together by timbre similitude and shared acoustical diffusion. It presents the motivation for this development, its initial goals and the strategies for the performance of an improvisation in a conference recital.

Keywords: Live electroacoustics, digital instruments, loudspeakers, improvisation.

Introduction
Live electroacoustics have been at the centre of some of the most interesting advances in music performance in practically any music genre, from popular to contemporary classical and experimental music. We observe, however, that particular fields of music expression have dealt with the new possibilities created by technology in different ways, in most cases preserving, or even reinforcing, the role of each of the agents implied in the process of creating/making/delivering music (e.g. composers, performers, sound technicians). In the contemporary classical realm, in particular, live electroacoustics are usually performed by an off-stage technician, sometimes the composer of the work being played. This establishes a frontier between the performance of the traditional instruments on-stage (even if they are modified with sensors or microphones) and a more reserved, typically not visible, role of
a sound technician. Other genres have adopted strategies for live electronic music performance, either by using controllers that convey the musical gestures associated with sounds being heard or by displaying realtime video. Our conference recital, along with this accompanying paper, proposes a rupture with this status quo and will develop upon the idea of the emergence of new approaches to music creation and performance in which the roles of the composer, performer, programmer and instrument maker mingle to create a new holistic approach to music performance. Using tailored instruments, which cross acoustic resources with electroacoustic media, we will perform music that combines both pre-composed material and improvisation processes.

1. Electroacoustic music performance

“The typical lack of gesture - i.e. physical work - in laptop performance foregrounds the audience’s need to be entertained by spectacle. This very lack of gesture or spectacle calls into question the exchange value of a laptop performance. Are the artists really performing on a laptop or are they merely playing a sound file while secretly checking their email?” (Cascone 2003:2)

It is a very common complaint of audiences of electroacoustic concerts that they don’t have anything to look at whilst listening to the music. In fact, many of these concerts happen in complete darkness, even if the composer is performing a live diffusion of the recorded tape.

In a seminal edition of the Contemporary Music Review journal in December 2003, titled “The Laptop and Electronic Music: Shapeshifting Tool or Musical Instrument?”, several authors, while recognising the importance of exploring the laptop as a musical instrument, stated the need to develop strategies for a more engaging and expressive performance of these new digital instruments. Most significantly for this project, Timothy Jaeger analysed the “potential for reviving the twentieth-century avant-garde tradition […] in laptop performance” (Jaeger 2003:53).

The recent surge of new digital interfaces, perceivable in the ever-growing community around the International Conference on New Interfaces for Musical Expression (NIME), reveals several approaches to this problem. Some aim to maximise expressive control while others strive to make music performance more accessible, but most of them uncover new paths and the potential of
unexplored vocabularies capable of reinventing some musical paradigms. Despite its richness, this diversity has somehow not been able to give birth to new instruments capable of establishing themselves alongside the traditional ones in terms of number and proficiency of players other than the builders themselves. Without this spreading, few composers will consider dedicating their time and effort to build a repertoire for an instrument. Therefore, more often that not these instruments and interfaces are being built for a specific purpose and abandoned or modified shortly after.

The T-Stick is a very good example of a different and promising approach. This family of instruments, described in an article titled “The T-Stick: From Musical Interface to Musical Instrument” (Malloch and Wanderley 2007:66), aims to bridge the gap between performers and composers by building a family of instruments that share “the same general structure and sensing platform”, but differ “in size, weight, timbre and range”. Composers can thus write, e.g., chamber music for a T-Stick consort and players can capitalise their effort on learning the instrument by being able to apply the acquired skills with all the members of the family.

1.1. Electroacoustic music with acoustic instruments

When working with mixed acoustic and electroacoustic media, many composers aim at the illusion of expanding a given musician’s gesture using electroacoustic gestures that are related to the instrument sound but often unfeasible with it. The mixed media work of João Pedro Oliveira is a striking example of this and his work raises some important questions regarding the fusion of the acoustic and the electroacoustic sounds.

1.1.1. Acoustic coupling

In works like “L’Accordéon du Diable” (Oliveira 2010a), the instruments are often amplified using the same loudspeakers as the tape part. This serves not only the purpose of balancing the dynamics between the two, but also helps to meld their sound, as they occupy different positions on stage and have very different diffusion patterns. Traditional loudspeakers are mostly unidirectional,
as opposed to acoustic instruments, which radiate sound in all axis and, most importantly, with different spectral characteristics in each direction. The Ondes Martenot (Bloch 2004), an instrument that goes back to the origins of electronic music, addressed this issue quite effectively by having four different diffuseurs with different sonic footprints. Three of these speakers included resonant materials in order to produce different timbres and instrument-like diffusion. Some recent attempts have been made to mimic the acoustic instruments diffusion in digital instruments, most prominently using hemispherical speakers like the ones built for the Princeton Laptop Orchestra (Trueman et al. 2006) and Rui Penha’s “obra com título longo*” (Penha 2010).

1.1.2. Synchronization
The need for synchronisation of electroacoustic and acoustic sounds has been traditionally met by one of two approaches: the use of click tracks with a prerecorded tape part or what is known as ‘live electroacoustics’, relying on either score-following techniques or on live triggering by an off-stage technician, the musician himself or the composer. The former sacrifices some of the interpreter freedom for the sake of accuracy and raises some problems when dealing with chamber music works, as the musicians need to hear the click track using headphones and therefore lose some aural connection with each other. The latter can suffer from some accuracy issues, specially when using score-following, and still doesn’t settle the electroacoustic part, albeit being live, on par with the instrument in terms of performance and interpretation.

1.1.3. Timbre fusion
In works like “Maelström” (Oliveira 2010b), Oliveira expands the instrument’s acoustic resources by using new techniques that mimic the electroacoustic sounds, e.g. using rotary electrical appliances to strike the strings fast and repeatedly, producing sounds reminiscent of granular synthesis. Albeit related, the result of this fusion is perhaps more effective than the traditional use of the instrument’s timbres on the tape part, as we are much more familiar with the instrument’s sounds and thus more capable of distinguishing between the established acoustic sounds and their electroacoustic counterparts.
2. Technical and aesthetical proposals

The surge of digital interfaces for musical expression is yet to produce systematic examples of performance integration with acoustic instruments, in the tradition of, e.g., the Ondes Martenot in some of Messiaen's works. We believe that the time is ripe for this to change. In this conference recital, we will perform an improvisation using the grand piano as the main acoustic source and both digital and acoustic resources will expand its timbral resources. Our main goal is to blend all these resources into one instrument, both sonically and performance-wise, using three main strategies discussed below. While targeting a complete fusion between the electroacoustic and the acoustic sounds, the performance obviously exposes the sources being played at any given time. We opted to place the digital instruments on the piano (figure 1) in order to minimise these clues and allow for mixed musical gestures.

![Figure 1: Continuum fingerboard on the piano’s music stand.](image)

2.1. Hidden transducers

We will develop on the idea of the diffuseurs and multi-directional speakers by using the piano’s soundboard as a diffuser of the electroacoustic sounds. Vibration transducers like the FoneStar TDO-15 (figure 2) are designed to turn
any surface into a loudspeaker. This surface imposes its frequency response and radiation characteristics into the sound being diffused. In this case, the diffused sounds inherit some of the piano characteristics, e.g. its specific modal frequencies, the interaction with the piano lid and the ability to use the sustain pedal to allow the strings to sympathetically resonate. By taking into account the sound characteristics of both the transducer and the soundboard when designing the digital sounds, we were able to achieve a fusion between the acoustic and the electroacoustic sources that we believe is unprecedented.

Figure 2: FoneStar TDO-15 transducer on the piano soundboard.

2.2. Timbre expansion

The idiomatic sound of the piano is immediately recognisable by virtually anyone, regardless of their musical training. As a consequence, the electroacoustic sound sources are easily revealed as such. Aiming for a fusion between the acoustic and electroacoustic sources, we felt the need to expand the timbrical characteristics of the piano in order to have more diverse resources to blend with the synthesised sounds. Besides the traditional expanded techniques, e.g. plucking the strings, we will use custom made mallets and several metallic bowls of different sizes that have gong-like characteristics. The main part of the timbre expansion, however, will be the use of digital instruments. The Continuum Fingerboard has been in constant development since 1990 as a digital interface for musical expression. It consists on a fabric surface laid on top of springs that sense the position of several fingers in the X, Y and Z axis in high resolution, while giving a tangible feedback to the player.
The first commercial version was released in 2002 and, since 2009, it has a built-in audio DSP capable of synthesising idiosyncratic sounds using techniques like, e.g., physical modeling or timbre morphing (Haken 2011). The Continuum fingerboard gets its name from its capability to produce continuous pitch and timbre changes, allowing virtually any tuning, vibratos and pitch shifts for each finger. As a consequence, it is not only useful in expanding the sonic capabilities of the piano, but also in freeing it from equal temperament and allowing the exploration of beatings and glissandos. We will also use a computer with digital synthesisers and controllers that, at the time of this writing, have not yet been completely defined.

2.3. Improvisation and Performance

While developing new instruments and musical interfaces, one has the option to either maximise the use of established vocabularies, in order to reduce the learning curve, or explore new interaction models, potentiating the emergence of new languages (Penha 2009). While we are not developing new instruments per se, the combination of all these resources in one performance medium confronts the performer with new challenges and requires some new approaches to be used along with the traditional vocabularies of the piano or the Continuum fingerboard. As there is no tradition established for this particular setup, we became aware of the need to freely explore it in order to reveal its potential. As this conference recital will be its first presentation, along with the fact that we are mingling the roles of instrument maker, composer and performer, we decided that an improvisation would be the ideal model to convey this exploratory approach to the audience. While an improvisation is not realtime composition, in the sense that the end result is not equivalent to the controlled development possible with the latter, we aim to bring to light the continuous refinement of musical gestures, the becoming of the material that could be the premise of a composition.
Conclusions and future work

Despite the fact that it is yet too soon to draw any definitive conclusions, this conference recital being the first presentation of this project, we are convinced that this research can lead to new insights on the performance of live electroacoustics in the contemporary music realm, specially regarding the sonic interaction with acoustic sources. The establishment of a permanent setup of instruments in the near future will catalyse the emergence of enough vocabulary to begin the development of compositional processes tailored to this setup. We also intend to explore the use of vibration transducers with other suitable resonant bodies, expanding this technique to different acoustic instruments and creating distinct sonic resources.

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Author’s biographies
Rui Penha is a prize-winning composer, conductor and performer of live electroacoustic music. Foremost interpreters regularly play his music in festivals around Europe and some of his works have been published. He is also a developer of music software, instruments and installations. Rui teaches at the University of Aveiro, where he is currently finishing his PhD.
Paulo Maria Rodrigues is a composer, performing musician and educator working in the field of Theatrical Music. He is one of the founders of Companhia de Música Teatral, coordinated of the Education Service at Casa da Música, Porto and has presented his academic and artistic work in Portugal, Spain, Greece, UK, Poland, Finland, USA and Canada. He is a Professor at DeCA, University of Aveiro and Advanced Research Associate at the Planetary Collegium.