INAUGURAL LECTURE

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Beauty and the Beast

The Faustian Bargain between Music and Techne

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INTRODUCTION

Many thanks for coming today to my lecture. I am very much honoured to share with you some of the research and ideas that give meaning and indeed urgency to my work here at the Conservatoire. It is very rewarding to do research in such an environment, full of opportunities for collaborations and that is never boring.

My lecture tonight is about the search for meaning in music technology. I will focus on so-called art music (contemporary music, concert music, new music) that employs electronic technologies. The French term '*musique mixte*' more closely approximates the kind of music I will be discussing. '*Musique mixte*' implies the coexistence of acoustic instruments and electronic technologies in performance and it is broadly similar to the expression 'music with live electronics' in English.

For many years I have been thinking about why we should use electronic technologies in the composition and performance of art music. For all my passion for the medium I couldn't help seeing through the hype and the novelty and finding the interaction of traditional orchestral instruments and computers as problematic. What I was looking for was a reliable foundation on which to base rationally what I felt instinctively to be true, and I will give you tonight a flavour of where my research has developed in this sense over the past few years. In order to do so I will step back from specific research problems and take the long view, a very long view, as the title of the lecture shows.

One of my main issues with music technology research not only in this country but also around the world is its inability to see the wider picture. Most current research has a narrow scope, focuses more on technology than music, and by doing so remains largely irrelevant to the wider community of professional musicians it should serve.

The expression 'music technology' itself is deeply problematic. Its very name expresses already a dichotomy that is not easily reconciled. At the intersection of art and science, music technology is eminently interdisciplinary – and this is a positive aspect – but at the same time lacks the clear taxonomy that is found in more mature disciplines. Accordingly, its identity is not clearly defined, nor is its 'centre'. Music technology seems to intersect many different things. In no particular order: computer music, sound recording, electroacoustic music, digital signal processing, software design, DJing, music production, acoustics, games music, and the list could go on and on. Among this plethora of potential research areas, it is hard to identify what is the main object of music technology research, or if there is one at all.

In my view there is indeed an object of music technology research, and it is the *techne*, that is to say the ensemble of knowledge, processes, techniques and tools that allow the creation, production and performance of music, with a definite focus on the musicians themselves. I'm not saying this because I'm in a Conservatoire, but rather than trying to establish academic credentials for music technology in its own right, I would much prefer to see music technology as subservient to music, and a branch of music as an academic discipline. This would go a long way in avoiding a scientific, or even worse, technological primacy in music technology research. In other words, the technology should always be approached through the music, rather than the other way around. Otherwise the temptation will always be strong to get bogged down in aspects

of technology that are not relevant to music practice, and do not take into account the aesthetic, cultural and social dimension of music making.

Technology affects every aspect of our lives, and considerable amounts of self-discipline and sane scepticism are needed if we are to maintain some semblance of human perspective and control over the all-pervading technologies that surround us. In our own fields we all have a role to play to keep the human perspective at the forefront, especially those of us that deal with scientific and technological subjects. As a Professor of Music and Technology I feel strongly that it is my duty to guard against the negative effects of an excessive focus on technology and maintain music, musicians and their artistic practice at the centre of my research and teaching efforts.

I also believe that for far too long in many technological disciplines ethical considerations have been either avoided or paid lip service to. As usual with technological innovations, there is a tendency to accept that if something *can* be done it *must* be done, following a kind of technological determinism that is wholly devoid of ethical considerations. The corollary is that technology is mostly neutral, a simple means to an end. Overcoming this instrumental approach to technology should be our aim. As I will show through this talk, the truth is that technology is not neutral at all, and understanding how it conditions and shapes every aspect of our lives is essential and urgent.

WHY BEAUTY AND THE BEAST

For many years I have been interested in myths and folktales, and their reverberations in our own work. The two traditional folktale motifs I refer to in the title of my lecture are well known: the marriage between a girl and a monster, and the man that sells his soul to the devil. Both stories have their original sources in the ancient world and can be defined in Joseph Campbell's words as 'living myths'. They can be read in many different ways, have rich constellations of meanings and continue to inspire artistic creation to this day.

The original motif of Beauty and the Beast (*La Belle et la Bête*) is found in the tale of the Marriage of Cupid and Psyche as narrated by Lucius Apuleius in the Golden Ass, written in the second century AD. Without retelling the whole story of Cupid and Psyche, it is worth mentioning that Psyche, as Belle, marries a man she believes to be a monster, only to discover that he is in reality a handsome youth: a god, and the son of Venus.

At a fundamental level these two tales are about Otherness. In both cases there is a tension that needs resolving through an unveiling, a revealing of the Other – Psyche lights an oil lamp in the middle of the night to get a secret glimpse of her husband, while Beauty sheds her tears over the Beast and transforms him in a beautiful prince. In both tales the girls are transported to a sumptuous castle full of all manners of abundant riches entirely at their disposal. Now, Psyche in Greek means soul, *anima* in Latin. In a metaphorical sense what is played out in these two stories is the conflict between the beautiful, innocent soul on one side, and the temptations of otherworldly (inhuman) wealth and knowledge on the other.

In my view it is a conflict that mirrors in the simplest, starkest way the tension between contemporary music and new technologies. On one side there is music as an art form and a specialised cultural practice, the latest incarnation of an extraordinary legacy that spans over more than five centuries, and on the other side there is technology, a wildly amorphous glut of devices, tools and techniques that seems to offer limitless possibilities for creative endeavour while at the same time resisting most efforts to try and make sense of it from a musical perspective.

Is this separation arbitrary? I don't believe so. Anyone who has ever walked into a concert where music with live electronics was being performed will have noticed at least three things:

1. The presence of spurious objects on stage and around the venue (microphones, speakers, cables, mixing desks, etc.).
2. The longer than normal intervals between pieces.
3. The tense expressions of those responsible for performing the electronics. (They know that something will go wrong…)

Does it need to be so? Maybe, but in order to understand why let's look more in detail at the issues first from the point of view of music.

MUSIC

I would venture to say that music with live electronics is artistically successful only when the electronics are completely generated from musical ideas and are integrated with the musical material, and only when the technology establishes with that material a profoundly satisfying and meaningful musical relationship.

I can think of two possible criticisms to this statement. The first is that it is normative, and contemporary aesthetics have great difficulty with questions of artistic judgement. The second is that it reinforces an instrumental understanding of technology, seen as a means to an end. The end is the musical composition, and the means are whatever technology the composer employs in order to bring into existence her artistic vision. Instead of questioning or subverting *techne* as part of the compositional process the composer uses it to arrive at the final artistic result, the finished composition. This approach, the critique goes on, is akin to the way technology is used in popular music, where composers use commercially available technologies uncritically to produce and perform their songs. Serious composers, is the implication, can do better than that.

I believe that this critique is only partially valid: it is certainly desirable for composers to question the *techne* available to them, and, in line with all that has been written on participatory design from Winograd's seminal work onwards, to engage in a hermeneutic dialogue with technology designers in order to arrive at a suitable *techne* for music creation and performance with live electronics. Incidentally, this is exactly what we have tried to do with the Integra project and the development of the Integra Live software here at the Conservatoire. On the other hand, musicians cannot really subvert the *techne* they are using because they don't understand how the *techne*

functions in the first place. If any artistic subversion is going to happen, it will be in the music domain, not in the technology domain.

Regarding artistic judgement, I wouldn't mind putting live electronic music to the test of the early 20th century aesthetics of Benedetto Croce and R. G. Collingwood. From this perspective the risk of technology, the Faustian bargain if you wish, is that it makes incredibly easy to create effects rather than musical meaning. But, according to Collingwood, effects eliminate the distance created by aesthetic interest, and leave only entertainment in its place. Interestingly, and not by chance, in music technology we talk a lot about 'effects'. Any type of audio signal processing, a delay, a reverb, is commonly referred as an effect. Making sure that a piece is more than a collection of effects, in both senses, should be the priority of every composer.

The genesis of musical compositions has been studied extensively. Like other forms of artistic creation it is a complex, ambiguous, non-linear journey, where obstacles, dead alleys and sudden illuminations all contribute to the final result. Bursts of creativity alternate with idle phases where not much happens, and highly complex structural considerations may coexist with intuitive, *ad hoc* solutions. Rules may be created and rules may be flouted. Throughout, the ability to 'think in music' is essential. Different composers will do it in different ways, through abstract thinking, or with the help of a musical instrument, but the need to remain 'in the flow' as much as possible will be shared by all. The technology of music notation is generally mastered and is an integral part of the creative process for most composers. Similarly to writing for a novelist, it is also an almost transparent technology. The use of computers for writing a book or a music score introduces a number of issues, but by and large the technology does not affect the ability of the creators to realise their original intentions.

If now we introduce to this scenario live electronic technologies, are they going to disrupt the creative process or can they become a part of it? Where does technology fit in, and how? Simplifying the rather vast landscape of technologies available to composers I will mention three main categories:

The first is Computer Assisted Composition (or CAC). Good examples of CAC are the Composers Desktop Project initially developed by Trevor Wishart here in the UK, and the PatchWork and Open Music software packages developed by IRCAM in France. CDP focuses on sound design and manipulation of sounds whilst Open Music adds to that the control of musical aspects of a composition at various levels – from pitches and dynamics to melodic contour, from rhythmic structures to sequences of chords, and so on. They are very powerful tools in the right hands, but they also exhibit an almost total lack of concern for the nature and the scope of the compositional process as we described it. They are rigid, low level, task-oriented software environments that encourage deterministic operations over creative ambiguity. They are also very difficult to master, with substandard user interfaces that require a huge cognitive effort from the composer.

The second set of technologies available to composers is software programs that synthesise sounds and process live audio signals thus allowing real-time interactions between musicians and computer in performance. Among those MaxMSP, Pure Data and Supercollider are the most commonly used. These are all in effect programming languages; with a graphical interface in the case of Pure Data and MaxMSP, or with a traditional command line in the case of Supercollider. The total flexibility allowed by

these programming languages is again counterbalanced by a very steep learning curve, and a frustrating user experience for non-programmers.

The third group of technologies is represented by commercial software – digital audio workstations and music production suites like ProTools, Logic or Ableton Live. These are the fully fledged software equivalents of a high-end music studio, and support a complete workflow that goes from choosing the sounds to writing, recording, editing and mixing. Unfortunately, because of their focus on recording, beat- and loop-based music or music for film and other media, they all have structural constraints that limits their suitability for designing and performing live interactions.

It does not come as a total surprise then if the leading composers and performers of our time tend to ignore these technologies, and when they use them, it is often in a perfunctory, anecdotal way. There are important exceptions obviously, like the late Jonathan Harvey, who sadly passed away less than three months ago, but to limit us to the UK, Thomas Adés, George Benjamin, Harrison Birtwistle Peter Maxwell Davies, Brian Ferneyhough and Mark-Anthony Turnage have all had very few encounters with technology in their works. Can they be blamed for ignoring the medium? I don't think so. The tools that they can access, often involving a long learning curve and great personal investment in time and energy, are not designed for them. Moreover, and this is another reason for concern, the long-term performability of works with electronics is in no way guaranteed. Technology changes all the time, there are no agreed standards – yet, this is something we are working on – and publishers have no appetite to devote resources towards the sustainability of the live electronic works in their catalogues. Finally, performances involving technology need longer rehearsals, are generally more expensive, and are believed to be more risk-prone than technology-free ones.

So, composers have many good reasons to stay away. You may rightly ask then, what is the point of technology in music? Well, when used wisely technology is a powerful instrument that vastly increases the expressive options available to composers. Technology can reveal hidden aspects of the music, project sounds in space, allow all sorts of interactions with a performer's musical and physical gestures, process and transform instrumental sounds in real-time, and so on. This is all very exciting, however, unless technology is allowed to become an integral part of the compositional process, it is meaningless.

But how can we enable composers to design more meaningful interactions with technology? We need to provide them with better tools that allow them to 'think in music' all the way through the creative process. In other words we need to rethink the *techne* of composition. This *techne* is generally polymorphous, involving a range of software, hardware and audio equipment, is in a state of continuous change due to the pace of technological innovation, and, more importantly, is never neutral. It conditions and disrupts the creative process by imposing a set of practices and behaviours that are alien to it. A seemingly integrated process becomes split in two, musically meaningful and creative on one side and abstract, procedural and task-oriented on the other side. Crucially from an aesthetic point of view, the same cognitive distance experienced by composers when they have to alternate between musical thinking and technological thinking finds an equivalent in performance, where often acoustic and electronic sounds do not merge in meaningful ways.

Let's compare this with popular music genres. Here technology *is* the process of music creation and production. There is no obvious tension between musicians and *techne*. In popular music, in fact, technology is not an external element that needs specific competences and skills. It is completely embedded in the way music is created, produced and distributed, and it is remarkably adapted to the demands of musician, both in the studio and in concert.

From a classical musician perspective it is problematic even to define what the *techne* of live electronic music consists of: to her eyes it looks like a loose aggregate of discrete objects, functions and connections that are hard to conceptualise as a single entity: microphones, MIDI and gesture controllers, software programs, computers, audio interfaces, mixing desks, multi-channel speaker systems, audio cables, and so on. Even in its simplest form, a live electronic setup will include at least an audio or gesture capture device, a processing unit, and a sound diffusion system. Some of these elements can be portable, but others will often be resident in the venue where the performance takes place, creating an additional layer of complexity.

Performers are trained to interpret a musical score. The challenge for live electronic systems is to allow performers to interpret the music. Interpretation can happen only if there is a constant feedback loop, a reliable and repeatable cause-effect relationship between the performer's gestures and the resulting sounds. This relationship of course may involve high levels of randomness and complexity, as it is often the case in live electronic music, but it is essential that performers be allowed to establish a trustworthy mental representation of the piece in its entirety before they can even begin to interpret it. Moreover, we consider a musical performance to be exceptional when the performer is 'at one' with his or her instrument. An ideal *techne* for live electronic music performance would allow a performer to feel 'at one' also with the live electronics element of the performance.

There are currently three main obstacles to creating a suitable *techne* for the interpretation of live electronic music. The first is composers themselves. Because of the lack of stable, standardised systems to design interactions and represent them on a musical score, composers often create ad hoc systems that need tweaking up to the last minute. These live electronic systems are very poorly documented, if at all, and precious rehearsal time is wasted sorting the aspects of the technical set up instead of working on the musical interpretation. In fact, it is quite common for performers to find out for the first time at rehearsals in the concert venue how the live electronic element of the piece really works.

The second obstacle is represented by the performer's lack of control over quality and volume of the overall amplified sound. In a typical live electronic set up the electronic sounds will be diffused by any number of speakers, and often the sound will be panned or spatialised following more or less precise score instructions. The natural sound of the instrument will also be often amplified to blend in with the live electronics. In this situation it is not at all easy for the performer on stage to maintain a reliable mental representation of both the sound she is producing and the amplified electronic sounds. In-ear personal monitoring is a possible partial solution, although it introduces another layer of technological complexity to the set up.

The third obstacle, as we have seen, is caused by the difficulty of defining conceptually the boundaries of what the *techne* of live electronics performance really is. Straddling as it does across different people, technologies, functions and stages

throughout the music production process from creation to performance, it cannot be readily identified with one person, one tool or one specific machine. This creates the inherent, constant cognitive dissonance that is well known to most performers involved in live electronic music concerts.

A potential solution to remove those three obstacles is provided by Sound Intermedia and the London Sinfonietta, one of the world's leading contemporary music ensembles. The live electronic music 'performers' become part of the ensemble and have the same status as the other musicians of the group. Ian Dearden and David Sheppard own this live electronic 'thing' on behalf of the ensemble, and act as a trusted interface between technology and the rest of the group, ensuring, as musicians, the quality of the performance, and, as technicians, the smooth running and transparent interaction with the technologies. This clever solution unfortunately works only for larger ensembles or orchestras that can afford this level of involvement. It is not a remedy for individual performers or smaller groups.

IRCAM, the Paris-based research centre for electronic music, the largest in the world, has tried – unsuccessfully, in my view – to bridge the gap between music technology research and contemporary music practice. The French predilection for a systematic, theoretical approach to research has been an obstacle to the development of tools and practices that can be embraced by composers and performers. The brilliant software developed at IRCAM comes at a very high cost to the French taxpayer and the members of the Forum IRCAM like this Conservatoire, but has never reached a stage of usability that is adequate for musicians. Moreover, IRCAM's rigid division in separate research teams has always encouraged a silo approach. Research at IRCAM is currently organised around seven independent groups supported by three service units. They all belong to the research department, one of four, the other three being education, creation/diffusion, and media resources. I recently noticed with some interest that IRCAM added a fifth department, called 'research/creation interfaces'. Its aim, from what it says on the IRCAM website, is "to create connections between scientific research and artistic creation at IRCAM". I leave it to you to consider the wisdom of setting up yet another department to help two existing departments to talk to each other.

TECHNOLOGY

Moving now on to technology, we have seen how *techne* can be defined as the universe of the technical tools and processes we use and the rationality that presides over them. *Techne* is an ancient Greek word. At a time when art and craft were not separate, *techne* meant the craft, the craftsman and the process of crafting something, be it an artwork like Praxiteles's Aphrodite or an everyday object like a chair or an amphora. This original meaning of *techne* is relevant because of its role in Heidegger's philosophy of technology. Because of the complexity of his thought and his peculiar terminology, Heidegger has been alternatively described as a nostalgic romantic bent on demonising technology, or as a radical prophet of a new technological age. In reality I find that Heidegger's philosophy of technology is relevant for us because of what it says about the role that art can play in re-establishing what he calls a "free relationship with technology".

Heidegger sets out to define what the essence of technology is in "*The Question Concerning Technology*" written in 1953 (sixty years ago). I quote:

> The essence of technology is by no means anything technological. Thus we shall never experience our relationship to the essence of technology so long as we merely conceive and push forward the technological, put up with it, or evade it. Everywhere we remain unfree and chained to technology, whether we passionately affirm or deny it. But we are delivered over to it in the worst possible way when we regard it as something neutral; for this conception of it to which today we particularly like to do homage, makes us utterly blind to the essence of technology.

According to Heidegger the essential, original meaning of technology is not only to be a means, and a process of making something, but also a mode of revealing the truth, in the sense of the Greek word for truth, *aletheia*, which means disclosing, unconcealing what was concealed. In ancient Greece the concept of *techne* was close to *poiesis* (bringing forth, creating, from which the word poetry comes) and *episteme* (knowledge). The artist, or the artisan, brings forth, reveals an artefact. "It is as revealing, and not as manufacturing, that *techne* is a bringing-forth" says Heidegger.

If you are still with me, Heidegger goes on to recognise a fundamental difference between technology as bringing forth, a mode of being that accompanied humanity until the industrial revolution, and modern technology as we experience it today. Modern technology represents a different kind of revealing, not through bringing forth but through 'challenging': Technology challenges nature and 'puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such." The world becomes thus a standing reserve. "Everywhere everything is ordered to stand by, to be immediately at hand, indeed to stand there just so that it may be on call for a further ordering. And whatever stands by in the sense of standing-reserve no longer stands over against us as an object." We could say that everything becomes classified and commodified.

Heidegger defines this mode of revealing that reveals the real as standing reserve trough 'challenging' with a new word, 'enframing' (*Ge-stell* in German). From the initial relationship in which the physical world reveals itself to humanity on its own terms, humanity moves into an 'enframing' relationship with the world. "The rule of enframing threatens man with the possibility that it could be denied to him to enter into a more original revealing and hence to experience the call of a more primal truth." Heidegger's words strike a chord, if we consider how technology rules our world, our economy and indeed ourselves.

But if technology can destroy us it can also save us. What Heidegger calls the saving power can only appear when the danger is greatest. We can return to a Greek concept of *techne* as revealing, as disclosing nature, only if, tragically, we go all the way to the brink of transforming humanity and the world in its entirety into a meaningless standing reserve. The essence of technology, not technology itself, is a power that challenges humanity. By allowing this power to grow unchecked, we will realise that we are not in control anymore, as the ancients felt with regard to nature. Being in the grasp of a fate beyond humanity's control is the only condition that will allow us to access the saving power of *techne* and enter "a free relationship with technology." How

is this going to happen? In Heidegger's words, "essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and, on the other, fundamentally different from it. Such a realm is art."

Art, music in our case, appears here because, as we have seen, in ancient Greece art and *techne* were one and the same thing. Now, if art is called to be the saving power from the extreme danger of our technological understanding of the world, then suddenly our work as musicians and technologists becomes meaningful and urgent. As I see it, the way forward for music with live electronics is clear. Its *techne* must be realigned to the nature of the creative process and the demands of artistic practice. Being already compromised with modern technology, live electronic music is directly exposed to the consequences of 'enframing'. In other words, it is closer to the extreme danger. But this means also that its saving power is greater. By reinterpreting *techne* and grounding it in artistic practice we will be able to imbue it with its original, and lost meaning as a 'bringing forth' mode of revealing.

At the Ferienkurse held in Darmstadt in 1956 the relevance of Heidegger's thought for electronic music was debated for the first time at a roundtable that saw among others Ernst Krenek, Karlheinz Stockhausen, Pierre Boulez, Bruno Maderna and Stefan Wolpe. Luigi Rognoni, an Italian musicologist, affirmed that electronic music was a way to confront nature, to investigate the nature of sound itself, along the same lines of Heidegger's vision of *techne* as *poiesis* and the search for a more primal meaning of technology. Interestingly, Stockhausen said at the time that Rognoni's comments were irrelevant to the debate on electronic music, but I beg to differ. The arts, and music in particular have a decisive role to play in achieving a different relationship with technology, one with a human face.

OUR RESPONSIBILITY

This raises some interesting ethical issues. In the encounter with technology an ethical reflection founded on music would put human values first, for example recognising the essential role of live performances as opposed to virtual experiences: from a music ethics perspective technology used to enhance live performances (as in live electronic music) would be more desirable than, for example, technology used to commodify even more music consumption.

The imperative today for people developing new technologies ought to be an ethical imperative. Programmers, researchers and technologists do not look often at sustainable solutions for the problems they are trying to solve as they are sorely lacking a deep-seated understanding of the ethical consequences of their actions. In reality ethical awareness and sustainability concerns are not constraints to innovation. On the contrary, they offer a direction of travel for innovation that is also right for humanity. The Human-Computer Interaction community, among others, is slowly waking up to the importance of this approach, and is moving on from the usability paradigm to embrace social, cultural and ethical concerns in the design of tools and interfaces. This new wisdom is finally orienting technology towards the organic, the gentle, the non-violent, the elegant and beautiful, as Fritz Schumacher demanded in

1973 in his pioneering book *Small is Beautiful – A Study of Economics as if People Mattered*.

Technology is the principal condition of our life. In the words of Albert Borgmann, "the problem is that we are not taking responsibility for the condition". It's not even on the agenda. What can we do as musicians, as technologists? Well, first of all, we need to, as I am doing tonight, raise the question of our own responsibility. As Heidegger questioned technology sixty years ago, we shall continue to question it today with renewed urgency. Our task is made harder because technology advances imperceptibly – it is always difficult to say when something becomes excessive and needs restraining – and it has become inextricably woven into the dominant narrative of economic growth and free-market capitalism.

The question of why technology, why live electronics, reflects the broader, metaphysical question that should guide our actions as researchers, educators and citizens. What is the fundamental purpose of a given technological innovation, in human terms? What need, what problem is it trying to solve? Is the problem, seen from an Aristotelian perspective of *frónesis* (the practical wisdom, *prudentia* in Latin), a meaningful one for humankind? A moral judgement needs to replace the instrumental calculation that if it can be done, it must be done.

An obvious goal of music technology, parallel to the goal of more mainstream computer technology, is to become transparent to the user. Think for example of the whole area of ubiquitous computing and Mark Weiser's vision of the disappearing computer: "Machines that fit the human environment instead of forcing humans to enter theirs will make using a computer as refreshing as taking a walk in the woods." Equally, we dream of powerful, standardised tools that mirror the nature of the creative process and the workings of the musical mind and we dream of designing and controlling ever more subtle and meaningful live interactions with technology. But is this really desirable? Is there any risk that developing technologies so integrated with our way of thinking will actually make us less human? I will let you ponder over this question, something Steve Talbott has done superbly in his book *Devices of the Soul: Battling for Our Selves in an Age of Machines*.

Our responsibility as artists, technologists and researchers is to give meaning to the use of technology by keeping always to the forefront the human and musical perspective. In 1976, in a book on electronic music edited by Henri Pousseur, Luciano Berio said prophetically that the search for a deep and meaningful balance between new technologies and music through real-time live electronics was the only historical and ideological perspective that gave a sense of completeness to current and future research. I hope that in this lecture I have presented a convincing case that this search has also a profound practical, aesthetic and philosophical validity.

Thank you.

REFERENCES

Apuleius, Lucius (1566) *The Golden Ass*. Translation by William Adlington, Wordsworth Classics of World Literature, Wordsworth Ed. Ltd., Ware, UK.

Belet, Brian (2003) 'Live performance interaction for humans and machines in the early twenty-first century: one composer's aesthetics for composition and performance practice'. *Organised Sound*, 8:305-312.

Berio, Luciano (1976) 'Prefazione in Pousseur, Henri (Ed.), *La musica elettronica*. Giangiacomo Feltrinelli Editore, Milano.

Bernardini, Nicola and Vidolin, Alvise (2005) 'Sustainable live electro-acoustic music'. *Proceedings of the Sound and Music Computing Conference*, 24–26 November 2005, Salerno, Italy.

Borgmann, Albert (1984) *Technology and the Character of contemporary Life: A Philosophical inquiry.* University of Chicago Press.

Borio, Gianmario (1993) 'New technology, new techniques: The aesthetics of electronic music in the 1950's'. *Interface*, Vol. 22, 1:77-87.

Buso, Nicola (2011) 'Terza partita. La musica nell'età della tecnica – un madrigale'. *Musica/Tecnologia*, 5:25-46.

Chapman, Owen (2011) 'The Elusive Allure of "Aura": Sample-based Music and Benjamin's Practice of Quotation'. *Canadian Journal of Communication*, Vol. 36 2:243-261.

Clarke, J.M. and Manning, Peter (2008) 'The influence of technology on the composition of Stockhausen's Octophonie, with particular reference to the issues of spatialisation in a three-dimensional listening environment'. *Organised Sound*, 13, 3:177-187

Collingwood, Robin G. (1938) *The Principles of Art*. Clarendon Press.

Di Scipio, Agostino (1995) 'Centrality of techné for an aesthetic approach on electroacoustic music'. *Journal of New Music Research*, 24, 4.

Di Scipio, Agostino (1998) 'Questions concerning music technology'. *Angelaki*, 3, 2:31-40.

Di Scipio, Agostino (2010) 'Mediazione e responsabilità, nel suono'. *Musica/Tecnologia*, 4:69-83

Dreyfus, Hubert L. (1997) 'Heidegger on Gaining a Free Relation to Technology' in Shrader Frechette, K.S. & Westra, Laura (Eds.), *Technology and Values*. Rowman and Littlefield, Boston.

Fallman, Daniel (2010) 'A different way of seeing: Albert Borgmann's philosophy of technology and human–computer interaction'. *AI & Society*, 25, 1:53–60.

Fallman, Daniel (2011) 'The New Good: Exploring the Potential of Philosophy of Technology to Contribute to Human-Computer Interaction', *Proceeding of CHI,* May 7–12, 2011, Vancouver, BC, Canada.

Feenberg, Andrew (1999) *Questioning technology*. Routledge, London.

Ferrari Di Pippo, Alexander (2000) 'The Concept of Poiesis in Heidegger's An Introduction to Metaphysics'. *Thinking Fundamentals*, IWM Junior Visiting Fellows Conferences, Vol. 9, Vienna.

Franklin, Rosemary F. (1984) 'The Awakening and the Failure of Psyche'. *American Literature*, 56, 4:510-526.

Frisk, Henrik (2007) *Interactive systems in improvisation and composition. A work in*

progress. Lund University, Malmö.
Frith, Simon (1986) 'Art versus technology: the strange case of popular music'. *Media Culture Society,* 8, 3:263-279.
Galimberti, Umberto (1999) *Psiche e techne. L'uomo nell'età della tecnica*. Giangiacomo Feltrinelli Editore, Milano.
Garnett, Guy E. (2001) 'The Aesthetics of Interactive Computer Music'. *Computer Music Journal*, 25, 1:21-33.
Gill, Karamjit S. (2010) 'Ethics of calculation'. *AI & Society*, 25:1–3
Heidegger, Martin (1977) *The Question Concerning Technology*. Translation by William Lovitt, Garland Publishing, New York & London.
Ihde, Don (1990) *Technology and the Lifeworld. From Garden to Earth.* Indiana University Press.
Lippe, Cort (1996) 'A Look at Performer/Machine Interaction Using Real-Time Systems'. *ICMC Proceedings*, ICMA.
Manning, Peter (2006) 'The significance of techné in understanding the art and practice of electroacoustic composition'. *Organised Sound*, 11, 1:81-90.
McNutt, Elizabeth (2003) ' Performing electroacoustic music: a wider view of interactivity'. *Organised Sound*, 8, 3:297-304.
Orwell, George (1946) 'Pleasure Spots'. *Tribune*, 11 January 1946.
Palombini, Carlos (1998) 'Technology and Pierre Schaeffer: Pierre Schaeffer's Arts-Relais, Walter Benjamin's technische Reproduzierbarkeit and Martin Heidegger's Ge-stell'. *Organised Sound*, 3, 1:35-43.
Penny, Jean (2010) 'Techne: Revealing Sound, Space and Self in Music for Flute and Electronics'. *Ninad, Journal of ITC Sangeet Research Academy*, 24:28-43.
Pinch, Trevor, (2008) 'Technology and institutions: living in a material world'. *Theory and Society*, 37, 5:461–483.
Postman, Neil (1993) *Technopoly. The Surrender of Culture to Technology*. Vintage Books, New York.
Rees, Fred J. (2012) 'Redefining Music Technology in the United States'. *Journal of Music, Technology and Education,* 4, 2-3:149–155.
Richard, Dominique (1997) 'The Beast's glove: The tactile and the digital in computer music'. *ICMC Proceedings*, ICMA.
Schumacher, Fritz E. (1973) *Small is Beautiful. A Study of Economics as if People Mattered*. Blond & Briggs.
Scruton, Roger () *Beauty*. Oxford University Press.
Tabachnick, David E. (2006) 'The Tragic Double Bind of Heidegger's *Techne*'. *PhaenEx* 1, 2:94-112.
Talbott, Steve (2007) *Devices of the Soul. Battling for Our Selves in an Age of Machines*. O'Reilly,
Thompson, Stith (1946) *The Folktale*. Holt, Rinehart and Winston.
Tripathi, Arum Kumar (2010) 'Ethics and aesthetics of technologies'. *AI & Society*, 25:5–9.
Weiser, Mark (1991) 'The Computer for the 21st Century'. *Scientific American*, Special Issue on Communications, Computers, and Networks, September 1991.
Winograd, Terry A. and Flores, Carlos F. (1986) *Understanding Computers and Cognition: A New Foundation for Design*. Intellect Books.