The composition of acousmatic electroacoustic music in a Norwegian context. Part-I

Natasha Barrett, 2022

Abstract

Electroacoustic music is an umbrella term for a broad diversity of aesthetics and compositional approaches. It is exciting to see that the evolution of electroacoustic music is unlikely to end. Yet this diversity is a cause of confusion for support structures, for organisations who create the frameworks that allow the creative process to flourish, and not least, for educational institutions who should offer composers a balanced and insightful view into electroacoustic music as a compositional artform. This text centres on one of the main sub-branches of electroacoustic music that has both directly and indirectly influenced composers and sub-genres, past and present: acousmatic music. Although well understood in our neighbouring countries, the traditions of the Norwegian education system have not embraced electroacoustic music. Instead, the art-form, and particularly acousmatic music, has flourished outside of these institutions. It is now timely to present acousmatic music from a Norwegian perspective.

Part-I is about history and theory relevant to Norwegian practice. It sets the scene by summarising electroacoustic music's historical background and then traces the rapid development of aesthetics and compositional approaches relevant for Norwegian composers. Part-I ends by untangling misunderstood, but important terminology nuanced in a Norwegian context. This text has been written as a prelude to "The composition of acousmatic electroacoustic music part II" (Barrett and Tveit 2023), which focuses on aspects of creative practice illustrated by specially composed miniatures by Natasha Barrett and Anders Tveit.

1. A fast track through history

The origins of our modern electroacoustic music are well documented (Manning, 1985): the advent of recording led to a new compositional language created from new sounds, which in turn revealed new possibilities for musical structures and forms, and served as an alternative to the traditions of acoustic instruments and the musical forms it promoted. In parallel, synthetically produced sounds added another type of new timbre. The former was pioneered in Paris by Pierre Schaeffer in the late 1940s, and the latter by a collaboration of several interested parties including Werner Meyer-Eppler, Herbert Eimert and soon after, Karlheinz Stockhausen in Cologne. The geographical divide also highlighted differences between French and German electronic music philosophies: the Paris school viewed structure as emerging from the sound and behaviour of the recorded materials. This approach was first called Musique Concrète, but soon after, Schaeffer revoked the term and instead chose to call it Acousmatic Music. The new acousmatic sounds - and what is especially relevant today - the *new musical structures*, presented an upheaval that was later exemplified in Scheaffer's 'Traité des objets Musicaux' (Schaeffer, 1966). In contrast, the Cologne composers followed the structuralism of the Second Viennese School born from

the traditions of instrumental music. Labelled as 'Elektronische Musik' they exercised control over time and timbre by planning details in scores that could be realised on electronic tone generating devices. Composers soon embraced both kinds of sounds - electronically produced and recorded - even though it would take many years before the two *structural* approaches were cherry-picked for their best offerings. In these early years, the seeds of electroacoustic music were also sown in Milan, most notably by Luciano Berio, Bruno Maderna, Luigi Nono, and in the USA by Louis and Bebe Barron, and John Cage.

A revolution in contemporary music was to follow, spreading to the Nordic countries in the 1960s and 1970s. Sweden was undeniably the most pioneering in the Nordic adventure, investing many millions of kroner into the development of the EMS studio (Elektronmusik Studio) in Stockholm, which was led by Norwegian composer Knut Wiggen. The Fylkingen concert society, also led by Wiggen, created a public outlet in the form of presentations and productions. In 'In search of the Nordic Electroacoustic' (Bentley et al., 2019), the authors ask whether it is reasonable to speak of a Nordic identity in electroacoustic music, and whether there is a 'Nordic sound'. Amongst the early Nordic pioneers they point to Rune Lindbald (Sweden) who combined real-world sounds with those from the VC3 synthesiser, Else Marie Pade (Denmark) who was influenced by Schaeffer and Musique Concrète in the 1950s as well as by the Cologne school and Stockhausen in the 1960s, and Arne Nordhiem (Norway) for his work Epitaffio (1963) for tape and orchestra and Solitaire (1968) for solo tape (musique concrète) created in collaboration with the polish composer and technician Eugeniusz Rudnik.

Historically, composers were associated with studios built from the latest, expensive and often custom designed facilities. Yet composers also travelled, and even though studios invested in one direction or the other, composers would visit and glean appropriate sounds and ideas for their music. For Nordic composers this meant travelling to EMS or to the studios in Warsaw (Rudi, 2018). The EMS studio in Stockholm was built around analogue synthesisers and analogue effects such as reverb and ring modulation, then eventually included computers running early sound synthesis programming languages and digitally controlled analogue synthesisers. The way these synthesisers could be controlled harks back to the Cologne approach of realising a score.

During the 1960s-1970s EMS hosted Pierre Schaeffer, Karlheinz Stockhausen, Robert Rauschenberg, John Cage, David Tudor, Iannis Xenakis, Nam June Paik and Gottfried Michael Koenig (Broman, 2007, GRM Archive, 2021, Geslin, 2002). The studios of GRM were centred around tape manipulation, recording, editing, and tape-based instruments that allowed real-time control over delays, pitch-shifting, filtering and feedback, and other custom-made instruments such as the Phonogène (which was a multiple playback-head harmoniser). GRM hosted many of the same composers as EMS: Schaeffer, Stockhausen, Xenakis, Cage, as well as Boulez, Varèse and Messiaen.

2. Musical repercussions for composers today

Technology and aesthetics have developed both in parallel and hand in hand. Yet while technology that uses semiconductors increase in speed at the rate driven by Moore's law (which is based on the observation that the number of transistors in a dense integrated circuit doubles about every two years, and hence the reason your personal computer is normally slower than the latest model on the market), aesthetics evolve at a slower pace. With this in mind, it is useful to summarise some of the key *musical* repercussions of these early years that remain

with us today: new materials, new approaches to composition, new ways of regarding form, a blossoming of aesthetics, and new ways of performing 'sound'.

2.1 A structural hierarchy turned on its head.

Melody, harmony and rhythm are the primary musical products of acoustic instruments. In contrast, non-instrumental sounds offer alternatives that also drive new musical structures. As put by Trevor Wishart in the introduction to his book Audible Design (Wishart, 1994, pp. 1):

- Any sound whatsoever may be the starting material for a composition.
- Musical structure depends on establishing audible relationships amongst sound materials.
- Sounds are not equivalent to notes. Sounds contain their own structure and cannot be considered to relate in the same way as note-based music.

The process begins by using microphones to investigate the sound, normally isolating one perspective. You then explore the sound for 'what it is not' in a conventional sense. For example, it is not important that the object was a china cup. Instead it is the sounds that the cup produces that are in focus. Schaeffer also realised that playfulness and improvisation in source gathering is a way to explore its qualities, and gives the example of a child playing with the sounds made by grass (Schaeffer, 1966/2017, pp. 268-275): he describes the child as performing the grass, exploring its sound for everything other than its normal meaning of grass. He goes on to explain that anything that reminded them of traditional instruments disrupted their quest. Most of their sound bodies were small and discrete: small objects, vibrating coil-springs, marbles bouncing or rolling in cups, sand running over membranes and paper being torn. These historical moments are still with us now. Sounds and recording techniques like those used by Schaeffer in the 1950s are still used by acousmatic composers today, as well as popular amongst contemporary improvisation performers, in particular percussionists.

The lineage from Elektronische Musik brought another concept to the table. Rather than the structuralist heritage of instrumental music, what we are concerned with here is *control*. The precise control of sound creation and musical structures blossomed into an interest for computer programs. The development of programming languages has been as fast as the development of computing power. Extreme precision and control can now be executed at all stages of composition: the smallest details of sound synthesis, the micro-management of recorded sounds and transformations into new sounds, and the macro-control over musical structure.

2.2 The primacy of the ear: the importance of listening

When we no longer think about notes and instruments we need new ways of composing with sound and developing musical structure. Recording brought repercussions changing how we work:

- Visual experience no longer dictates listening. When we listen to a recording, especially when we do not know the 'what, how or where' of the recording, we hear qualities that are less obvious in the live context as well as the many sounding details that vision distracts from.
- In the original context time passes too fast to grasp all sounding features. In contrast, recording allows repeated listening and we become more aware of these features and their musical potential. Although computers can analyse the sound, and indeed nowadays a naive artificial intelligence could be left alone

to select features of some kind or another, at the current time only the composer, by listening 'out of real time', can fully explore the sound by consciously directing listening focus.

Other theorists have developed Schaeffer's ideas for all kinds of music and listening situations. We will return to this later. Here it is important to acknowledge the primacy of the ear as a way of exploring 'unheard' elements in known sound, the implications for musical structure, and the value of intuitive knowledge. To quote Schaeffer, "by *deliberately* ignoring any references to instrumental causes or pre-existing musical meanings, we seek to give ourselves over entirely to listening, and so to come across those instinctive pathways that lead from pure 'sound' to pure 'music' […] turning our backs on the instrument and musical conditioning, and *placing sound and its musical potential squarely before us.*" (Schaeffer, 1966/2017, pp. 69).

2.3 Musical meanings of recorded sound

In a composition, a recorded sound can mean many things depending on how we listen to it, interpret it and manipulate it with sound processing. Nowadays we can summarise three meanings of sound:

- Sound referring to the real-world: the sound is intended to refer directly to the real-world, or instead to seed our imagination and transport our listening to another place. This is commonly called 'extrinsic' information[1].
- Sound inferring or alluding to the real-world: we may intend our sound to infer, allude to or remotely suggest 'something' from the real-world. This is achieved not through hearing the source in the sound, but by the spectrum, how it is articulated and how it changes over time and space, or in other words how the sound behaves. For example, we may infer the *idea* of a forest swaying in the wind by creating sounds that behave in this way, rather than using a recording of the actual event.
- Sound used 'in itself': this where the sound is intended to be appreciated solely for its interesting timbral, spectral, spatial and morphological properties on a purely musical level, and is commonly called 'intrinsic'.

It is important to understand that these three facets may be bound up in a single sound and unfold simultaneously in one composition. The way this comes about depends on how we choose to direct the listener though our choice of sound manipulation and composition strategy. The musical implications are profound, particularly in terms of counterpoint - instead of a traditional musical counterpoint of pitch, harmony and rhythm, we can now create a counterpoint between musical meanings which collide, combine and create new entities (Barrett, 2002). But how do we shift listening focus? History has the answers in the often-misinterpreted terms 'acousmatic', 'reduced listening', and Schaeffer's 'modes of listening', which are elaborated below in section 3.1.

2.4 Present day (2022) in Norway and internationally

[1] Further writing on extrinsic and intrinsic links can be read in Smalley, 1997.

Rather than retrace the electroacoustic compositions of Norwegian composers since the 1960s, I will jump straight into 2022. In figure 1 I have placed electroacoustic music as a top-level umbrella term. The first layer below indicates a connection between acousmatic music and electroacoustic music with a visual performance element. From here, the musical potential diversifies. Practitioners may not consciously realise that their sound-worlds or methods, intuitively shaped and influenced by trends and technologies, share similarities to the sound-worlds and methods of acousmatic music that have infiltrated cultural imagination. Yet the influences are evident in certain aspects of the sounding results. Even in genres driven primarily by rhythm and pitches (such as electronica), we hear non-beat-based acousmatic introductions or interludes, or indeed sampled sounds indicative of acousmatic ideas that enrich the music.

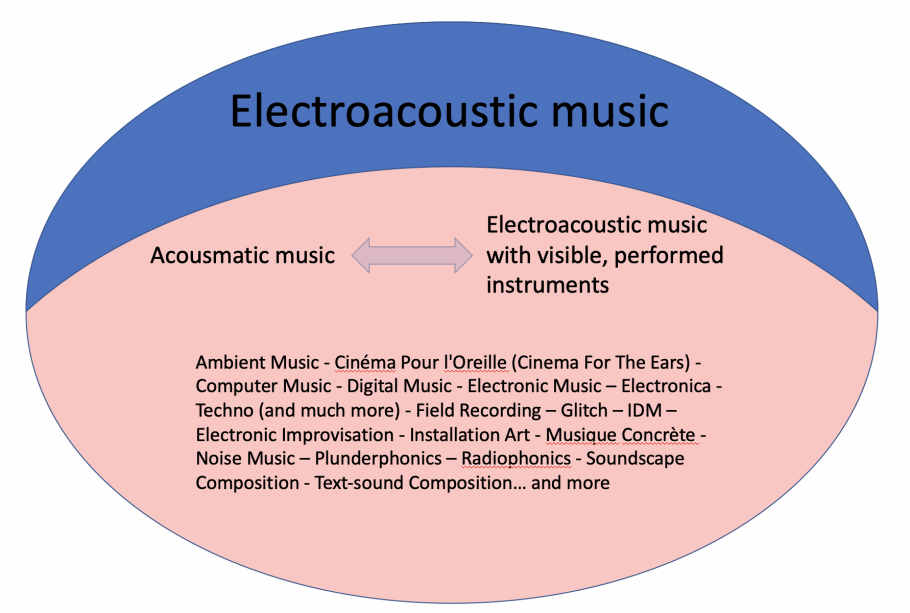

Figure 1: The umbrella of electroacoustic music.

2.5 Performance and public concerts

Because there are no performers on stage playing known instruments, acousmatic music is played over loudspeakers. Nevertheless, there is a thriving performance technique called ‘sound diffusion’ or ‘live spatialisation’ which was invented hand in hand with the genre. The technique is in constant development, aligned with new technologies, new compositions, and new concert spaces.

The contrast to instrumental music was clear early on: by distributing loudspeakers in the concert space, the sound could be controlled to appear to move in space (which was also a vision of the world-famous French composer Edgard Varèse). Schaeffer’s early experiments in sound diffusion were performed from a five-track tape: four of the five channels were routed to four loudspeakers (front left, front right, one at the rear and one in the ceiling), and the fifth track was performed over the four loudspeakers using a device called the ‘potentiometre d’espace’. However, besides a few multi-track works composed predominantly by Stockhausen, for the following decades stereo was the most common format. Harrison points out (Harrison, 1998) that this was driven by the availability of stereo as a recording and production format. In 1974 the Acousmonium or ‘loudspeaker orchestra’ was inaugurated by François Bayle at GRM in Paris. Bayle’s acousmonium continues to feature in Paris concerts

and consists of a variety of different loudspeaker types distributed mainly on stage[2]. In 1982 Jonty Harrison founded BEAST in the UK (Wilson and Harrison, 2010), which was based on the same idea as the GRM acousmonium, but with more speakers surrounding the audience. Acousmonium-type systems, ranging from just a few to up to a hundred loudspeakers were also established in other countries, predominantly in Europe.

The fact that the acousmonium combines loudspeakers of diverse frequency response and power, placed at different distances and angles from the audience is important. Firstly, the system is installed to consider site-specific room acoustics and audience seating. As the sound's frequencies change, the music's spatial images will appear to move. Besides this subtle natural result is an even more important performance element. The performer actively controls the volume of the signals being sent to separate or combined loudspeaker groups, originally by way of a conventional mixing desk and now with custom made faders and controllers. Rather than simply control the angle and elevation of a sound in relation to the listener, performance is about creating what are called 'phantom images'[3], that appear to change in size and distance from the listener.

If the composer is available, he or she will normally perform the work. If not, another performer learns the composition by creating what is called a 'graphic diffusion score'. This is a hand-drawn and personal, high-level symbolic aural interpretation representing the most important *perceived* information to be actively spatialised over the loudspeaker array. The emphasis on perceived is important: a diffusion score is not an amplitude waveform overview nor is it a sonogram of the sound. Although waveforms and sonograms may be useful starting points for an accurate time-line, neither capture sound identity or all relevant perceptual aspects of the music. The layout places time on the horizontal axis and the vertical axis can indicate approximate pitch, spectral height and gestural shapes. In Norway, sound diffusion performance is rarely understood. This is due to there being few opportunities for composers and performers to experience and practise the artform. It is, however, an important performance practice abroad. In Norway, the Electric Audio Unit (EAU) is the only ensemble with diffusion performance skills.

Harrison emphasises that diffusion is motivated by more than performance practice: it is also inextricably linked to the acousmatic compositional process where spatial diffusion 'completes' a work. With 30 years of experience in composition and performance I would tend to agree, but performance practice is changing, especially in Norway. Here there has been a shift towards ambisonics. Rather than write a lengthy technical explanation, we can summarise by saying that ambisonics involves spatial encoding (or recording) which preserves composed 3D spatial information in an encapsulated format, and spatial decoding over a user-defined loudspeaker array. A difference between the ambisonics loudspeaker array and the acousmonium is that the loudspeakers should be the same (or matched), of equal distance from the centre of the audience (as far as is possible) and evenly spaced. Loudspeakers distributed in a circle, an oval, a square or rectangle and hemisphere layouts are suitable. Ambisonics offers different degrees of spatial precision: in the encoding stage this is defined by the mathematical order of the equations, and in decoding, by a combination of the encoding format and the number of available loudspeakers. More precise encoding requires more channels in the encoded sound-file and more loudspeakers in the decoding. To give an example, 1st-order is a four-channel format, while 7th-order is a 64-channel format. Higher-order ambisonics (HOA) can be anything from 2nd to nth-order. Luckily, in most instances, composers need to know

[2] GRM's own website offers the best historical overview of the GRM acousmonium and its development today: https://inagrm.com/en/showcase/news/202/the-acousmonium.

[3] Phantom images are sound images that appears to emanate from a point between two speakers due to the sound intensity, frequency, and time of arrival at the listener's ears.

very little about the maths as many software tools are available. For more detailed information see Barrett, 2019[4]. Although originating from the 1970s (Gerzon, 1977), since 1999 ambisonics has offered interesting ways for composers to control sound in 3D space and has featured in my music since this time (Barrett, 2002). Although some composers ventured into 8-channel fixed media, composing with ambisonics was motivated by the excitement of new possibilities in the invention and composition of spatial musical structure (Barrett, 2016). In Part-II our compositions are composed in ambisonics. Rather than a diffusion score, a technical specification for the ambisonics projection, and general information about volume and dynamics enhancements during the performance, will suffice.

The shift to ambisonics occurred more rapidly in Norway than in the other major acousmatic music hubs in Europe. To understand why, we need to delve into Norwegian history and its repercussions. Sound diffusion requires a loudspeaker orchestra as described above. Equipment is accumulated over many years and requires large concert spaces and significant long-term investment. A facility on the scale of BEAST or the GRM acousmonium is not possible to build from equipment hired from PA companies, yet this was all that was available in Norway. Up until 2001, sound diffusion concerts were primarily organised by NICEM (The Norwegian Section of the International Confederation for Electroacoustic Music). As electroacoustic music began attracting composers and audiences, the motivation to play more concerts increased. Yet the costs of hiring large numbers of high-quality loudspeakers from PA companies, and technical staff to set up the equipment, outstripped funding. In parallel, ambisonics as a technical solution for composed spatial music was on the uptake. Ambisonics requires large numbers of high quality, matched loudspeakers that do not need to be as powerful as PA loudspeakers used in normal sound reinforcement. In 2007, an array of Genelec studio monitors were purchased by Grieg-07 (a festival commemorating 100 years since Grieg's death), to play commissioned ambisonics and multichannel installations. At the end of Grieg-07, the equipment became the property of Lydgalleriet in Bergen, and was used for spatial audio sound-art installations. By 2014 it was clear that PA costs for acousmatic concerts in Oslo were no longer feasible and in 2016 I established '3DA - the society for 3D sound-art'. 3DA received a one-time grant from Rom for Kunst to buy a modest array of 24-Genelec loudspeakers that could be used by composers specialising in 3D electroacoustic music and sound-art. 3DA was active by autumn 2017 and the equipment has been in regular use for concerts and installations, exposing Norwegian and international work to a larger audience. To keep the cost of usage as low as possible, 3DA is run on a budget that covers basic administration, insurance and smaller repair costs. To sustain future activity, support is needed for administration and investment. The organisations NOTAM and NyMusikk (both in Oslo) also own equipment suitable for smaller ambisonics setups. Since 2008, Electric Audio Unit has been the main performance group for electroacoustic music and has special skills in all things spatial.

3. Cultural industry challenges for Norwegian composers at home and abroad

3.1 The Norwegian scene in 2021

Active Norwegian composers can be generalised in three groups:

[4] Technologies of wave-field synthesis (Berkhout et al., 1993) and VBAP (Pulkki, 1997) are alternative technological solutions.

- Established composers: this group has focused on electroacoustic composition for decades. They are generally familiar with the history, concepts and established repertoire, experiment with the latest technologies, methods and compositional approaches and sometimes lead cutting edge artistic research in the field. They often visit international artistic or research centres for specific projects as a supplement to the offers available in Norway.
- Newly educated composers: unlike the rest of Europe and North America, Norway has no education program specialising in electroacoustic composition. Composers may however learn technology and studio techniques as part of their classical composition studies. Some also travel abroad and return with new competences. Independent organisations such as NOTAM also offer one-off courses on specific topics.
- Sound-artists and composers as improvisers, noise and live-electronic musicians: this group is maybe the largest, and includes many cross-over genres as well as composers from the above two groups. Practitioners sometimes create works that lean into acousmatic music even if they choose to use other labels to describe their output. Although this group often labels their work 'experimental music', this refers more to improvisation as an experimental approach to sound-based art. All groups work experimentally, especially those who are pioneering new methods and theories.

3.2 Ongoing challenges

Artificial intelligence

Machine learning and other algorithms of artificial intelligence are on the uptake. The application of AI in music is increasingly successful for note-based genres, and it is only a matter of time before AI approaches are affecting sound-based artforms. However, AI cannot function alone: it may be 'artificial' but it is not 'intelligent' (it is what is more commonly known as 'narrow AI'), and most likely for a long time to come, will only be as successful as the human programmer who creates any given version of the AI system, and the sources used to train its behaviour. Harnessing, rather than being dictated by AI, will involve ongoing curiosity and questioning on the part of the composer.

Norwegian infrastructure

The infrastructure for different kinds of performances were explained in Part-I: 2.5. Unlike acoustic music where performers travel with their instruments, for electroacoustic music and acousmatic music in particular, performances are limited to venues with suitable equipment. In practice, this means that concerts within a realistic budget based on cultural funding are limited to Oslo (3DA equipment) and Bergen (Lydgalleriet equipment). It is possible to hire facilities in the larger cities, but at a high cost. Some venues and festivals do however install 8-channel systems for specific events.

Export is an important resource, and we need to know what happens when we play concerts abroad and what happens to our music without us. Norwegian acousmatic music is regularly performed abroad, by the composers themselves as well as by sending the music to the concert organiser. Facilities, performance skills and

knowledge are generally good, but ambisonics 3D compositions are better overseen by the composer, who will know the best solutions for decoding their work in the given context.

4. Untangling misunderstood and important terminology in a Norwegian context

The EARS archive lists hundreds of terms and definitions that have in the past or present connected to electronic music. [ref http://www.ears.dmu.ac.uk/]. In this section I clarify often misunderstood terminology and add nuances specific to the Norwegian context. The terminology is divided into two sections: acousmatic terminology and performance terminology. For the former, the literary sources behind these explanations are lengthy, often misquoted or misinterpreted and less easy to understand for a general reader. I have therefore written them in simpler terms and where appropriate referenced the original sources. For the latter, the terms included are important for composers, performers, and for the import and export of electroacoustic music.

4.1 Acousmatic terminology

Musique Concrète

Musique Concrète was a term given by Pierre Schaeffer around 1948 to a method of working that starts with concrete sound material (i.e. sound recordings, normally of non-instrumental sounds), and then sought to abstract musical values from it. Musique Concrète describes a reversal of the way musical work is done. Instead of notating musical ideas using the symbols of music theory (where the composer creates the abstract score), leaving it to known instruments and known performance techniques to realise the score (which leads to concrete listening in the performance), the aim was to gather sound, and abstract the musical values it potentially contained. The composer perceives every detail that constitutes the sound, from which musical structure and an abstract discourse are then derived (Schaeffer, 1966/2017, pp. 1-16).

Acousmatic

The term ‘concrète’ was taking on too much natural or external reference for Schaeffer and no longer described his new musical language. In 1958 he distanced himself from the term and instead used the word ‘acousmatic’. ‘Acousmatic’ is a Pythagorian term reintroduced in 1955 by Jérôme Peignot, meaning the distance which separates sounds from their origin. Myth has it that Pythagorus lectured to his students from behind a curtain so that they would focus on the meanings of his teachings, rather than on his appearance. This is only a myth and there is no evidence to certify the claim! In musical terms, simply put, acousmatic describes the process of listening and composing with sounds removed from their visual causation. In practice it means much more: the acousmatic approach to listening and composing is not as straightforward as simply using recorded sources (which was one of the issues Schaeffer had with the term ‘concrète’), and to quote Schaeffer, “by *deliberately* ignoring any references to instrumental causes or pre-existing musical meanings, we seek to give ourselves over entirely to listening, and so to come across those instinctive pathways that lead from pure ‘sound’ to pure ‘music’… turning our backs on the instrument and musical conditioning, and placing sound and its musical potential squarely before us.” (Schaeffer, 1966/2017, pp. 64-69).

The definition can therefore be read as a refocusing of what the term Musique Concrète was originally intended to mean.

Modes of listening

Schaeffer proposed four ways (or modes) of listening to sound:

1. Écouter (listening) is the act of listening to something through the agency of a sound, that is, we are attempting to identify its source. We listen to sounds as indices of events which cause them, for example, "I hear the sound of a car and do not cross the street".
2. Ouïr (hearing) concerns passive perception. We neither listen nor seek to understand, for example, "Traffic noise is continuous outside my office window but I am not aware of it".
3. Entendre (attending), the selective hearing mode. Here we attend to aspects of the sound that attract our attention. We are not listening to attributes of the sound that connect to an external object, and instead how those attributes affect the sound itself. For instance, we might be interested in the unfolding timbre of the sound, for its own sake.
4. Comprendre (understanding) is that mode in which, having identified the referent object of the acoustic sign, we attribute meaning to (or infer meaning from) the sign.

Schaeffer laid emphasis on 'entendre' as the starting point for how sounds could create music. However, an important aspect of his explanation relevant for modern composers is often overlooked: as listeners we can move *fluidly between the different modes*, and also that the modes connect and support each other. (Schaeffer, 1966/2017, pp. 80-93, 111-115). This fluidity in listening, and subsequently how composers choose to focus on different facets of their sounds, is an important feature of Norwegian acousmatic music.

Sound Object

A sound object is a sound phenomenon or event that can be perceived 'as a whole' or as a coherent entity. It does not exist in itself, is not simply a sound surrounded by silence, but concerns the way we direct our listening (Schaeffer, 1966/2017, pp. 210-212). Quoting Schaeffer paraphrased in Chion, 1983, pp. 32-33, he adds what the sound object *is not*:

(a) The sound object is not the sound body.
(b) The sound object is not the physical signal.
(c) The sound object is not a recorded fragment.
(d) The sound object is not a notated symbol on a score.
(e) The sound object is not a state of mind (because it remains the same across different listening modes).

To describe more clearly what the sound object *is*, we need to now look at the term 'reduced listening'.

Reduced listening

In reduced listening we listen to the sound for its intrinsic information by ignoring its real or supposed source, or the meaning that the source may convey. Reduced listening refers to the notion of the phenomenological reduction called Époché (suspension of judgement), or bracketing out the sound from its real-world context. To quote Schaeffer, "The acousmatic situation first disconnects the audio-visual context, but above all it makes possible,

but not compulsory, to explore the sound in itself […]. We must emphasise the fact that this type of interest does not follow automatically from simply being disconnected from the audio-visual complex but from a *specific intention on the part of the listener*." (Schaeffer, 1966/2017, pp. 212-216). Here I have italicised to emphasise what is often misunderstood. In other words, we are not putting the existence of the external world in doubt. The point is to keep oneself in a state of freedom, which is particularly important because it means as composers we can still access the other modes of listening if we wish. Yet for normal listeners, reduced listening is difficult! It requires a listening focus that is unnatural compared to how we engage with the sounding world around us, and is normally attained by repeated listening to small sections of sound. Yet in composition it is a useful way to explore the musicality of real-world sounds and reveal qualities that can then be emphasised through sound manipulation. It is not necessary to engage in reduced listening while enjoying the final work.

Field Recording

Field recordings are sound recordings made outside the studio and intend to capture some of the features of a sound landscape. Stereo microphone techniques are most common, although cheaper ambisonic microphones have allowed more composers to record directional information over 360 degrees. Other experimental techniques such as recording with several spot-microphones to capture sounds at close proximity, and synchronising these signals with ambisonics or stereo microphones, are also employed by composers who see the recording phase as the first phase of composition. Field recordings are often used in Soundscape Composition.

4.2 Genre and performance terminology

Tape music

Tape Music is a term derived from the pre-digital technology of magnetic tape. Compositions were created with tape recorders and magnetic tape using various techniques such as splicing (cutting tape up and sticking it together again), tape loops (making a physical loop of tape), tape echo, tape feedback, speed changes and tape reversal. Tape Music is therefore a 'fixed medium music'; you start at 0 seconds and play continuously to the end without any interaction other than the spatialisation diffusion performance mentioned above. During the transition into the digital age the term remained in use, and is still sometimes used to refer to electroacoustic music that is played or performed in this way regardless of media. Whether the music is stored on a digital audio tape (DAT), a CD, or a single sound file played back from a computer, you press play and let the music run its course. The term is less-used in Norway as it sounds old fashioned. Instead the term 'fixed media' or simply 'acousmatic' can be used.

Instruments and Tape

I decided to include music for instruments and tape in this explanation section due to the tape part often being very similar to acousmatic music. In music for instruments and tape, an instrument (acoustic or electronic) would play in sync with a continuously running tape part. The performer synchronises with the tape via a stop-watch or a click track. Some longer works would split the tape part into sections for easier performer synchronisation, or to allow rubato, cadenza or improvisation. In Norway, the term live electronics is nearly always incorrectly used to describe what is in fact music for instruments and tape. It is understandable that composers feel an old-fashioned ring to the term 'tape', and for newly composed music, alternatives include 'instruments and electroacoustic music',

‘instruments and electroacoustic sound’ or ‘instruments and fixed media’. Even if a composer creates a work from sound-files that are played back in a predefined sequence from a computer, this is more akin to a ‘tape part’ than it is to live electronics. In composition, works for instruments and fixed media push certain workloads onto the composer. In works for live electronics, these workloads are pushed over to the performers, where often a dedicated performer is needed to execute the live electronics.

Mixed Music

This is a general term used to describe music which combines acoustic instruments with diverse electronic set-ups, including instruments and electroacoustic sound, instruments and tape, and instruments and live electronics. The term is used exclusively for contemporary electroacoustic music, and not for pop, jazz or other genres.

Live electronics

Live electronics is a term that dates from the pre-digital age of electroacoustic music where electronic instruments and outboard effects were performed in real-time. In the digital age it describes the live interaction between performers and electronic technology. This may include the real-time manipulation of live microphone signals, real-time control over the way a computer plays pre-made sounds, the use of haptic controllers to interact with digital technologies as part of the performance, or humans playing computers as a performance. The term can be used by improvisers as well as by composers who create performance scores, and the works may include pre-made electroacoustic materials as well as live sound processing. For compositions that involve all possibilities it is more precise to say ‘instruments, electroacoustic sound and live electronics’.

Electroacoustic sound

Electroacoustic sound is non-instrumental sound created by manipulating acoustic recordings with computer tools (prior to this, analogue methods) or by creating new sounds through original computer synthesis. Sounds from commercial and standard (i.e. not specially made) hardware or software synthesisers do not normally fall under the term.

Computer Music

The term ‘computer music’ has changed in meaning since computers were first used in the creation of music. Early on, computer music was associated with algorithmic instrumental composition and sound synthesis. The term is now so general that using it without further elaboration is meaningless. Well-known books, journals and conferences are proof of the generalisation. For example, in the synopsis of the Computer Music Tutorial (Roads, 1996) states that the book is, “a comprehensive text and reference that covers all aspects of computer music, including digital audio, synthesis techniques, signal processing, musical input devices, performance software, editing systems, algorithmic composition, MIDI, synthesiser architecture, system interconnection, and psychoacoustics.” The Computer Music Journal focuses on “digital sound technology and all musical applications of computers”. The International Computer Music Conference embraces almost every facet of music made by computers. Although pop and beat-based electronic music is made with computers, the term is not normally used to describe these genres unless the work involves a particularly innovative aspect of either art or technology.

Electronic Music

The term Electronic Music (or in German, Elektronische Musik) was first used to describe the sound materials and musical structuring aesthetics of the Cologne school explained in the history section above. Nowadays the term carries different meanings depending on the country in which it is used. In the USA the term electronic music is a synonym for electroacoustic music. In other countries in Europe it is *currently* used as a synonym for genres of popular electronic music. In Norway this is also the case, but we must remember that there is an overlap between experimental and contemporary electroacoustic music and some types of more complex electronica.

3D sound

The term '3D sound' has been applied indiscriminately to playback systems, to technical methods, to sound and to composition. When referring to playback systems, 3D has described a variety of loudspeaker arrays including equally spaced setups arranged horizontally, hemispherical arrays and ad-hoc arrays with height, and the loudspeaker orchestra described above. When referring to sound, all sound is 3D in that it occupies and propagates through space, whether this is real-world sound or sound emanating from loudspeakers. In music and sound-art '3D' has been used to describe sound played back from loudspeakers surrounding the audience. There is no agreement as to the qualities that merit a definition of 3D. To help us we can instead focus on composition rather than loudspeakers or technologies, and state that 3D is where musical ideas explore the complete dimensionality of space (Barrett, 2019).

Surround Sound

Surround sound is a general term referring to (a) the use of multiple loudspeakers surrounding the audience and (b) studio mixing techniques. Surround sound is most commonly used to describe commercialised technical formats for movie sound, such as 5.1 or Dolby Atmos configurations.

Sound Installation

Sound installations have to some extent been discussed by NOTAM in the Soundscape in the Arts symposium (Rudi 2011). Rather than repeating text from the symposium, it is more useful to identify the two flavours common to Norwegian practice:

- Installations driven by the visual arts, where visual elements are important to the work and sound is an accompaniment, or a concept, or an atmosphere, or made by a physical sounding object of some kind.
- Installations where sound is the primary feature, and if there are any visual elements, sound is at least as detailed, and with at least as important a role.

In Norway the main features that distinguish sound installations from concert works are the following:

- Duration: works are normally long and played in a loop, or are constantly changing by way of a computer algorithm.
- Temporal structure: works will rarely have beginning or end, which empowers the audience to sample the work for as long as they wish.

- Audience interaction: although some installations will suggest the audience to sit, lie or stand, others will encourage an explorative approach.

Soundscape composition

What is Soundscape Composition? A definition has been widely debated, but it is generally agreed that Soundscape Composition contains environmental sound recordings where features of the sound environment inform the musical structure or vice versa. However, there is no agreement as to how *much* of the composition needs to be formed in this way! Barry Truax makes a good case for what he regards as "the real goal" of soundscape composition as the re-integration of the listener with the environment in a balanced ecological relationship. (Truax, 1996).

Electroacoustic music with live instruments

In contrast to instrument-centred composition or improvisation extended by simpler live electronics, electroacoustic music with live instruments can include all we have elaborated upon in Part-I and Part-II. Additionally, the composer must consider human constraints and the work overhead of the notated score. Drawing on acousmatic theory (explained in Part-I), we are then able to understand that the visual performer will change the listening experience, and ultimately the experience of the music[5]. The workload is often double that of a purely instrumental or acousmatic work, or composition involving just simple live electronics.

Noise music

Noise music is currently a label used by some composers who create simpler acousmatic music with sounds that either contain a high degree of noise (from an acoustic definition), longer drones, textures or articulations. Performances often feature an improvisation element, and high sound-pressure level where the effect on the body and aural physiology are as important as the heard sound. Noise music from 1970s onwards derives from Noise rock, Japanese noise music and alike, and not Pierre Schaeffer's work which has incorrectly been called noise music due to his composition "Cinq études de bruits" (or "Five Noise Studies").

The composition of acousmatic electroacoustic music part-II

Part-II exposes two composers' acousmatic music from concept to composition and performance from a Norwegian perspective. This publication will be available in 2023.

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[5] Live electronics improvisation falls outside of our discussion, even though some of the technology and musical ideas may overlap.

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