

Ear-training using the computer and PROGREMU¹

Abstract

Few practitioners of contemporary music value “ear-training” more than composers working in the medium of electroacoustic music. Scrupulous attention to this discipline is particularly relevant in the genre of “tape” or “acousmatic” music. In acousmatic music, composers usually have no contact with physical instruments by which sounds can be modified and transformed. While sound sources might be implied by dynamic and spectral behaviours, technology removes limitations normally imposed by the physical systems of musical instruments. Consequently, despite the virtually limitless number of potential sound elements, the tasks of categorisation, description and, most importantly, organisation of sounds can only be achieved by the self-conscious activity of perception. It can be argued, therefore, that in the electroacoustic medium, composers have no choice but to resort to “primacy of the ear” (*primauté de l’oreille*) in any investigation of their materials and resulting musical structures. In this article I intend to describe and explain the subject of “ear-training” within the framework of the researches of the French composer and theoretician Pierre Schaeffer (1910-1995). I will also suggest methods by which the computer can be used for this important area of musical training. In addition to the notion of “solfège”, Schaeffer adapted other pedagogical concepts to assist musicians working in the studio environment. Thus, terms such as “version” and “thème” (common in French language studies) describe the processes of translation from and into sound. Michel Chion even suggests that the Schaefferian solfège represents “exercises” in “version” and “thème”, the former resembling “musical dictation” (Chion, 1983: 90). Because the Schaefferian approach is independent of the sounds’ causal origins it can be applied to any sound. There is, therefore, the potential for examining certain types of instrumental and vocal music, particularly works which make use of a vocabulary including long, complex sounds.

Introduction

In Great Britain the role of ear-training is frequently misunderstood in both university music departments and conservatories. Ear-training is rarely the most popular subject for students:

¹ This article is an expanded and revised version of a talk presented at the “II. Kongress der Deutschen Gesellschaft für Musiktheorie”, Munich in October, 2002.

they believe it is imposed on them without any substantial explanation of its objectives. Teachers give exercises in music dictation because the curriculum demands it. These tests usually consist of writing melodies, harmonies and rhythms in exercises of dictation. Developing aural awareness should encourage the students to think critically and (it is assumed) intelligently about music. But this objective should include all music, not simply tonal music of the period between Bach and Brahms - important though this repertoire is. Even if the teacher restricts the examples to tonal works, important issues can still be addressed. I ask students to analyse phrases to determine the principal “structural” chords, they are then asked to consider structural levels and draw general conclusions from these particular examples. By listening to different performances of the same work the relationship between the “score” and the instrumentalist can be examined. Notions of freedom and constraint reveal the score to be more than simply instructions to be followed mechanistically. These discussions can be extended to include more complex relationships identified in much 20th century music. Indeed, the notion of the “score” itself exemplifies many issues concerning the principal elements of musical language and the extent to which pitch, for example, is culturally imposed or whether it is the “natural” consequence of our perceptual tendencies. Some attempts have, of course, been made to make ear-training more relevant to contemporary music such as investigating (often empirically) how easily pitch class sets are perceived and related when transposed and inverted. Nonetheless, the 20th and 21st centuries include many complex musical languages which are not susceptible to the kind of aural analyses described above. Ear-training should be a dynamic, intellectually demanding part of the music student’s education and it is only correct that we continue to assess its effectiveness.

I am a researcher on a course called “Sonic Art” at Middlesex University in London. Our programme of study involves not just electroacoustic music, but also installation art, radiophonic art, sound design... in fact any art-form using sound as its principal means of expression. However, I am also employed in a music department (properly speaking) at Goldsmiths College, University of London as well as a conservatoire - the Guildhall School of Music and Drama. My field of musicological research is that of electroacoustic music, in particular the music and theories of the French composer Pierre Schaeffer. I am particularly interested in the relationship between composers’ practices and how these are influenced by working in the electroacoustic studio. I have always been impressed by Schaeffer’s concern

with what can only be described as pedagogy. He realised that the new environment of the studio should not cause musicians to abandon traditional musical practices. Instead, these practices must be elaborated and adapted to the work methods of the studio where composers had to generate musical material and assemble it with equipment not intended for music composition (Schaeffer's early studio was part of the French radio broadcasting organisation). This is less true today, of course - most composers will use software specifically written for music composition. Nevertheless, the "resistance" of the technology created a unique situation in the 1950's and the approach developed by Schaeffer was a consequence of the French insistence of "primacy to the ear" which should be differentiated from the serial-based elektronische Musik of the Cologne studio. (There is no criticism implied in this comment; with the benefit of hindsight both methods are valid but both had fundamentally different agendas which are rarely confused by musicologists today.) I believe that the nature of the electroacoustic medium emphasises certain problems and has, therefore, a particular role to play in addressing issues concerning the development of ear-training for all contemporary music. Technology does not (or should not) take precedence over the musical ear.

There will be three sections to this article. First, I will briefly describe the particular problems experienced by practitioners of electroacoustic music. (I should also add that I will concentrate on electroacoustic languages which do not use explicit quotations from the "real-world" such as soundscape composition. Electroacoustic music, of course, includes many different languages.) Second, I intend to select certain aspects of the Schaefferian approach - which is both complex and subtle - to illustrate that ear-training was recognised to be of fundamental importance to the musicians of early *musique concrète* and later to the composers of the *Groupe de Recherches Musicales*. Lastly, I will describe how I have applied this approach by means of computer technology in my own teaching of electroacoustic music and how it might be applied more generally. I do not consider electroacoustic music a separate part of contemporary music. Its practice and theories provide a critique of many traditional musical notions such as the instrument, what sounds can be regarded as elements of music, what is the nature of electroacoustic performance...? Thus, it has much to offer music education as a whole. Indeed, I would argue that the "experimental" approach advocated by Schaeffer and others will develop real musical skills more effectively than

simply placing a student in front of a computer attached to a MIDI keyboard. The computer is capable of real exploration of sound.

1 The Problems of Electroacoustic Music

I would not be so presumptuous (and insulting) to claim that only practitioners of electroacoustic music are concerned with developing aural skills. However, composers (in addition to analysts and listeners) of electroacoustic music are acutely aware of the need for what can only be described as “ear training”. In the earliest days of the electroacoustic studio the practitioners had no choice. Pierre Schaeffer identified problems which concern not only electroacoustic music but music generally. He developed a whole field of musical research which is unfortunately often overlooked by many musicians today.

The equipment used by Schaeffer in 1948 would be unbelievably crude by today’s standards. We can imagine the long, complex sounds (or sound objects to use Schaeffer’s terminology) that could be achieved with little difficulty by using techniques such as the “closed groove” (*sillon fermé*) on his shellac discs. The technique of the “cut bell” (*cloche coupée*) facilitated the editing of sounds. In addition to reversing sound objects and changing their dynamic and spectral behaviours it was immediately evident that the potential vocabulary of sounds could be expanded enormously by means of technology. Sound objects could be created which had no reference to instrumental models as the causal connection between a physical source and the resulting sound no longer existed. (Such sounds create a fascinating problem for our perception - unfortunately the subject exceeds the remit of this article.) Schaeffer’s problem was in essence simple: how could the composer organise this vast amount of material solely by perception? After several years he devised the five operations of the *Programme de la Recherche Musicale* (or PROGEMU). The need for PROGEMU was a consequence of Schaeffer’s ultimate ambition. Despite the clear anecdotal references of his early works such as “Etude aux chemins de fer” he was adamant that he concerned with the: “(...) reclaiming of the indispensable musical abstract”² (Schaeffer, 1966: 24) - in my view a statement of enormous significance, but often ignored or simply misunderstood. He wanted to discover the basic foundations of musical structure and meaning and this could only be achieved once the sounds were freed from their causal origins. In his book “La Musique Concrète” (published within a year of the *Traité*) Schaeffer suggested five “rules” to guide musicians who were

² “(...) la reconquête de l’indispensable abstrait musical.”

unfamiliar with the new medium. The first was: “To learn a *new solfège* by systematic listening to sound objects of every species.”³ (Schaeffer, 1967: 29). The use of the term *solfège* is significant. According to the composer Michel Chion (quoting Schaeffer), *solfège* is quite simply: “the art of practising better listening”⁴ (Chion, 1983: 90). *Solfège* thus implies not simply ear-training as an exercise of hearing music that has already been composed but a dynamic, exploratory process resulting in the practical application of music theory. (Contrast this with the apparently pointless exercises often presented to conservatoire students in their ear-training lessons.) Chion continues by claiming that it is: “(...) a kind of becoming aware of the new materials of music while distrusting preconceived ideas and relying first and foremost upon what is *heard*.”⁵ (Chion, 1983: 91). As confirmation of the importance of *solfège* as a concept it is also noteworthy that the term is used in the title of the sixth book of the “*Traité des Objets Musicaux*” (*Solfège des Objets Musicaux*) - as well as in the title of the work “*Solfège de l’Objet Sonore*”. To quote Chion again: “This *solfège* is ‘not yet music’; it is the indispensable preliminary to it”⁶ (Chion, 1983: 91).

2 The Schaefferian Approach

The five stages of PROGREMU are: typology, morphology, characterology, analysis and synthesis. The Schaefferian programme offers a comprehensive system for all sound objects, without exception. The first two stages - typology and morphology - are stages of sound taxonomy. Typology allows the composer to begin sorting sound objects into types according to aspects of duration and spectral behaviour. Ambitious though it might seem, the entire sound universe can be accommodated in this system. In his “TARTYP” (Tableau récapitulatif de la typologie) (Schaeffer, 1966: 459) Schaeffer sets out these types in a diagram which can be used both to initiate a basic classification of sound objects and to “navigate” the passage from type to type. The result of typology is a number of sound types such as “tonic sound”, “complex sound”, “web” and “large note”. Each type has particular characteristics of spectral and dynamic behaviours. Once a type has been assigned (and some ambiguity might result according to context) the stage of morphology is used to achieve a more precise description. Any feature of the sound could be chosen as a principal means of creating structure though Schaeffer acknowledged the importance of “mass” - his generalised term for pitch. At the

³ “Apprendre un *nouveau solfège* par des écoutes systématiques d’objets sonores.”

⁴ “l’art de s’exercer à mieux entendre”

⁵ “(...) une sorte de prise de connaissance des matériaux nouveaux de la musique, en se méfiant des idées préconçues et en s’appuyant d’abord sur ce qu’*on entend*.”

⁶ “Ce *solfège* ‘n’est pas encore la musique’; il en est l’indispensable préalable.”

stage of characterology the composer begins to move from the single elements of musical discourse to higher level structures. Characterology facilitates the grouping of sounds into “families” or genres in an elaborated version of instrumental thought. This is not a naïve acceptance of our tendencies to group similar sounds together. All instruments produce a variety of sound types and if the composer is working in the “virtual” space of electroacoustic sounds gradual transitions from one genre to another are possible according to position in pitch-space, dynamic level and so on. I must add parenthetically, that Schaeffer accorded a special place to sounds of long duration which are, of course, precisely the sounds which can be produced in the electroacoustic studio and which challenge our musical assumptions by their duration and spectral complexity.

The final two stages could only be sketched out by Schaeffer as the composer begins to move from initial exploration to the actual process of composition. Analysis facilitates an assessment of how a particular characteristic of sound objects might form “scales” which could result in structures exhibiting “directional tendencies”. The objective was the creation of new sound objects but with a purpose, a musical intention directed by these stages of minute examination and analysis. According to Schaeffer the stage of analysis was the crucial difference between *musique concrète* and *elektronische Musik* (see, for example, Schaeffer, 1966: 60), this is, however, a rather simplified view of an important and complex historical situation.

Naturally, the preceding paragraphs cannot do justice to Schaeffer’s programme. At best the explanation can only give a brief indication of its potential. In these processes of classification, description and grouping sound objects according to their perceptual criteria Schaeffer used two terms from language teaching which are relevant for our discussion of ear-training. These terms illustrated the fundamental activities in the studio: *thème* and *version*. They have been retained in French though in the “*Solfège de l’Objet Sonore*” they are translated respectively as “translation into sound” and “translation from sound”. Strictly speaking, *thème* refers to prose translation, where the student translates from the mother tongue into a foreign language. *Version* is the opposite; it describes unseen translation, translation from the foreign language into the student’s own language. Schaeffer thought that the processes used by composers when listening to a sound and describing it in minute detail was - *version*. According to Schaeffer much contemporary music is composed according to

thème. This means the music is composed according to procedures entirely dependent on the score but possibly independent of perception before their realisation in sound. It is easy to understand how this criticism can be applied to music for which the extensive pre-compositional planning results in matrices of numbers which are then applied after numerical operations to pitch, duration, articulation etc. According to Chion one of the principal aims of Schaeffer's "Traité des Objets Musicaux" was: "to give a *method for version* (...)"⁷ (Chion, 1983: 90). Once musicians have acquired fluency in methods of classification and description it is then entirely possible to reverse the procedure and attempt to make sounds from any sound object according to a plan - thème. Indeed, thème is vital at the stage of synthesis as the composer begins to create the sound objects that are required.

It is clear, therefore, that Schaeffer carefully considered the passage from the lowest to the highest structural levels in the transition from the stages of typology and morphology to those of characterology and analysis. Naturally, composers pass from one stage to another in the process of composition without necessarily treating each stage as separate. Schaeffer, however, did clarify and systematise these stages and, as a result, they can be applied to ear-training.

3 Practical Applications

In my teaching I have formulated exercises that can be described as "exercises of version" in that they are similar to traditional exercises of dictation. Some concentrate on the basic elements of music, others ask questions regarding higher structural levels in which the sounds might function. For example, it is easy for a teacher to create sound objects that are short to medium in duration. With basic software (much of which is available without cost) sounds can be edited and transformed without difficulty. In addition, I must stress that these sounds can be purely synthetic or derived from recordings of instruments. There is a huge resource of electroacoustic works which can provide many interesting examples of Schaefferian sound types. Thus, the "real" source - even if it is known - is not important at this stage. The great strength of Schaeffer's system is that it is applicable to any sound. Initially the sounds could be restricted to Schaeffer's nine "balanced sounds". Broadly, speaking these are the sounds that resemble most closely the traditional "note" and are placed in the "central" box of TARTYP. The students are asked to classify sounds into types such as "tonic note" or

⁷ "Donner une *méthode de version* est une des principales préoccupations du T.O.M."

“complex note” on the basis of their spectral constitution. More difficult and ambiguous examples are provided by sounds with greater spectral complexity or which move in the pitch-field. Such exercises are valuable because they encourage students to consider the ambiguous examples - is a sound object “noisy”, does it occupy a clear area of the pitch-field? If it consists of individual components, do they fuse together or separate? Each question has implications for further development in composition. Furthermore, even if several sounds can be classified as belonging to the same type, does this mean that they all suggest the same “virtual source”?

After exercises in these “crude” classification procedures the student can begin to scrutinise each sound object in order to identify more precisely its constituent characteristics. For example, a group of sounds might be classified as “tonic” pitches but a clear perception of pitch could be the only characteristic in common. Thus, morphology would enable a more refined description after the sound objects have been placed in types. This close description of sounds is, of course, an important issue. If the students become more conscious of aspects such as “allure” (this is Schaeffer’s generalised vibrato) or “grain” (the surface texture of the sound), they could become more sensitive to such characteristics being used as principal means of creating structure. For example, a group of sounds can be created on the computer which vary very little in the pitch-field but which display differences of “grain”. I will pose the question: “To what extent can these differences of texture be promoted to the most significant variations in the sound?” and “Can these variations be used to create a sense of ‘expectation’ or ‘tension-release’?”. If these sound objects are stored as sound files, creating linear structures of sounds is not difficult. Thus, by ear we move from classification of single sounds to description and to creating musical structures.

Schaeffer’s own “Etude aux allures” - one of the earliest works of *musique concrète* - is an interesting composition for students to analyse. It is significant that Schaeffer described his early works as “studies”. This is not intended as a mitigating excuse - he was adamant that practice had to precede theory, a body of works was needed before theories could be derived from them. By examining short sections of this composition we examine and perhaps even test Schaeffer’s hypothesis that “allure” can be a musical value - that is, it can function as the main means by which the musical structure can be articulated. Rather than a melody of varying pitches and rhythms is it possible to hear a “melody” of changing allures? (This is

not so different conceptually as the suggestion we can perceive Klangfarbenmelodie.) Such a claim should prompt the student to ask pertinent questions regarding this particular characteristic. How can we identify and describe the various allures? What are the basic elements of any structure based on allure? Do we use description of speed: fast, slow, accelerating, decelerating etc. or changes in pitch such as: wide, narrow, medium - or a combination of both. Is it possible to create structures that have a sense of “direction” and what “gaps” might be missing in these structures? Can we apply perceive structures in “retrograde” or “transposed”? What is a “motif” of allure and can it be “developed”? This is the function of Schaeffer’s stage of analysis and it . Any gaps that are detected might be filled by creating new sound objects - that is the stage of synthesis. But, as Schaeffer himself wrote, synthesis would now come only after several stages of intense and detailed listening.

I have also applied Schaeffer’s classification of long sounds to aural analyses of orchestral works such as Ligeti’s “Atmosphères” and “Lontano”. The slowly developing sounds of these works can be described as various types of “homogeneous” sound objects. By creating different types of these sounds the student can then be asked to describe more exactly whether the sound develops in intensity or the spectrum or whether it remains stable. The handling of such sounds in contemporary composition (they are placed at the extreme edges of Schaeffer’s diagram TARTYP) is, of course, a common feature of many musical languages⁸.

I would like to conclude with another quotation by Pierre Schaeffer. It comes from his work: “De la Musique Concrète a la Musique Môme”. In it Schaeffer wrote: “Musique concrète has certainly caused me pain; I found the sounds exciting but terrible. (...) And if you imagine that this has diverted me from conventional sounds, you’ll have to think again. On the contrary, I have reheard traditional music, but with a different ear. I have heard better...”⁹ (Schaeffer, 1977: 169). Surely “hearing better” is something all musicians should strive for, whether their medium is electroacoustic, vocal or instrumental. In this endeavour I firmly believe the computer and the medium of electroacoustic music have much to offer all musicians.

⁸ I have presented a paper on this subject at the “Music without Walls? Music without Instruments?” in June 2001 at De Montfort University, Leicester, England.

⁹ “La musique concrète, certes, m’a fait souffrir; j’en trouvais les sons passionnants, mais terrible. (...) Et si vous imaginez que cela m’a détourné des sons conventionnels, je vous détromperai. J’ai, tout au contraire, réentendu la musique traditionnelle, mais avec une autre oreille. J’ai mieux entendu...”

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