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THE ELECTRONIC MUSIC OF ROBERTO GERHARD

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ABSTRACT

Roberto Gerhard was a pioneer of electronic music in England creating over twenty substantial concert, theatre and radio works from as early as 1954. However, for various political, cultural and personal reasons Gerhard's electronic music has not been published or widely disseminated. Gerhard's electronic music is one of the richest repositories for understanding the development of the composer's late compositional technique as well as the early development of electronic music in the UK. As a result of an AHRC study of the tapes held in the Gerhard Archive at the Cambridge University Library it is possible to understand the composer's technique and thoughts on electronic music and how they evolved as his work with magnetic tape became more and more refined.

1. INTRODUCTION

Roberto Gerhard considered himself an explorer of sound rather than someone who merely experimented with it. Central to this exploration in the final two decades of his life (1950-1970) was electronic music. In his writings from 1930, Gerhard is as prophetic regarding the future of music as Cage and Varese's were to be later in the decade. He wrote,

Adding 'noises' to music, on the other hand opens doors to a distinctive cinephonic genre [...] we should accept that there is all the immense repertoire of acoustic impressions of an 'extra-musical' order that attack our ears all the time, and constitutes an almost unexplored territory, untested as to its aesthetic value to the musician. [1]

Although Gerhard writes in *Concrete Music and Electronic Sound Composition* that he approached 'the electronic medium strictly as a sideline' [2], the importance of this work and its impact on his instrumental composition has thus far received scant academic interest. Gerhard himself maintained that working in the electronic medium had resulted in a,

number of far-reaching morphological changes in the manner of organizing sound and it seems to me that these changes are bound to affect methods of composition in the traditional field of instrumental composition as well. [3]

Gerhard's approach to electronic music traversed the aesthetic paradigms that polarized early *musique concrète* and *Elektronische Musik*, often using instrumental, concrete and electronic sound materials. Working very much on his own (the BBC Radiophonic Workshop was not opened until 1958, some four years after Gerhard has started working in the medium) he was critical of the mainstream *avant-garde*, writing that,

most of us had already noticed for some time that, whether German, Italian, Dutch or Belgian, electronic music sounds curiously alike in its timbral aspect. If the possibilities were really unlimited, one couldn't help feeling that these composers were strangely coincident and repetitive in the use they made of them [4]

and that the sine tone has a 'rigid, cold, dead-signal quality. It is utterly unsuited to convey anything warm, tender, vivid, alive in human experience' [5]. Gerhard was rather interested in the transformation of acoustic source materials, stating that 'the microphone captures the living spark of the natural acoustic source' [6]. Gerhard was, however, more circumspect than either Edgard Varèse or John Cage in his use of such acoustic sources. In an unpublished notebook entry from 1957 Gerhard writes that he considers that, 'the term 'musique concrète' is ridiculous' [7] and later in 1959 he wrote that,

in principle, anything that comes from an acoustic source is possible material for *musique concrète*. This, of course, throws the gates wide open – too wide, perhaps – to material of all sorts, musical and not so musical. The French themselves, for instance, are not above using pots and pans for their *exercices aux casseroles* as they describe them.' [8]

Gerhard's approach to electronic music with its emphasis on the abstract 'musical' quality of concrete sounds rather than their associative meaning and the sampling and transformation of his own instrumental compositions is akin to the work of Iannis Xenakis and Bruno Maderna – two composers for whom electronic music and its techniques were to play a central part in informing their compositional aesthetic. For instance, Gerhard's use of concrete, instrumental and electronic sound sources in *Audiomobile II DNA* (1963) has a kinship in approach with Maderna's *La Rire* (1962) which incorporates the sounds of voices, footsteps in rain,

white noise and sine-tone generators, as well as transformed timpani, flute and piccolo.

2. SOURCES

Whilst Schaeffer, Stockhausen and their respective colleagues at the GRM and WDR studios propagated concert electronic music and produced significant theoretical output on their work and the new medium, Gerhard was a more practical composer. Gerhard's experiments were carried out in the public glare initially through composing incidental music (*The Prisoner* (1954), *King Lear* (1955) and *Pericles* (1958) being some of his earliest such works).

One of the disadvantages of not working permanently in a major radio or state-funded studio meant that there was no archival administrative structure to preserve Gerhard's electronic works. Apart from the electronic component of the *Symphony no.3*, 'Collages' neither of the publishers of Gerhard's instrumental music (Boosey & Hawkes and OUP) hold copies of his electronic works, or his incidental works incorporating electronics. The major repository of Gerhard's electronic music is the archive held in the Cambridge University Library. A small number of recordings and cues of theatrical productions are held at the British Sound Archive and the Archive of the Royal Shakespeare Company.

During the 1950s and 1960s, Gerhard gathered a significant magnetic tape collection in his studio, corresponding to a major repository of historical sound recordings of his own work in which all areas of his compositional activity are represented. Following Gerhard's death in 1970, Poldi Gerhard continued to play back the recordings, helping to identify their contents with her own annotations and comments. After her own death in February 1994, the studio was dismantled and the tapes were deposited at the Cambridge University Library with the rest of Gerhard's archive. In 2008 the inventory of the tape collection took place, and later that year, Gerhard's archive was donated to the Cambridge University Library.

A preliminary catalogue of Gerhard's Tape Archive comprising 714 items was compiled by one of the authors (Karman, 2008). During this stage, the annotations on boxes and other materials found on the tape containers were documented and the general state of the collection was assessed. Different problems were identified including on-going chemical degradation processes (see Fig.1), and a number of tapes were found to be incorrectly labeled or misplaced. The current research project¹ involves

to digitize all of the tapes as well as to produce a complete catalogue of the contents of the archive. The current research project² has digitized all of the tapes as well as documenting the annotations on boxes and other materials found with the tapes to produce a full catalogue of the archive.

For Gerhard's electronic works, the magnetic tape collection at the Cambridge University Library is the primary source. Over half of the tapes in the collection are directly related to Gerhard's sound compositions [9] – the rest comprising a considerable number of recordings of his own instrumental works and a library of music by his contemporaries (including Schoenberg, Webern, Berg, Bartok, Stockhausen and Nono). Excluding one remarkable exception, the *Symphony no.3* 'Collages' (1960) [10], most of this work remains unpublished, and in a number of cases is not available from other sources. The tapes contain all different stages of production, from initial source recordings to 'multilevel compound mixes' [11] and completed compositions.

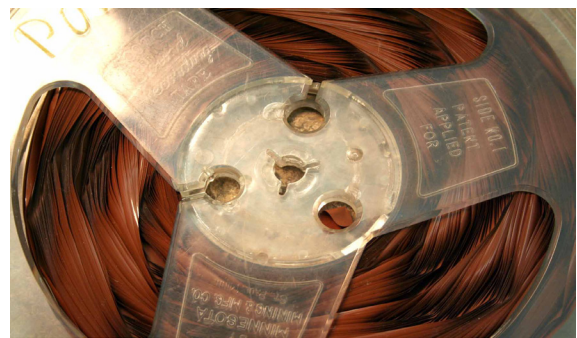


Fig.1: a tape affected by severe curly deformation.

This in itself offers a unique perspective on Gerhard's working methods as he left very few sketches relating to his instrumental work, preferring to destroy them and leave only the fair copy of the autograph score.

All tapes have a single gauge of ¼ inch, and comprise a variety of track formats including: full-track mono, half-track mono, half-track stereo, or quarter-track stereo. Digital transfer of the tapes involves taking care of irregular or loose winds, mechanical deterioration of tape headers, or dry splices. However, most of the tapes in the collection are in excellent playing condition.

3. GERHARD' STUDIO

According to the International Electronic Music Catalogue (1968) compiled by Hugh Davies, the first informal activities in Gerhard's private permanent studio are listed as having been initiated in 1954. The

¹ 'The Electronic Music of Roberto Gerhard' funded by the Art and Humanities Research Council 2012.

² 'The Electronic Music of Roberto Gerhard' funded by the Art and Humanities Research Council 2012.

official foundation of what Gerhard termed his 'Home Office' (perhaps the first private 'home' studio in the UK), can be dated to 1958, coinciding with the composer's change of address to 14 Madingley Road, Cambridge on October 1st 1958. Gerhard's close friend, Joaquim Homs, visited Cambridge in September 1959 and provides a first-hand impression of the studio one year after the Gerhard's move to Madingley Road:

The study was ample and, at the back, near the window that lead to the garden, there was a grand piano. [...] By now Gerhard had constructed an electronic laboratory [...] with the aid of the Radiophonic Workshop, and it was full of tape-loops of concrete music [12].

A series of undated black and white portraits of Gerhard at his workplace [13], perhaps simultaneous to Homs' visit, present varied perspectives of four open-reel tape recorders, together with numerous reels on shelves and an unusual image of hundreds of tape splices fixed on hooks to the lid of the grand piano (see Fig.2).



Fig.2: tape loops attached to Gerhard's piano.

Although Gerhard maintained that

I've always been working with shoe-string equipment in electronics. It comprises: one microphone, five tape recorders, a track mixer of five channels, and that is all. I've never used oscillators or white noise generators. I'm allergic to sine tones. When I needed certain types of white noise, the BBC Radiophonic Workshop has kindly provided lengths of tape. I would have been happy to have been able to install envelope control. I could not afford it. But I have been able to develop some measure of envelope modification by a manual means. I have no visual or audio monitoring. I wish I could have had some modulators. No automatic switching devices. On occasion their absence has been very trying. [14]

A closer investigation of these photographs (see Fig.2 and Fig.3) [15] supplies further information about the recording equipment in Gerhard's studio c.1958-59.

There were two EMI TR50³ mono recorders, an early Vortexion WVA⁴ mono recorder and a Ferrograph Series 66 mono recorder⁵. In the early 1960s, Gerhard incorporated a new Ferrograph Series 4⁶ mono recorder and a five-channel mixer⁷ into his studio. It would not have been uncommon to find a similar set of open-reel tape recorders in the facilities of the BBC [16].

With this in mind, and though Gerhard was eager to underline the modest equipment with which he worked in the 'Home Office', it would be better to characterize his studio as one that contained some of the best commercially available equipment at the time.



Fig.3: Gerhard working in the Home Office, c.1959.

³ A robust machine employed in many professional studios in the early days of tape music. It was advertised by EMI as being "Used by the experts in the world's leading recording and broadcasting organizations. A transportable high fidelity tape recorder designed for professional use". It recorded full-track format (i.e. recording only in one direction), was capable of tape speeds of 15 ips and 7.5 ips (a model with 7.5 ips and 3 ¾ ips was also available), and provided separate microphone and line inputs. The take-up reel rotated clockwise, resulting in a tape wound with the oxide coating facing out rather than inwards, in order to reduce print-through. Few other machines employed this method. It was introduced in 1951.

⁴ Mono recorder with Wearite (Ferrograph) deck. There were full and half-track versions. The WVA model had two heads (no off-tape monitoring). The model was introduced c.1951-1952.

⁵ The Ferrograph series 66 chassis model is a mono half-track recorder with two selectable speeds (15 / 7.5 i.p.s. or 7.5 i.p.s. / 3.75 i.p.s.), based on the standard Ferrograph series 3-deck mechanism. It did not include a power output stage, so it had to be connected to an external amplifier. Aimed at Hi-Fi enthusiasts, it was designed to be incorporated into a cabinet alongside the Hi-Fi system: an amplifier, turntable and radio tuner. First introduced in 1957.

⁶ Ferrograph Series 4, mono, half-track with two selectable speeds (15 / 7.5 i.p.s. or 7.5 i.p.s. / 3.75 i.p.s.). Introduced in 1959 as a successor of Series 3. The main changes were a more ergonomically designed control knob and a new head cover design.

⁷ Probably a Vortexion valve mixer, which were produced with between three and twelve channels.

4. BBC RADIOPHONIC WORKSHOP

For Gerhard, his contact with the BBC Radiophonic Workshop, was vital and the only external support he had for his work. It opened on 1 April, 1958 some four years after Gerhard had started work in the medium; the technicians working in Room 13 at Maida Vale (Radiophonic Workshop headquarters) included, among others: Daphne Oram (who resigned in January 1959, after 15 years with the BBC, to follow a career as a composer); Delia Derbyshire (who joined the BBC in 1960 and collaborated with Gerhard on his 1965 Prix Italia winning *Anger of Achilles*) and Dick Mills (who assisted with performances of Gerhard's work (particularly the *Symphony no.3 'Collages'*) at the Royal Albert Hall and also the Royal Festival Hall). When the Radiophonic Workshop opened, an invitation was sent out to numerous composers to come and see the new facilities with a view to discussing the possibilities for composition opened up by the studio. Apart from Gerhard, only two other composers accepted the invitation. Peter Manning writes,

The 'closed door' policy of the BBC Radiophonic Workshop, and the continuing lack of support from other quarters, severely retarded developments in Britain during the 1960s. Indeed, Roberto Gerhard was the only established composer from the broader community to be granted reasonable access to the BBC facilities during the decade. This permitted him to produce a number of pieces, primarily for radio, working both at the BBC and at his own private studio in Cambridge. [17]

The years 1958-1965 were the most productive regarding Gerhard's electronic music output. It is perhaps because of the regular commissions (*The Unexpected Country* (1957), *Asylum Diary* (1959), *The Overcoat* (1961) and *The Anger of Achilles* (1963-64)) that Gerhard received from the BBC for music for radio plays and the William Glock's admiration of Gerhard's work that allowed him to work in his home studio and in the BBC Studio with great flexibility.

5. GERHARD'S ELECTRONIC MUSIC

Hugh Davies, in his 1981 *Tempo* article on Gerhard's electronic music wrote that,

Gerhard was not only the first important British composer to adopt electronic music techniques; it seems probable that he was, by a few months, the creator of the first British score to involve tape [18].

Gerhard's pioneering achievements can be put in a broader, less localized, perspective. The first *musique concrète* work, the *Étude aux chemins de fer*, was produced by Pierre Schaeffer in 1948 at the Club d'Essai, RTF (later INA-GRM). In 1950 Schaeffer

and his then assistant Pierre Henry produced their first substantial work in the genre: the collaborative *Symphonie pour un homme seul*. The NWDR studio opened in 1953, where Stockhausen produced his first experiments with Elektronische Musik, the *Studie I & II* (1953 and 1954). The first acknowledged work that combined instruments and electronic sounds was Maderna's *Musica su due dimensioni* produced in Bonn, in 1952 for flute, cymbal and electronic tape. One of the most famous early works incorporating electronics was Varèse's *Déserts* (1954) for ensemble and tape. Varèse's work alternates rather than integrates the instruments and electronics, having three tape 'interpolations'. It was in the same year, 1954, that Gerhard completed his first ensemble and tape work, the incidental music for Bridget Boland's play, *The Prisoner*.

Gerhard was well aware of the techniques of electronic music on the continent: transposition, looping and layering of sounds, cutting and splicing to create rhythms or dynamic envelopes, feedback, filters and ring modulators, were thoroughly described in a special number of the technical magazine of the Nordwestdeutschen Rundfunk devoted to the Cologne Studio for Electronic Music [19], part of the composer's book collection along with other seminal texts relating to the early days of electronic music by composers such as Pierre Schaeffer, Karlheinz Stockhausen and Milton Babbitt. While always suspicious of studios operated by sound technicians, Gerhard, on occasion regretted his lack of more sophisticated devices, envelope controllers and modulators. It is therefore not surprising that one of his favourite resources was the use of transposition (see Table 1).

Although Gerhard wrote that he was primarily interested in producing electronic music for 'applied works... to works of radio and television, for the stage and screen' completing twelve substantial scores for ensemble or orchestra and tape between 1954 and 1964 for BBC Radio productions or for theatre, he produced a number of works with or for electronics not intended as incidental music.

Take	Play	Effect	Sounds
7"	15"	one octave higher	Maracas, Timpani, White noise
15"	7"	one octave lower	Maracas
15"	7" & 3 3/4"	one & two octaves lower	Cymbals, Timpani, Crumpling papers, White noise
3 3/4"	7" & 15"	one & two octaves higher	Crumpling papers
7"	15" & 3 3/4"	one octave higher & lower	Crumpling papers, Wind

Table 1: Tape-speed⁸ combinations found in *King Lear's* sound score.

⁸ It should be noted that Gerhard often annotated his tape boxes 7" rather than 7 1/2" i.p.s.

Gerhard's electronic works for concert include the *Audiomobiles* series of works (1958-63), the second of which became the soundtrack for Hans Boye and Anand Sarabhai's film *DNA in Reflection* (1963); *Lament for the Death of a Bullfighter*, for speaker and tape - a musical setting of the reading of Lorca's poem entitled *Llanto por Ignacio Sánchez Mejías*, for speaker and tape (1959); *Symphony no.3, 'Collages'* for orchestra and tape (1960); *Caligula* (1961), the projected *Sculptures* series (1963) utilising sounds recorded from a sculpture by John Youngman (only one work in this cycle was completed although there are multiple tapes that contain substantial compound mixes), and the epic, though unfinished *Vox Humana* (1966-67). The *Ten Pieces for tape* are extracts from *Audiomobiles II: DNA in Reflection*⁹. The last work in this category is a live electronic work entitled *Claustrophilia – a page to John Cage* (1966) scored for eight harps (or as many multiples of four as available) and four backstage radio sets, tuned to different wavelengths, monitors backstage and loudspeakers [20].

The *Audiomobiles* series and projected *Sculptures I-V* are Gerhard's most abstract electronic works. These works were not commissioned and therefore provide the testing ground for Gerhard's most extreme exploration of the new medium of magnetic tape. As such, they also provide the most confusion regarding Gerhard's intentions and which works were actually completed. Although Gerhard's work list officially contains an entry for *Audiomobiles I-IV*, from preliminary study of the archive it appears that only three were completed. *Audiomobiles I* was completed in 1958. The second in the series was composed for the film *DNA in Reflection* in 1963. A third *Audiomobiles* appears in the tape catalogue often listed as *Audiomobiles 3 'Sculpture'*. It is the authors' belief that Gerhard having recorded and processed the sounds of John Youngman's metal sculpture realized that their sonic potential was considerable. Therefore, having originally intended the material merely to be used for the next in the series of *Audiomobiles* works decided rather to create a new cycle of works based solely on Youngman's sculpture.

In private letters to Davies, Gerhard indicates that he has '...an accumulation of work in a state of near-readiness, I mean ready for com-po-si-tion, namely ca 25 to 30 7" reels of multilevel compounds classified as 'good'' [21]. One such example is tape CUL_OR01_011601 on the box of which Gerhard

has written 'very good bits of electronic music' and contains twenty four minutes of highly developed (almost) continuous electronic music derived from the Youngman sculpture.

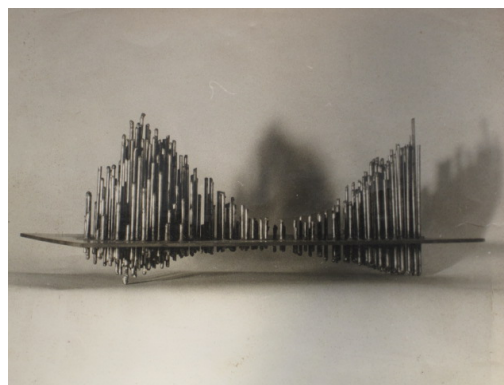


Fig.4: John Youngman 'Sculpture' (1960/1)

Although neither the *Audiomobiles* or *Sculptures* series of works were completed it is clear from the amount of working material in the tape archive that Gerhard was not dissatisfied with the results he obtained from working and processing sounds for the works. It was merely that his time for the final editing and montage of the works was limited. As none of Gerhard's electronic concert works were commissioned, one scenario is that the pressure of increasingly prominent commissions and his such as the *Concerto for Orchestra* (1965), *Epithalamium* (1966), *Symphony no.4* (1967), *Leo* (1969) and the unfinished *Symphony no.5* (1969) there was little time to complete time-consuming works for tape that carried little financial reward.

6. SOUND COMPOSITION

Gerhard's working processes are fairly well documented in his notebooks. They contain numerous annotations of source materials and comments on these. For Gerhard, the first step toward creating a sound composition was to gather a repertoire of raw materials on tape. This process is described in ff. 1-10 of the sound score [22] for the incidental music to *King Lear* (1955), which contains detailed instructions for recording a catalogue of instrumental sounds using different dynamics and modes of attack, including: maracas, cymbals, xylophone, turkish cymbal, tam-tam, piano, chromatic timpani, bass drum, gong and mbira. In his studio, Gerhard had a microphone available for making recordings of piano effects¹⁰ - or smaller percussion instruments. But the sound materials he

⁹ They are listed in the Bowen catalogue as composed in 1961. However they are extracts from a work completed in 1963 and released on *Electronic Music*, by Roberto Gerhard, (Southern Library of Recorded Music, MQ 760) in 1964.

¹⁰ For example, the tape labelled 'Roberto working on piano strings for incidental music' [CUL_OR01_005501] would be a document of those experiments, with similar recordings to those described in *King Lear's* sound score (low piano strings: pluck, rub with wire brushes, comb, roll with timpani sticks). [Gerhard.7.102].

utilized were by no means limited to instrumental sources. Production notes reveal the regular use of daily objects for making sounds (packing paper, paper tissue, combs, ashtray), as well a wide range of incidental noises (birds, dogs, axe strokes, cracking tree, thunder, wind, rain and storm, whipping gusts, crowds, chatter, laughter, screams), which could be home-made¹¹ or taken from the everyday environment. In his notebooks, Gerhard writes,

[...] we all have got to start in the same way: by building up a repertoire of sounds which are stored on tape. [...] The sounds selected may either be appropriate in their original form to the sound-picture one has in mind or else require further treatment before being used. Most of my stored sounds are of instrumental origin, recorded on tape through microphone. The next step - what I called my second stage - is directed towards a certain transformation of that original sound, ideally towards a metamorphosis of the sound [in] which [its] origins are blurred, and a far-reaching change of identity might be achieved. [23]

Gerhard's methods for obtaining such source materials for his compositions are documented by Lindsay Anderson and Dick Mills. Anderson writes,

I remember visiting Roberto in Cambridge, talking about the score, and even assisting him in throwing various objects down the stairs, in an effort to produce the right kind of abstract sounds which he felt he needed. [24]

Dick Mills, who worked at the BBC Radiophonic Workshop describes recording sessions in which Poldi Gerhard was fond of participating too, writing that:

Roberto had a rather difficult problem to overcome when attempting to record his basic sounds, as he lived on a busy trunk road in Cambridgeshire and the only quiet period was around 3.30 in the morning. One can imagine the scene as Roberto twanged and banged and bonked metallic objects as his wife Poldi acted as recording engineer. Both of them were in their sixties at that time. [25]

Aside from sound sources recorded in his own studio, Gerhard also recycled fragments of recordings of his own instrumental works. Where the materials he needed could not be easily recording or created in his own studio Gerhard would resort to commercial sound catalogues or to outsourcing the recordings to a professional facility when a wider palette of instrumental sounds was needed. One such example is the music for the Royal Shakespeare Company's performance of *Pericles* (1958) for which Gerhard produced the incidental music for ensemble and

electronics. The box of tape CUL_OR01_025401¹² credits 'Studio Black, Queens Way' for the recording of percussion and exotic instruments. The multiplicity of sources from which Gerhard would obtain sounds also include his close friend Joaquim Homs for recordings of castanets which were required for the tape part of *Symphony no. 3*, 'Collages', an Australian friend bringing recordings of fishes. Although Gerhard had a preference for sounds of acoustic origin, this did not rule out the occasional use of synthetic sounds, such as white noise or sine tones.

In the second stage of the production process, Gerhard listened intently to the internal characteristics of his material, abstracting the sounds from their physical sources through various means of processing. During this stage of processing the primacy of the original sound as a means of grouping material developed from it became redundant as a means of classification. As Gerhard processed his material he regrouped it so that the timbral or gestural relationship between the sounds now assumes the most important means of classification. This processing stage allowed Gerhard to re-classifying the transformed sounds into sound-families – what Gerhard referred to as his 'theory of change of family through sound mutation' [26] in which material is grouped together because of its similar sound behavior or timbre. From these sound-families Gerhard developed a series of clear compositional stages and his own terminology for each:

- small mixes Gerhard termed 'sound images' or 'sound aggregates';
- these 'aggregates' were mixed to form 'compounds';
- numerous 'compounds' were mixed to form 'multilevel compounds';
- from these multilevel compounds the final 'assembly' would be mixed through editing.

In the instances in which Gerhard required variable speed playback, the transformation would again be organised in an external facility (often the BBC Radiophonic Workshop). By working between his own studio and the BBC Radiophonic Workshop Gerhard was able to achieve such processes as the mixing of three disks on three turntables at different speeds and applying simultaneous glissandi to the recordings. In his notebooks, Gerhard used capital letters to identify the sound patterns that resulted from the combination of multiple sources in such

¹¹ For example, the labelling 'Rain and storm home produced by Roberto' [CUL_OR01_039101]

¹² The cataloguing of the tape collection is part of the current project. The format is CUL (Cambridge University Library)_OR01 (open reel collection no.1)_0254 (item no.254)_01 (first spool – there are boxes with up to four small spools in.)

processes as that outlined above. Such processes enabled Gerhard to mix sources at fixed or variable loudness to obtain more articulated sound images, and successively build up several strands up to 'multilevel compounds' ready for editing in the final composition. In his notebook Gerhard writes lists of the elements that make up these strands (Figure 5),

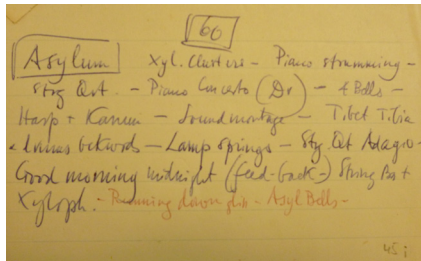


Fig.5 Gerhard 7.115 f.45i

For Gerhard, the final part of the composition process was the 'sound-montage' – the assembling, editing and juxtaposition of 'compound mixes'. Gerhard considered the sound-montage 'something of a game; something like a jigsaw puzzle with pieces upside-down or the wrong way around, bumping into one another and thus emphasizing their isolation, rather than giving them a common purpose which would lift them onto a plane of poetic imagery' [28]. Gerhard was not the type of personality to consider any composition a 'game'. What we can infer from this statement is the intuitive freedom that working in the electronic medium gave Gerhard – an immediate tactility of working with, and transforming, sound. Here a further comparison with Maderna may be drawn. About electronic music, Maderna once said, 'we no longer listen in linear time - our consciousness casts various projections of time that can no longer be represented with the logic of one dimension' [29]. Working with electronic music made Maderna trust in his compositional intuition. The influence of electronic music in Maderna's instrumental composition can be found in works such as the *Serenata per un satellite*. Gerhard himself wrote that 'the way time is felt in electronic music differs entirely from the way time is experienced in traditional music.' Gerhard was adamant that there is a fundamental difference between working with electronics and instruments. He uses the term sound-behaviour to characterize this difference. Gerhard writes,

the operative work is *behaviour*, it will be noticed, not colour; colour is never of decisive importance. Instead of 'behaviour' I might have used the term *sound-activity*. The electronic medium, in effect, makes possible new modes of action with sound which have greater freedom of tonal movement, of configuration and of textural weaving than those which our traditional instruments permit. [30]

Gerhard's notion of sound-behaviour bears a close conceptual resemblance to what Denis Smalley

would later term spectromorphology [31] – literally the shaping of sound through time. In line with thinking in fields of sound-activity the electronic works are driven by gesture and texture led sections. Although Gerhard did not care for Schaeffer's term for the basic perceptual unit in *musique concrète*, the *objet sonore*, it is clear that in his electronic works and increasingly in his later instrumental works, he nevertheless moved away from the 'note' as the essential unit, to his own notion of the sound object or sound-field as building blocks for his works. This is particularly evident in the *Symphony no.4 'New York'* (1966). Examples in the *Symphony no.4* are the 'structural chords' and Gerhard's use of percussion. The structural chords are played in the brass and are used to articulate the structure of the work, in particular the transition from one texture to another and cadential points at the end of sections, for instance in bb.14-15 (Figure 6).



Fig.6: Gerhard Symphony no.4 bb.14-15

They are always marked *ff* or *sfz.*, a large brass group (15 musicians) generating a wall of sound. In Gerhard's electronic music, there are also such structural sounds, used to separate textures, differing timbres and for articulating new sections. Such examples occur at the beginning of *Audiomobiles II: DNA in Reflection* and parts of *Vox Humana*.

In the *Symphony no. 4* Gerhard often uses four cymbals playing simultaneously to emulate electronic sounds. Figure 7 creates a 'noise' crescendo similar gestures developed from white noise in *Caligula* and *Audiomobiles II*. Later in the work (bb.485-486 – Figure 8) Gerhard creates a similarly striking sound by drawing screw-rods over suspended cymbals indicating that

For the *crescendo-sforzando* effect, start drawing the rod quietly across the edge of the cymbal, at a small gradient to the surface; then quickly increase the gradient and finish with a swift stroke and considerable pressure. [32]

Fig.7: Gerhard Symphony no.4 bb.346-347

Fig.8: Gerhard Symphony no.4 bb.485-486

7. CONCLUSION

The present study of Gerhard's electronic works and writings aims to contextualize Gerhard's pioneering work within the existing canon of early electronic music. His work from the 1950s not only pre-dates the establishing of the BBC Radiophonic Workshop but also the seminal later work of Peter Zinoviev, Tristram Carey, Hugh Davies, Tim Souster and the subsequent rise of the 'home studio' in England. As such, Gerhard's work provides a unique insight into the development of electronic music in England and offers a critique of the French and German schools of musique concrète and Elektronische Musik. The tape archive at the Cambridge University Library contains the work of a dynamic and original composer. One who was at the forefront of the exploration of the new medium of electronic music and one who deserves to be recognized as such.

8. REFERENCES

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[3] Ibid. 2 p.180

[4] Ibid. 2 p.181

[5] Ibid. 2 p.183

[6] Ibid. 2 p.183

[7] Gerhard unpublished notebooks, CUL GERHARD.7.115 f.20

[8] Ibid. 2 p.184

[9] For a detailed description of the contents of the collection see KARMAN, G., (2007) Roberto

Gerhard's Sound Archive at the Cambridge University Library, 29.12.2007, CUL, Cambridge, and KARMAN, G., (2008) Roberto Gerhard's Tape Collection, 10.10.2008, CUL, Cambridge.

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