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# The Performance Practice of Electroacoustic Music: a practice-based exchange between musicology and practice

## Glissandi

### Introduction

Glissandi was realized in 1957 at the Cologne studio of WDR (Westdeutscher Rundfunk). It was Ligeti's first electroacoustic piece. Ligeti himself called the piece an "exercise" (Ligeti, *Gesammelte Schriften*, Vol. 1, p. 246). While there is no realization score for the piece, some sketches exist (Paul Sacher Stiftung, Basel, Sammlung György Ligeti). The sound material consists of synthetically produced impulse sounds and glissandi presented in different registers, in different speeds and dynamics that are generally developed through repetition and variation. Formally, two roughly symmetrical parts can be distinguished. In the first part, an increased density leads to a climax at the connection point. This is marked by acute impulse sounds starting numerous short glissandi. The second part is a heavily filtered mirrored version of the first part with additional variations of materials and motifs.

### Audio sources

#### Rent material

The performance material was received from Schott on an Audio CD. the source tape for this digitization is not identified. The audio file has two identical mono tracks at 44.1 Hz/16 Bit. The duration is 7'35:43. The recording is split into 2 tracks, probably due to IDs having been automatically set at pauses. A hum is heard at 50 Hz (+ harmonics); it is not constant but changes according to cuts or independently of them. It is more present in the second part of the piece. There are many dropouts and "scratches". However, sound quality is clearly superior to that of the commercial releases.

#### Archived material

-The Paul Sacher Stiftung has a cassette tape (GL TC 128 B mono C60) that was used by Doati for analytical purposes. There are no reel-to-reel tapes containing Glissandi at PSS.

-The Institute of Sonology (Den Haag) has three copies of Glissandi made at the WDR. They are marked "Original", "Ersatzoriginal" (replacement original) and "Hauptkopie" (main copy). The latter is 15', the others are 30' tapes. The "original" tape has a defect in the beginning, however, it has the best sound quality of the three. The copies were made using the Telcom noise reduction system. Digitization of these tapes was carried out by Kees Tazelaar.

## Commercial releases

Two CD releases were compared, György Ligeti (Wergo, 1988) and Acousmatrix 6: Cologne-WDR: Early Electronic Music (BVHAASST, 1991). They differ in filtering and loudness. Both have the 50Hz hum and the harmonics described above. Sound quality is inferior to the Schott material and to the WDR copies. Duration is different to the Schott material in both the Wergo (7'34:07) and the Acousmatrix release (7'36:12).

## Technical reports

### Different durations

The differences in duration were analyzed by comparing the respective frequencies of specific motifs in the piece. Since no constant rate can be established, the differences are most likely to be caused by normal wow and flutter in the tape machines used in possibly two different transfers.

### Restoration

A first attempt at restoring the file proved unsatisfactory due to the very loud noise signal, which proved problematic especially in the piano and pianissimo passages. Restoration was then realized using the iZotope RX4 software. In a first step, 50 hertz hum was eliminated using four harmonically tuned notch filters, Linear Phase, -48db, -40db, -35db, -30db. The goal was to find a setting that would not weaken the bass sounds (e.g. at 2:37 etc.). A noise profile was then established. The first de-noising had the side effect that the high frequencies in some glissandi were less brilliant (e.g. at 0:40). Also, decaying sounds and reverberation had changed to strongly in some places. The noise profile thus had to be modified listening to the critical passages. Clicks and dropouts were then removed. Low clicks (probably analogue errors) and dropouts from the DAT tape had to be manually corrected, since the music is to "noise-like" for the algorithms to work. Finally, the signal level was normalized.

## Performance

There is no documented performance practice of Glissandi by Ligeti himself or people associated with the WDR at the time. Although it was not common for many composers to realize a live or prepared spatialization of a monophonic tape composition, a dynamic sound projection through multiple loudspeakers is not to be ruled out. There are compositional features that can be highlighted and/or differentiated through such a performance:

Movement of the glissandi (register, direction, speed); attacks of impulse sounds; specific motifs and their variations; distinguishing near and far with respect to strongly filtered sounds; dynamics.

Such an approach was chosen for the concert on January 29, 2015. It was realized using more than 20 speakers on two levels. The audio used was a restored version based on the publisher's rented audio file.

## Outlook

With respect to the available audio sources for *Glissandi* it would seem important to locate and digitize the original tapes. Judging from the quality of the first-generation copies of these tapes (see above), it might be necessary to combine passages from the "Original" and "Ersatzoriginal" tapes in order to achieve the best possible quality.

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