The Sonogram: A tool for visual documentation of musical structure.

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ABSTRACT: The purpose of this paper is threefold: to introduce a technique for representing musical information, to suggest potential uses for the tool described, and to give brief practical examples of the sonogram's use.

INTRODUCTION: The sonogram's particular value lies in its provision of a large scale visual reference for musics which cannot be notated conventionally (e.g. ethnic or electro-acoustic music), but it is suggested that the nature of the insight into many areas of musical structure which it allows will encourage applications even with notated musics.

The features which distinguish our SONOGRAM program (Ungvary/Lunden) from others of similar nature are primarily its size, and the flexibility with which information can be represented. Whole musical works can be taken in at a single glance, allowing unparalleled visual access to the 'architectural' level of composition.

The fundamental difference between a sonogram and a conventional musical score is that the latter is prescriptive, which is to say that its primary purpose is to convey a series of instructions to the performer consisting of several types of symbolic code representing high-level musical concepts such as pitch, rhythm and dynamics. In situations when the main musical concerns are not pitch and rhythm but perhaps timbre, the sonogram, as a descriptive notation which enables representation of sound in a relatively unambiguous form, becomes useful. In the sonogram the vertical axis represents frequency and the horizontal axis time. Amplitude is represented by printing density.

The sonogram makes it possible to relate sounds intuitively to visual images. It allows the recognition of individual sound objects, descending and ascending contours, silences, sound density in both the frequency and time domains, registration, sound profiles, characters and gestures.

POTENTIAL USES: Composition: The sonogram provides a solution to some of the practical problems frequently experienced by studio-based composers of electro-acoustic and computer music. By providing a hard-copy reference of a whole work, a degree of conscious control is given over the formal architecture of a work which is often difficult to maintain otherwise. The studio environment tends to promote a seduction into detail which can often be at the expense of the formal success of the work. Repeated listening also tends to numb the critical ear significantly, so the provision of a visual reference may be important in that it reduces the necessity for some repeated playing.

Performance: The sonogram has a further application as a diffusion aid because of its accurate distinction between spectral areas. This enables clear articulation and spatial separation of materials with different spectral characteristics through the use of loudspeakers with appropriately tailored frequency responses.

Score: The elegance of the sonogram as an object in itself, the fact that it forms a visual reference for the musical public, making musical structure comprehensible in an intuitive manner, is at least as important as the

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more specialised information it provides for the professional. In solving the problem of the lack of a publishable score by the electroacoustic composer output the scoregram provides an explanation for the output of a music which has hitherto been regarded as difficult partly because of that lack of a score.

Mixed media: The strength of the scoregram lies in its non-reliance on a user being fluent in conventional notation, and that its basic principles can be grasped almost immediately by non-musicians. It can provide a time-objective working tool for artists and technicians working with music and other media. This enables composers, performers in conjunction with electroacoustic music to tape, film and video makers. The accuracy and proportionately planned events on the scoregram is a fixed temporal reference for anyone concerned with the synchronisation of such media.

Education: As an educational tool within the context of aural analysis, formal criticism, composition, pedagogy, etc, in comparative study of notations/graphic score systems such features are of immediate practical use.

Of particular interest within the educational field and to the non-specialist public is the scoregram's intuitive flexibility. The majority of the features so far described are evident in the non-musically literate when the hitherto secret of the principles of representation, not least because the possibility exists to draw analogies with other disciplines at various levels from the obvious (sound) to the bizarre (weaving notation).

Analysis: Much current music analysis takes as its starting point the principle of the aural experience. Sonogram aided analysis is seen as a tool which supports this emphasis, evident in the writing of e.g. Schaeffer, Chion, Small, Cogan & Escott and Thorens [3], because of its description which is not dependent on words.

The possibility of viewing a complete musical formal structure or architecture as a single scene is one of the most significant advantages offered by this approach. This also facilitates the critical comparison of different works within a given genre and of different characteristic musical forms. It becomes possible to distinguish characteristic spectral tendencies within the output of a given composer. Robert Cogan's observations (4) about the spectral clarity of Stravinsky's writing being a case in point. The possibility of relating different levels of the structural hierarchy, of viewing similarities of mixed media: The strength of recognizing instantly such devices as transposition, repetition and elongation, is also a significant feature. The internal structure of individual sounds can also be displayed and at the level of spectral typing, a transcription through the pitch to noise continuum, where the uppermost element, a steady sine tone, fluctuates a little, returns to stability, then gradually transforms into a relatively distributed noise spectrum, can clearly see Smalley's (5) concepts of motion types such as construction, divergence, accumulation, dissipation, undulation and convolution (to name but a few) as are well displayed by the sonogram as the plane and descent, as is the style of motion (continuous/discontinuous, periodic/aperiodic, streamed/docked).

More problematic is the identification of structural function. This is rarely possible from the sonogram alone, however in combination with aural analysis it becomes possible to distinguish such functions.

PRACTICAL EXAMPLES

As artists in different fields increasingly search for a common basis for their work, the digital encoding of such attributes as contour, gesture and transformation allows for the transition of constructional devices between media, with a consequent enriching of the conversational formal dialogue. A practical example of such dialogue can be seen on the Nusillus project (6) in which composer and choreographer use a notational system with a common formal base, and can specify contours or gestures in terms of functions which map onto parameters within each medium.

A further example of the sonogram's use as a reference point for collaborative artists working in different media is the QAZ project, a combination of dance, music, lighting and multiple slide projection commissioned by Folkung in Stockholm. During the rehearsal period the sonogram was repeatedly referred to by all the participants, but in particular by the dancer, who found no apparent difficulty in

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its use.

Tamás Ungváry's "Praeludium" for organ and tape (1987) made use of the sonogram as visual reference of the architecture of the work freeing the composer from the limitations of simple auditory comparison at the last stage of the compositional process.

D. Glas (Switzerland) transferred sonograms into score.

In the field of critical evaluation of performances Anne Chateney Shreffler (2) uses sonograms to support her thesis that the spectral characteristics of the (cornal-like) baroque flute (Bach Partita in A), which are almost the inverse of those of its (cylindrical) modern equivalent, are essential for the clear structural articulation of the music which was written for it.

H. Stoltz (Germany) used sonograms to enhance timbre sensitivity of students.

Sonograms have been shown on concerts by Cogan, Escot, Koos, Ungváry etc.

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NOTES AND REFERENCES


EXCERPTS OF SONOGRAMS.

Fuchs: Gaz  Mingus/Dolphy: Better Git it in your soul

Ungvary: Anonace  Verdi: Don Carlos, Act IV, Ebeli

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