Abstracts

Acoustical quanta and the theory of hearing
Dennis Gabor

Writing in 1946 and 1947, the author considers the possibility to describe acoustical phenomena with quantum methods, and emphasizes that such an approach on sound analysis connects very neatly with issues in the psychophysiology of hearing. Central to Gabor's paper is a representation of sound signals including the explicit determination of both frequency and time variables (different from the classic Fourier analysis, where sound is analysed in terms of perfectly periodical oscillations, i.e. oscillations of indeterminate duration). The author illustrates an «information diagram» that splits the sound signal in «logons» or acoustical quanta, e.g. rectangular units of minimal time/frequency area. These latter are formally described as functions or «elementary signals» consisting of a real part (oscillation) and an imaginary part (a pseudo-Gaussian pulse). The author shows that the time/frequency unit area in the information diagram are subject to quantum uncertainty. And that the definition of such unit area of acoustical energy might definitely converge with a number of (then accepted) empirical measurements in the psychophysiology of hearing.

Gabor's acoustical quanta *in sound and music technologies*
Agostino Di Scipio

Through a series of brillant paper publications dating from the late 1940s, Dennis Gabor developed a new conceptual and operational framework for the analysis of sound signals, based on a quantum-oriented view of acoustical phenomena. In the present essay, I try to illustrate the shaping up of Gabor's quantum analysis of sound, especially as delineated in two papers from 1946 (*Theory of communication*) and 1947 (*Acoustical quanta and the theory of hearing*), and to overview its legacy in scientific research as well as in audio and musical applications. After some introductory remarks, I follow a hybrid path, between history of science and history of audio technology, sketching a "genealogy" of Gabor's quantum view of sound (i.e. as

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connected to Heisenberg's indeterminacy principle, to Mach's analysis of sensation, etc.), and relating it to an empiricist tradition of modern science. I eventually situate his research in the context of contemporary research preoccupations shared by other, at the time, and I finally discuss some of the earliest audio devices that seem to tie back to Gabor's own practical experiments (beside his theoretical framework) and that revealed of primary interest to pioneers in analog and digital music technologies and related creative practices.

Xenakis and the "granular connection"
Makis Solomos

Many ways start from or go through Xenakis. One of these ways is the granular paradigm. In this paper, I will start from Xenakis, suggesting that, in his aesthetic, this approach is a "theory" in the ancient meaning of the word, and searching for the constituent elements of this "vision". Then, I will try to incorporate the granular paradigm into a musical historicity, searching for his becoming inside other aesthetics, in particular with Horacio Vaggione's and Agostino Di Scipio's music.

Interacting with Inner and Outer Sonic Complexity: from Microsound to Soundscape Composition
Barry Truax

It is possible to think of the two extremes of the world of sound as the inner domain of microsound (less than 50 ms) where frequency and time are interdependent, and the external world of sonic complexity, namely the soundscape. In terms of sonic design, the computer is increasingly providing tools for dealing with each of these domains, through such practices as granular synthesis and multi-channel soundscape composition.

Time-segment processing
Pierre Dutilleux, Giovanni De Poli, Adrian von dem Knesebeck and Udo Zölzer

The text deals with sound processing in the discrete time domain, whereas a phase of segmentation, a subsequent analysis, and a temporal signal of the recomposition strategy in order to obtain transformations on audio resynthesized. Various algorithms are presented illustrating the historical analogue techniques as well as developments and implementations using the digital audio techniques. Anthology musical compositions are also cited where composers and musicians use these calculations, contributing to the evolution of techniques of electronic music and sound.

State of the art in sound texture synthesis
Diemo Schwartz

The synthesis of sound textures, such as rain, wind, or crowds, is an important application for cinema, multimedia creation, games and installations. However, despite the clearly defined requirements of naturalness and flexibility, no automatic method has yet found widespread use. After clarifying the definition, terminology, and usages of sound texture synthesis, we will give an overview of the many existing methods and approaches, and the few available software implementations, and classify them by the synthesis model they are based on, such as subtractive or additive synthesis, granular synthesis, corpus-based concatenative synthesis, wavelets, or physical modeling. Additionally, an overview is given over analysis methods used for sound texture synthesis, such as segmentation, statistical modeling, timbral analysis, and modeling of transitions.