# THE RECONSTRUCTION OF CREATIVE PROCESSES AS A MEANS OF COMPOSITION (IANNIS XENAKIS' *S. 709*)

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## ABSTRACT

This paper employs Iannis Xenakis' electroacoustical composition *S.709* as an example to demonstrate that an algorithmic composition requires the reconstruction of creative processes, and that the actual creative act of the composer is the formalization of the knowledge gained through the reconstruction. This paper intends to examine how the decoding of this formalized creative process can influence listening and contribute to the understanding of music.

## 1. INTRODUCTION

Iannis Xenakis' electroacoustical composition *S.709* may be irritating for the first-time listener. He might be confronted with the question, "what kind of music is this?" The fascination that may be experienced by some listeners upon hearing this music cannot be compared to a general understanding of music. A true interest in this music requires the desire to understand and learn about this music in order to acquire access to it. However, the listener who is interested in *S.709* should ask himself if his fascination for this music already means understanding it.

## 2. *S.709*

The composition *S.709*, composed in 1992, is the result of the computer-program *GenDyn* which Xenakis developed at *CEMAMu* (Research Center for Mathematical and Automated Music) in Paris.

### 2.1. Stochastic Music

Stochastics, as a general term, deals with everything that concerns mathematics and statistics in relation to computation of probability. Something that is stochastic can be understood in this connotation to be something randomly dependent. Xenakis employed stochastics to generate musical shapes, not only as a compositional tool but also to formalize his own compositional processes. Xenakis is considered the founder of stochastic music.

### 2.2. *GenDyn*

*GenDyn* is the term used to describe the dynamic, stochastic sound-synthesis developed by Xenakis, which generates sound waves and their formal employment based on the principles of probability.

**Digital Representation of a Sound Wave.** The smallest unit of a digital sound wave is called a sample. At a sampling rate of 44100 samples per second, the duration of one single sample is about $2.268^{-5}$ seconds. One amplitude value is assigned to exactly one sample. At a resolution of 16 bit, there are $2^{16}$ (65536) different amplitude values.

**Stochastic Generation of a Sound Wave.** The amplitude values of a sound wave are randomly changed within a certain range of tolerance by means of computations of probability as well as the length of the sound wave, i.e., the quantity of the samples. The resulting sound wave is processed with the same stochastic procedure. The continuation of this principle and the succession of the newly generated sound waves leads to a course of sound whose quality is dependent on the size of the changes between the individual sound waves. The more similarities that exist between the succession of sound waves with respect to its amplitude shape and the quantity of samples, the more audibly apparent the transformations in pitch and color will be. Conversely, greater differences in the succession of the sound waves causes a more noise-like sound to be perceived.

**Stochastically Generated Musical Form.** The musical form of a *GenDyn* composition like *S.709* is a result of layering several sounds of various characteristics. The order of the individual sections of the courses of sound is established stochastically.

### 2.3. Intention

Stochastics, which in science attempts to describe statistical phenomena, are used by Xenakis to generate a composition from a course of sound. Pitch, duration, color and shape, as well as all other musical characteristics are derived from the principles of probability. The digital samples of a sound wave are randomly dispersed, so that all musical parameters are derived from the manipulation of the individual samples. The resulting sound is an electroacoustical composition that musically represents the behavior of probability as pure musical information.

## 3. RECONSTRUCTION OF CREATION

*S.709* is the result of an algorithmic formalization of the compositional process, which is based on the connection of stochastic principles. The creative act of the composer , in this way of working, is to reconstruct one's own creative processes with respect to the development of a musical idea and its possible formalization, i.e., the reconstruction of creative processes can be regarded as the actual process of composition. A listener interested in the composition *S.709* has the means to understand it by exploring the algorithm of *GenDyn*, and therefore observe and study the compositional thinking behind its creation. Moreover, the possibility to experience the creative process for oneself presents itself through practical experimentation with the algorithm.

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# 4. UNDERSTANDING *S.709*

Insights in the algorithm *GenDyn*, i.e., in the creative process of the origin of *S.709*, indicate the intentions of the composer as shown above. The listener understands not only what the composer intends to transmit, but also how he achieves it. The result is a specific perspective of listening to this music, which in this respect is either an understanding of the dynamic stochastic sound synthesis through listening or an observation of an electroacoustical representation of statistical phenomena with certain determined requirements. However, doesn't music entail more than understanding the actual intention of the composer?

## 4.1. Listening to *S.709*

One can listen to *S.709* as the unbroken will of a foreign species to make itself understood, to communicate: an electroacoustic stream of information, from which one gains the impression of a soon-to-arrive possibility of comprehension, a perspective of listening originating with the listener and independent of the intentions of the composer.

## 4.2. Listening and Understanding

Does one understand music through listening, or does one listen to music on the basis of understanding? This question will be examined by performing a listening analysis with several listeners. There will be a questionnaire compiled, in which questions concerning listening and understanding of the composition *S.709* will be presented. This questionnaire is to be completed by the listener after the first hearing of *S.709*. After the illustration of the intention, i.e., after a detailed insight in the compositional process, the listener will answer the questionnaire again after hearing the composition anew. The evaluation will then reveal the differences and/or similarities between the first and second listening analysis.

**Expected Results.** The listening analyses will presumably be divided into two groups of listeners:

1. The explanations of *S.709* are relevant, however, they are not necessary in understanding the music. The music is understood solely at the listening level.

2. The explanations are necessary for an understanding of the music. The listening is dependent on an understanding of the compositional process.

The results will likely be dependent on the level of musical education and specialization of the individual listener, as has to be documented in the questionnaire.

## 4.3. Understanding *S.709* with the assistance of *GenDyn*

More important than the question of the general connection between listening and understanding is, in this study, to consider the following: if the decoding of the algorithmically formalized compositional process in *GenDyn* can contribute to the understanding of *S.709*? The questionnaire will therefore ask for an evaluation from the listener concerning the relevance of the explanations with regards to understanding the music.

## 4.4. Results

The results of this examination and the acquired knowledge concerning the listening analysis will be introduced in my presentation at the ESCOM 5.

# 5. REFERENCES

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