

Theses of a Dissertation

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## Chaos and Composition

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## I. Background to the research

The integration of some of the results and models of chaos theory into the musical discourse is a relatively new initiative. The novelty of the concept, the many areas to be explored, makes it a good field for experimental artists. However, mapping fractals, Lindenmayer systems and diverse dynamical systems requires complex algorithms and a rather large computational capacity. Chaos theory models are therefore part of the ever-expanding field of algorithmic music composition. Algorithmic music composition is a woefully neglected field in Hungary. Its procedures are almost completely unknown, there is no Hungarian equivalent for the terms used for its individual processes, and the structure resulting from algorithms and the ways and methods of its perception and interpretation are not clear. Since I am very interested in this field, I thought of trying to approach the description and construction of models arising from chaos theory with the tools of algorithmic composition. I have chosen two pieces that draw on the results of chaos theory, but to different degrees. The reason for this is, on the one hand, to present a piece, *Modulaciones* by A. Posdas, which preserves to a large extent the mathematical context of the model used as a starting point. On the other hand, I also wanted to explore, in the context of an analysis, the impact of chaos theory as a source of inspiration. Among other things, this is what I explored in my analysis of T. Murail's *Allégories*.

## II. Sources

I found very little literature on the subject in Hungarian, so I could hardly use any Hungarian sources. The literature used consists of analyses, descriptions and explanations in English and French. Márta Grabócz helped me with the interpretation and translation of the French texts. In this language, I have made most use of *Tristan Murail's Modeles et Artifices*. Andrea Szigetvári assisted me in the editing of the English texts. In English, I relied on the book *Metamodels in Compositional Practices* by José L. Besada and the unpublished dissertation *Applications of Generative String-Substitution Systems in Computer Music* by Roger L. DuBois. In order to explore the principles of editing algorithmic pieces, it is essential to know the parameters and algorithms used by the author, and, as appropriate, the exact description of the virtual entities. I used the authors' starting points and algorithms from the analyses and presentations in the books, then recreated them one by one.

### **III. Method**

In order to present the two compositions in this thesis (*Modulaciones* and *Allégories*) and the L-systems assignment strategies, I had to take my programming skills to a higher level. I have tried to explore all the details of the structures of the pieces, for which I have created several software tools. I then used these software tools not only to present a specific detail, but I used them in every situation where it was possible. I combined different algorithms to get the most accurate and visual representation. This was necessary, on the one hand, because I wanted to make it as easy to understand as possible, so as not to discourage the reader, but rather to make him curious. On the other hand, in Tristan Murail's piece, instead of combinations of components, I have seen the emergence of similar musical objects and a structure organised according to a probability distribution, for which I had to develop tools capable of describing this novel approach. I then used the software environment I developed to analyse the pieces, however I was not able to do these analyses to the extent that I was able to describe the structures. This requires, among other things, writing additional software to control the data and to systematically capture the large-scale timbre manipulations in the pieces. For the L-systems, I have not analysed pieces to demonstrate this approach from the ground up using simpler, more accessible examples. To do this, I have used a variety of graphical representations.

### **IV. Results**

In my thesis, I have tried to explore all the aspects of chaos theory that could be represented by algorithmic composition techniques. I have presented two specific compositional approaches that use complex algorithms to place fractal models in musical context and interpret chaotic movement. I have presented musical mappings of L-systems and summarized the techniques of assignment that I found most effective and applicable. However, there are still many unexplored areas in the relationship between the syntax and the associated semantics of the pieces, on the one hand, and in the specification and description of further techniques and paradigms of algorithmic composition, on the other. Algorithmic composition involves a number of approaches and procedures which, although they are increasingly being explored abroad, have so far been little discussed in Hungary. I hope that my thesis will begin to fill this gap and

provide a source of inspiration and technical assistance to further explorers of this exciting field.

## **V. Documentation of Activities Related to the Topic of the Dissertation**

My first public appearance related to the topic of my thesis was my article in the special issue of *Hungarian Science* 2022/03, entitled *Fractal shapes in computer music. A review of Charles Dodge's Profile*. My further public appearance related to the topic of my dissertation was my DLA recital. This concert included two premieres, a shakuhachi electronic piece (*Lukash*) and an eight-channel fixed media piece (*Mariposa*). Both pieces contain a high proportion of results from the use of algorithms explored in my thesis. In my teaching practice, I made the software I created for writing this thesis available to students in my Composition Methods class. Using these software, we implemented several composition exercises and practices related to the topic.