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Traditional patterns and textures as values for meaningful automatisation in music

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Abstract: This contribution focuses on the accelerated loss of traditional sound patterning in music, parallel to the loss of linguistic and cultural variety in a world increasingly globalised by market policies and economic liberalisation, in which scientific or technical justification plays a crucial role. As a suggestion to an alternative trend, composers and music theorists are invited to explore the world of design and patterning by grammar rules from non-dominant cultures, and to make an effort to understand their contextual usage and its transformation, in order to appreciate their symbolism and aesthetic depth. With this aim, some practical examples are provided.

Usually, when one talks about patterns and textures as structural sources for algorithmic composition, one bears in mind certain objects taken from computer science and a variety of statistical models. Some examples are L-systems, fractals and other recursive structures, Markov chains, and different kinds of noise classified by their relationship between frequency and power distribution. For their applications to music, all these possibilities have been studied extensively in mathematical, acoustic, and computational perspectives. However, it is worth to investigate these resources, in order to distinguish if they are completely new means producing new meanings, or rather they represent an adaptation to concepts and meanings already existing in traditional contexts.

One may notice, in the last twenty or thirty years, an increasing cascade of books and articles, discovering mathematical qualities in the so called classical music. Several researchers found, for example, a fractal dimension for a variety of compositions by J.S. Bach or W.A. Mozart (Hsü and Hsü 1991, Bigerelle and Iost

2000, Dagdug *et al.* 2007). Some others create artificial intelligence systems to automatically or semi-automatically reproduce formal and stylistic characteristics of the work of certain composers (Holland 1975, Goldberg 1989, Todd 1989, Bellgard and Tsang 1994, Melo 1998, Bohlen and Pierce 2009). Obviously, many of the fundamentals of music automation are already implied in their own rules and prescriptive grammars—for instance, in the treatises of harmony and instrumentation, and their application, as well as in the iteration of practices, in the vocal and instrumental performances by styles that consolidate a tradition.

This contribution wants to focus the fact that musical traditions reflect deeper aspects of innate cognitive domains, and many of these aspects are correlated with basic notions of counting, imitating, comparing, expecting, and making analogies by a universal, synecdochic system of cognition and structural association. This system is common for a variety of conceptual domains such as geometry, music, and design (see Gelman and Brenneman 1994).

In particular, I want to pay attention to the power of intersemiotic translation between traditional patterns in music and plastic arts, suggesting strong aesthetic and symbolic links among them, by mental operations like analogy and synecdoche. Assuming that new tools, such as L-systems and fractal geometry provide elements of grammar and style to a new musical repertoire, a lack of musical assimilation of traditional plastic patterns should be fulfilled by equivalent methods for sound design and structural elaboration, as an alternative for grammar and style in music.

A concept founded by Jakobson (1959), *intersemiotic translation* is nothing else but describing a forest as Sibelius does by symphonic means, or to articulate a programmatic narrative through sonic elements and relationships, as it happens in many traditions of instrumental music. In general, the concept of intersemiotic translation refers to the symbolic transfer from one medium to another: one talks about intersemiotic translation when describing an empirical problem from physics, with a mathematical formulation, or when drafting a poem or a sculpture based on a mathematical formula or a landscape or the appearance of an object. Intersemiotic translation also occurs in the systematic relationship between a score and its musical performance, and equally, in the conversion of an L-system into a musical pattern. In all these examples there is a symbolic transfer from one medium to another.

An L-system is defined as a self-generative grammar, which operates through the coordination of an axiom, a set of rules, and their application entities. Originally the L-systems were used to emulate the growth of plants, such as self-organising systems under fix and variable cycles of development (Lindenmayer 1968). "L-systems generate strings of symbols by repetitively substituting predecessors of given productions by their successors" (Prusinkiewicz 1986, 455). After Prusinkiewicz (*op. cit.*), several composers and music theorists propose self-structuring grammars using L-systems for the design of 'seeds' and their development for composition and analysis, implementing basic operations of symmetry and affine transformation.

L-systems are not the only self-structuring codes used as generative grammars for music. The variety of these possibilities is very broad, and includes proposals such as the conversion of the genetic code (Gena 1999, Alexjander 2007), or the elaboration of sequences by processes of stochastic recursion from a given set of symbols and rules (Xenakis 1963, Lidov and Gabura 1973, Gogins 1991, Harley 1995, McAlpine, Miranda and Hoggar 1999), for producing music. Through intersemiotic translation systems, all these means are able to construct rhythmic patterns, melodies, harmonic sequences, and derivations and transformations in different structural layers.

In a universe of craft examples there is a vast array of objects and constructive processes with self-structuring steps, to the extent that in craftsmanship, the symbolic agreement between tradition and production, is equivalent to the balance between axiom and recursion in an L-system. An example of this, similar to what happens in music, is the continuity and gradual transformation of abstract brocades, in textiles.

A wide range of textures and fabrics has feasibility of adaptation to hearing, in order to be translated as music: examples are traditional textiles with patterns analogous to those of music, with systematisation of intervals, pauses, repetitions, prolongations, segmentations, tessellations, brocades, and loops in local and overall symmetries. The examples shown here can be translated into music. For there are at least three possibilities, analogous to the three mental operations described by Jakobson (1959, 232–233) as translation systems:[1]

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[1] One may say that these three operations are comparable to those of Jakobson's scheme (intralingual, interlingual, and intersemiotic translation) as gradation of mental operations in three steps. Jakobson's use of these three steps is, however, very different, in that it deals mainly with the translation processes of verbal language and its visual representation.

(1) Translation of *source relationships* from an α category, to *target relationships* in a β category, without losing information that allows reversibility of α to β, in β to α. This method includes the sequential rendering of digitised images as bitmaps through electronic readers. These examples can be interpreted directly as audio signals, for example, using Ekman (e2005) audiovisual techniques. In this case visual information is *not* lost, although new audio information is produced.
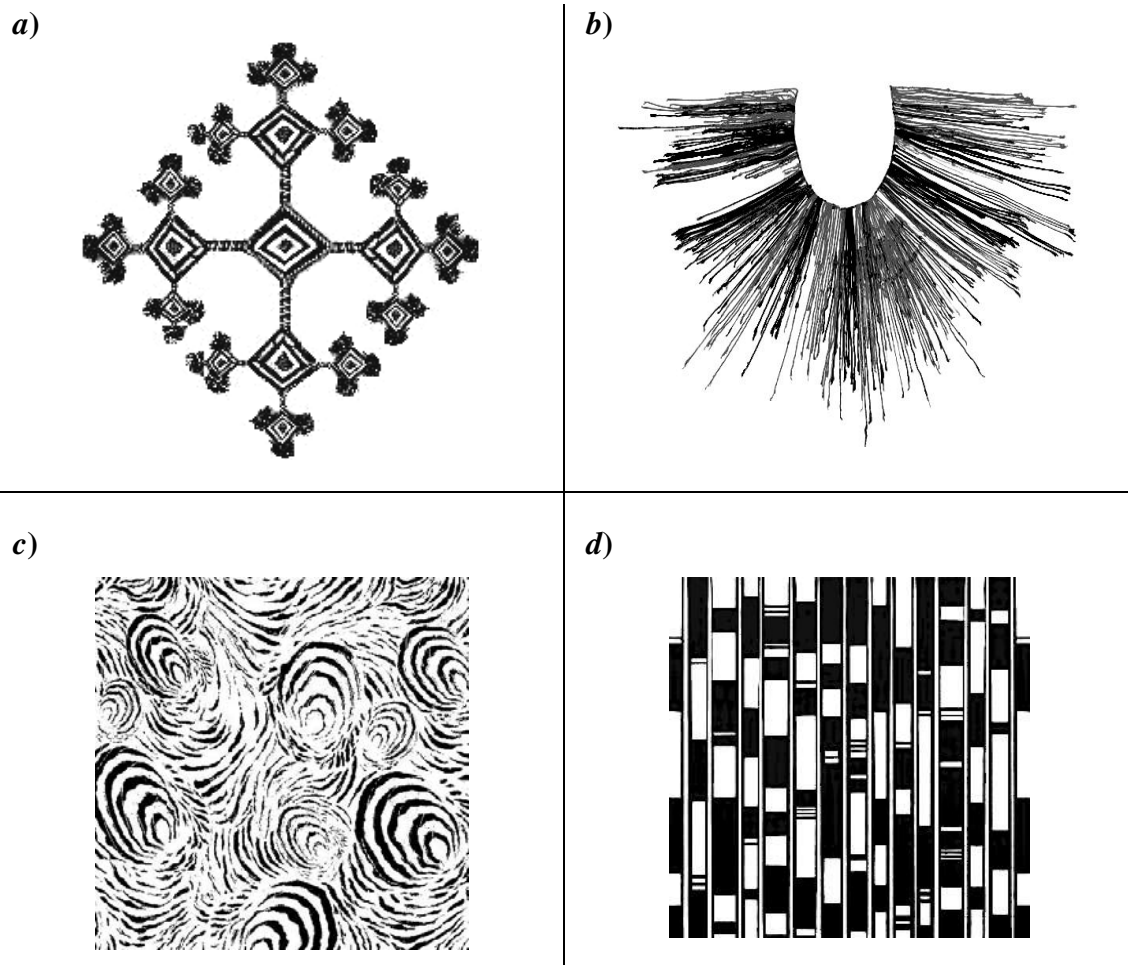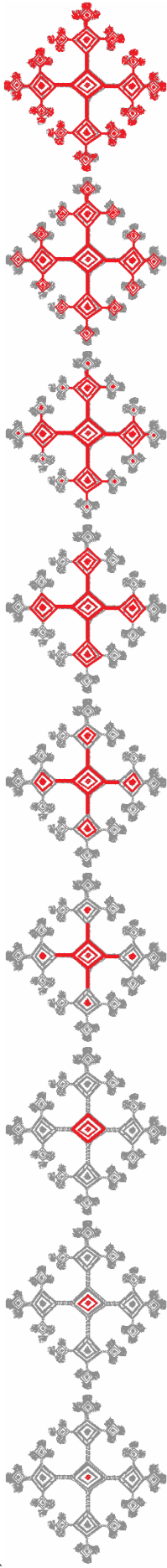

(A) Samples of statistical self-similar patterns and textiles from different usages, cultural, geographic and historical contexts: (*a*) Si'kuli wixarika, Tlaquepaque, Jalisco, Mexico. (*b*) Inca Quipu, Larco Museum, Lima, Peru. (*c*) Sarong batik, Bali, Indonesia. (*d*) Bozo batik, Bamako, Mali.
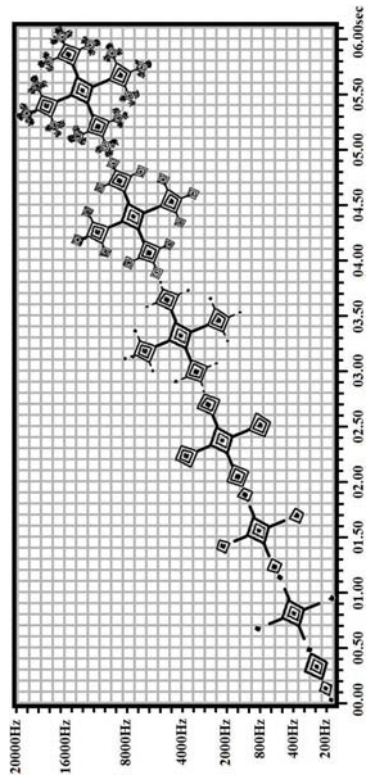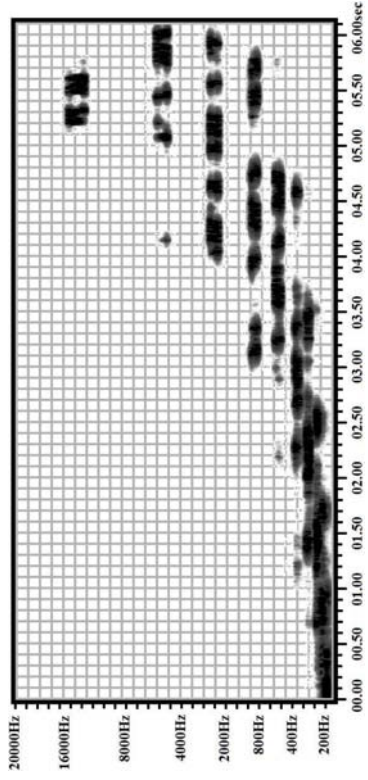
(B) Intersemiotic translation of a traditional textile pattern (Si'kuli made by Wixarika people, see table A) into sound: (*a*) Bidimensional representation of the original design; (*b*) Structural analysis of its symmetric components, as hierarchies; (*c*) Diagonalisation of the latter, within pitch (*y*) and length (*x*) axes; (*d*) Quasi-vocal formants obtained from *c*.

(2) Conversion of images and textures into sound, with a proportional or functional distribution of its parts (see table in the next page). This method includes instant renderings, passing information from a visual or tactile matrix into an aural matrix. Unlike Ekman processing in a Cartesian coordinate of time and pitch, this method consists in passing units from a space divided into equal parts (a grid with filled and empty cells), into a scalable time-sound space, divided into equal parts (series of sine waves). This method can be processed by computer, or executed manually using a sieve with values proportionally assigned to the object to be translated. The final result does not allow reversibility of β in α.

(3) Conversion of source relationships (materials, colors, shapes, distributions, ranges, quantities, etc.) into relationships within musical parameters comparable but not strictly similar to the source. This method is applied for the regeneration and transformation of original relationships, into completely different target structures: not only is not allowed any form of reversibility of β in α, but the relationship $\alpha \rightarrow \beta$ does not preserve most of the original relationships of symmetry, repetition, ratio and proportion (*i.e.* ἀναλογία as conservation of proportion). This is the most flexible and common form of intersemiotic translation. It comprises, for instance, the conversion of the *Devil staircase* (*i.e.* the Cantor function), and the Koch curve into piano pieces like Ligeti's *L'escalier du diable* (1993) and *Désordre* (1986). As Richard Toop (1999, 201) asserts, regarding these examples, "the exactness of the analogy is of secondary interest".

Other forms of translation of visual and tactile textures into patterns of sound and musical structures within a prescriptive or descriptive grammar, can be obtained as a combination of two or more of the mentioned methods, through a contiuum (by simultaneous parameters) or discontiuum form (by differentiated sections).

In an almost boundless world of textures, cultivated in different textile traditions, brocades and tilings have a special place because—analogously to music, they convey relevant traits of consistency, structural economy, proportion, and balance between order and disorder. This hypothesis is supported upon empirical research developed by estheticians, semioticians, design historians, and industrial designers (see Kaneko 1987, Mori, Endou and Nakayama 1996, Mori and Endou 1999, Situngkir 2008).

Considering these aesthetic values comparable to those of music, one may say that the textile tradition is a *musical* heritage, just as the universe of languages convertible

into musical sound. By extension of this concept, not only textiles, but also ceramics, marquetry, brocades, laces, friezes, tapestry, stone carvings, and many other forms of traditional design propose a dialogue with music, based on repetition, consistency of textures, motif recursion, and self-similarity as an intuitive interplay between order and disorder: a balance between consistence and difference.
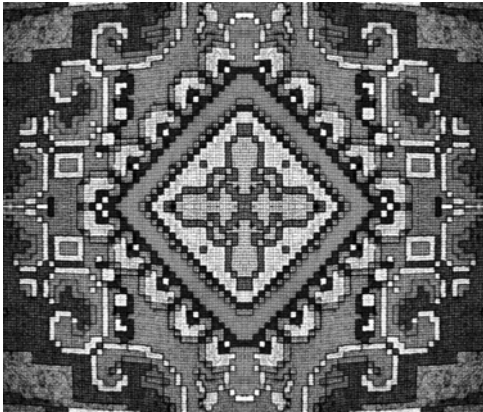
An immediate use of the translation hereby proposed may comprise the implementation of sound filters, seeds for L-system automatisation, traditional motif design, structural planning for composition, templates for analytical purposes, and wide-range semiotic studies. The risk of using these possibilities as means for program music in a simplistic sonification of patterns, is a jeopardy that can be avoided whilst intersemiotic translation purports coherence among aesthetic expression, symbolic content, grammatical structure, and ecological context. This sort of coherence may also help to avoid another form of indiscriminate exploitation of cultural resources. In sum, the difficulties in this operations are similar to those found in other processes of translation, at the risk of falling into the unintelligible and the betrayal of the symbolic content and expressiveness of what is translated (see Schleiermacher 1813, Eco 2003, Ricoeur 2004).

The consistent use of these patterns may contribute to *subversive actions* (creative, propositive changes) against a *musical regime* (totalitarian acculturation) increasingly closed in itself with the worship of resources and objects related to a notion of 'progress', with art and music technology becoming instruments of control and imposition.[2] This choice for resistance can be compared and make sense with the strategies for maintaining and developing language and idiosyncratic diversity, combined with ecological diversity. After all, intersemiotic translation of culture and nature is a feature of all musical traditions.
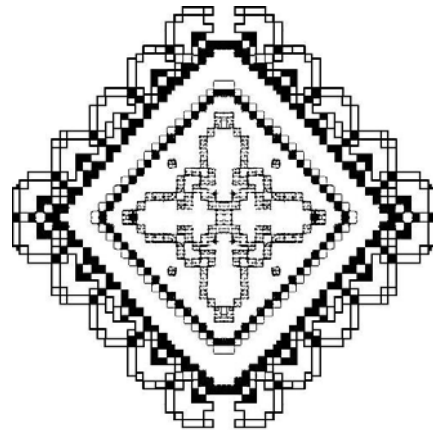
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[2] One example among many possible, is the publication of the book *On Beauty* (Umberto Eco, ed., Secker & Warburg, London, 2004), whose original edition omits the subtitle *A History of a Western Idea*. This book, a monumental and expensive publication, joins a long list of titles assuming beauty as an exclusive feature of European culture. Most of encyclopedias and histories of music, and published scores, catalogues and technical books, also contribute to extend this system of segregation in music.
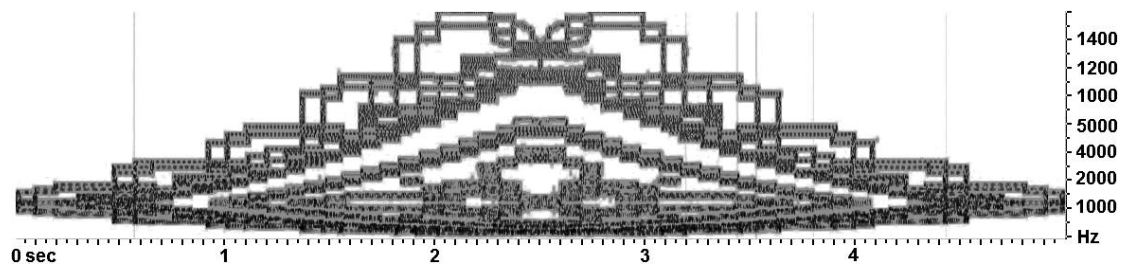
(C) Finnish traditional tapestry as a source for sound generation. Embroidered carpet, permanent exhibition at Törnävä Manor (Seinäjoki City Hall), pictured during the Musicology in the 3rd Millennium Symposium reception (March 17, 2010): (*a*) Carpet's picture reduction and simplification from polichrome to gray scale. (*b*) Isolation of the carpet's central motif and structural simplification. (*c*) Quasi-three-dimensional transformation of the latter, and its view as sound harmonic spectrum in time/pitch coordinates.

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