Abstract

Intervalic and Rhythmic Patterns – a Computer Assisted Statistical Research

The purpose of this interdisciplinary research is to investigate the possibilities of using relatively simple statistical methods to identify both melodic and rhythmic patterns in Music, to establish the uses and limitations of techniques such as statistical distribution and entropy, to develop ways to measure and express diversity, to build up a possible set of algorithms that could be used for detailed statistical analysis of musical style. Based on the fact that listeners are often capable to recognize the style of pieces of Music that they never heard before, we assumed that there must be certain types of patterns – both melodic and rhythmic – that influence the perception of Music and contribute to the identification of style.

These techniques that build upon a long tradition of computer assisted methods of research conducted by a large number of scientists since the early 1960's were tested initially on a *midi* database that we built from pieces by Mozart. Later we extended the scope of the analysis on similarly large samples of works by Haydn, Bach, Schūtz, Monteverdi, Palestrina and Lassus. We compared individual melodic lines written for voice, orchestral instruments and piano. A series of strategies have been applied to simplify the data, thus the only two parameters that we considered were pitch and duration, separately.

We analyzed the statistical distributions of patterns of single intervals, two and three consecutive intervals using a series of softwares, some commercially available, others created specifically for this research.

In the next phase we used the same database to explore the rhythmic diversity of Music We reduced the number of patterns by treating the different rhythmic patterns as mathematical proportions of note lengths considering patterns of two, three and four successive rhythm values.

Shannon entropy was used to attribute a precise value to the measured diversity and *standard error* to express the statistical margins of error in each case, both for intervallic and rhythmic diversity.

Monteverdi's case was given a special focus as his oeuvre consists of two stylistically very different parts: a number of earlier Renaissance style pieces and a later corpus of works that belong to the early Baroque. By analyzing these two distinct parts we tried to answer to the question: how are the changes in musical language reflected by the results obtained through these statistical methods.

The results that were obtained are largely confirmatory in nature, they confirm by these specific means many results that were obtained by other, more traditional techniques of analysis, although in some cases new information was also added. We attempted to give explanations for our most important findings from a musical standpoint. These arguments are presented as two distinct categories: those that explain the specific results that we got for each composer in part and those that seem to describe more general characteristics that we found in most of the Music we analyzed.

Based on these results we conclude that these statistical methods seem to be suitable for research in several different areas of stylistic analysis. The data that we obtained suggests the possibility of an entire series of specific research that can benefit from these techniques and yield significant results.

Keywords: style, patterns, statistics, distribution, diversity, entropy, musical language, computer assisted research