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TOWARDS A THEORY OF THE CHORD SYNTAX OF GEORGIAN POLYPHONY: NEW TOOLS, NEW PERSPECTIVES AND NEW RESULTS

Introduction

The present paper can be seen as a delayed follow-up study to the work of Arom and Vallejo from the years 2008 and 2010 who had manually analyzed a small collection of scores of traditional polyphonic Georgian music. In a nutshell, what they had been doing was to generate tables of typical chords and chord progressions in these scores and looking for patterns that might be syntactically meaningful and that might reveal elements of a theory of the chord syntax of this music. What was already pretty obvious at that time was that this work needed to be done with computational support, but it was not really clear how. Even today, Computational Ethnomusicology is still a very young field of research and it was even more so ten years ago, when we, the two authors of the present paper, met for the first time. As related to traditional Georgian music, it was barely existing. This meant that we were travelling uncharted research territory and most of the tools which we needed had still to be developed. In addition, open-source digital datasets of traditional Georgian music were sparse as they were mainly used for publishing song books and therefore kept private. Moreover, the usefulness of sheet music for our goal was not clear at all, because the tuning system of traditional Georgian vocal music is not adequately represented by a 12-tone equal temperament system on which the Western score notation is based.

During the first couple of years of our collaboration, we spent most of our time exploring different ideas and making a couple of exploratory studies. A lot of effort went into building a research corpus and developing computational tools which we applied in a number of exploratory studies. From a comparison of a small collection of musical scores of Georgian and Medieval polyphonic songs (Arom et al, 2018) for example, we learned that although the essential chord inventory of those two collections was not very different, the chord syntax – in other words the temporal structure of the chord sequences – seemed to be characteristic of each subset. This encouraged us to use N-gram analysis, which is a quantitative way to analyze chord progression statistics, on the whole corpus. As a result, we could demonstrate that different regional and stylistic subsets in this corpus showed clearly different chord-progression patterns (Scherbaum et al., 2024). In the same study, we could also finally demonstrate how to systematically correct scores of traditional Georgian music in Western notation for the distortions caused by the transcription process.

It took us a long time to solve this problem in a satisfying way, because it also required the understanding of the Georgian tuning systems, a topic which was discussed in several recent studies (Scherbaum et al., 2020, 2022). Regarding the analysis tools, in the present paper we focus on the use of Harmonygrams (Scherbaum, 2024), a new notation system for three-voiced music, which is briefly discussed in the following chapter.

Harmonygrams

Harmonygrams are a new graphical notation system for three-voiced music that seamlessly integrates all melodic and harmonic elements of a song into a single, intuitively comprehensible graph. Individual voices are represented as note sequences in Global Notation (Killick, 2020). The vertical spaces between the individual voices are color-coded to indicate the corresponding harmonic intervals. The interval between the lowest voice and the highest voice is portrayed below the lowest voice as a vertical mirror image, with the note trajectory of the lowest voice serving as the reference curve. This system allows users with minimal training to grasp both individual melodies and harmonies more or less effortlessly.

Harmonygrams offer several noteworthy features. First, they can be generated computationally from traditional musical scores. Second, they allow for algorithmic correction of some of the tuning system distortions happening during the transcription into Western notation. Third, the perception, but also the structural analysis, of the whole chord progression structure of a song becomes easily possible with Harmonygrams, even for lay people, since it all boils down to recognizing simple visual patterns. This has proved extremely beneficial when attempting to separate structural pillars from ornamental elements of a song by looking at groups of similar songs, as explained below.

The Erkomaishvili dataset

The Erkomaishvili corpus is based on recordings of the former Georgian master chanter Artem Erkomaishvili, which were preserved in the archive of the Georgian Folk Music Department of the Tbilisi State Conservatoire. One advantage of this dataset for our study was that the transcriptions by David Shugliashvili (Shugliashvili, 2014), which also include the separation into individual musical phrases, were available in digital form. It is also a dataset which we have used extensively to study the tonal organization of traditional Georgian music (Scherbaum et al., 2020). As a consequence, it is currently the best study object for structural corpus analysis available to us.

Analysis

For the subsequent analysis, we have first corrected all the scores for the distortions caused by the transcription process using the method described in Scherbaum et al. (2024). Subsequently, Harmonygrams were calculated from the resulting ‘tuning-independent’

scores in scale-degree-index (SDI) notation. These were visually inspected to identify those subsets which contain highly similar or even identical chants, harmonized in (slightly) different ways. This resulted in three categories of reiterated chants in various formats:

1 • Same title, same lyrics, same music, same length:
Chants 1, 3, 4;
Chants 15, 18;
Chants 16, 19.

2 • Different titles, different lyrics, same music:
Chants 5, 6, 7;
Chants 8, 9, 10, 11[1];
Chants 12, 13;
Chants 14, 17, 29, 35*;
Chants 44, 112 ;
Chants 62, 69;
Chants 77, 80*;
Chants 115,116.

3 • Different titles, different lyrics, some common musical segments:
Chants 50, 71, 79;
Chants 52, 54;
Chants 73, 74;
Chants 101, 102-103, 104.

Discussion

In the context of our analysis it turned out that Harmonygrams proved to be a useful tool for the study of chord syntax in Georgian polyphony.

Why and how? They make it possible to effectively identify similarities and differences, in other words, to compare different harmonic structures *at different levels*, i.e. repertoires, pieces, and different versions of the same piece. This paves the way for *characterization*, *modeling,* and *transmission*. Let's take a closer look.

The *comparison* of certain types of chords present in different regions and/or repertoires (such as liturgical or popular) is essential for the *identification* and *characterization* of a musical repertoire and the pieces that make it up. This operation aims to reveal the relevant traits that these repertoires or pieces share.

[1] Has a different length than the other songs in this group.

What is music modeling?

In the present context, modeling a musical piece consists of reducing it to its essential structural elements. This is an all-embracing but simplified representation, with respect to which all variations are produced, and which summarizes all its characteristic features, *and only these.* Modeling thus allows us to apprehend the relations prevailing between the spontaneous production of a musical event and the idea it springs from.

Harmonic modeling

In the context of Georgian polyphony, harmonic modeling means reducing it to a series of chords that form *the supporting pillars of its architecture*. How can these chords be determined? By *comparing* different versions. In doing so, we find that many of the chords, *located in identical positions*, do not vary from one version to another. It is therefore reasonable to assume that these are the pillars.

The modeling proposed here is a two-step process:

a - the first consists in removing all chords whose duration is less than one beat. This takes care of a lot of ornamental features such as apoggiaturas, passing notes, embroideries, and escapes;

b - the second, to remove from the remaining chords those that lack one of the three pure intervals around which Georgian polyphony revolves - the fourth, fifth, and octave.

In addition,

- any repetition of two or more identical successive chords should be replaced by *a single one* for which the total duration is conserved.

This operation is necessary to preserve the temporal structure of the piece under consideration. As such, it is essential for its characterization.

Transmission

The purpose of transmission is to maintain the vitality of tradition, *within the framework of orality*. It therefore involves introducing younger generations to the practice of its polyphonic heritage – while still preserving a certain degree of freedom. The aim is not simply to be able to reproduce a piece of music as it is, but to lend a certain spontaneity to its performance, by means of variations improvised on the spot.

Variations on what? Precisely in relation to its model, i.e. the elaboration of possible melodic pathways that enable the performers to progress from one harmonic pillar to another. Conceiving transmission on the basis of models - and not as a simple “copy-paste” - could fundamentally change the way things are generally done today, and thereby maintain the vitality of the musical heritage.

Validation

In order to acquire legitimacy, a model has to be validated by its stakeholders. For this purpose, several procedures are conceivable. For example, the model could be auditioned

by listeners familiar with the repertoire from which it is derived. Its presentation could either be done by 3 experienced singers, or by any other sound source, provided that it is reliable in terms of pitch, temporality and timbre.

Outlook

In this study, we presented new tools, new perspectives, and some new results of our ongoing collaboration in studying the syntax of Georgian music based on musical scores. We are aware of the fact that the general problem is still largely unsolved. Against the backdrop of the current rapid development of research in the field of machine learning and artificial intelligence, we believe that ultimately this goal can only be reached with new and largely extended datasets.

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