A STUDY OF THE RHYTHMIC COMPLEXITY ON THE DIFFERENT TEMPO RANGES OF ARAB-ANDALUSIAN MUSIC

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ABSTRACT

This study provides insight into the rhythmic complexities present in Arab-Andalusian music and how they vary across different tempo ranges. By proposing a measure of complexity and applying it to a dataset of annotated scores, the author was able to identify the differences in the distribution of rhythm complexity between the different forms of the *nawba*. This approach could be extended to further analyze other aspects of Arab-Andalusian music or even applied to other musical traditions for comparative purposes. According to the results, the slower *muassaʿ* and *mahzūz* tempo ranges show higher levels of complexity while the fastest *inṣirāf* form also tends to be rhythmically simpler.

1. INTRODUCTION

This study analyzes the different tempo ranges in a *nawba* of the Arab-Andalusian music tradition in terms of their rhythmic complexities. The approach of the analysis consists in a simple beat retrieval from the .xml scores and classification according to the beat complexity using the music21 library in Python.

Studies have been carried out targeting analysis related to *ṭabʿ* [1] or the modes, and *mīzān* or the rhythm in a traditional *nawba*. Few has been researched in the field of computational ethnomusicology about the different tempo ranges in Arab-Andalusian *nawabāt*.

This study is focused on the rhythmic characteristics of the different forms in a *nawba*. It is expected for the slower tempo ranges to have more nuanced rhythmic patterns while the faster tempo ranges are expected to be composed of simpler rhythmic patterns.

2. ARAB ANDALUSIAN MUSIC

Arab-Andalusian music is the term given to the rich and diverse musical tradition that emerged during medieval times in Al-Andalus, the Islamic territories of the Iberian Peninsula. It resulted from the fusion of local musical traditions with the poetry and aesthetics of the Arab world from the Middle East and it has been preserved to this day as classical repertoire in several North African countries [2].

It is typically performed by a small ensemble of mixed choir and instrumentalists, including performers playing the oud (a fretless, pear-shaped instrument similar to the lute), kamanja (a kind of violin), qanún (zither), and percussion instruments such as the darbouka (a goblet-shaped drum) and the ṭaʿrīja (a type of tambourine) [3]. Some instruments from western traditions have been introduced into this ensemble, such as violin, viola, double bass and piano.

The traditional composition is the *nawba*, which is a suite of instrumental and vocal pieces arranged according to their metrical pattern in order of increasing tempo. All the pieces contained in one *nawba* share the same *ṭabʿ*, or mode, formed by an ascending and a descending scale without any microtones [1].

2.1 Tempo ranges

The *nawba* typically includes three main tempo ranges, performed in order of increasing tempo: *muassaʿ* (slow), *mahzūz* (medium) and *inṣirāf* (fast).

3. DATASET

The dataset used for this task is the Arab-Andalusian Music (AAM) dataset [4] from Music Technology Group in Barcelona. It contains 158 *nawba* scores in .xml format including metadata for the *nawbas*, lyrics and information about the sections that compose each of the scores.

For this paper five of these scores were analyzed.

Figure 1. Nawba sheet fragment example.

4. METHODOLOGY

To compare the complexity of the compositions targeting each of the tempo ranges a "complexity" measure is proposed.

To measure this complexity of each of the tempo ranges the Python library music21[5] was used. From the annotated scores only the *muassaʿ*, *mahzūz* and *inṣirāf* sections were taken and all notes contained in them were analyzed.

Considering the time signature of each of the sections (and changes in time signature inside the same section) three "complexity" levels were stablished:

- Level 0: notes starting on the beat.
- Level 1: notes starting any amount of 8th notes positions after the beat.
- Level 2: notes starting on a 16th note position.
- Level 3: notes starting on a 32nd note position or 16th note triplets.

The number of occurrences of each of the complexity levels for all the analyzed scores are noted and compared to the total number of notes as a percentage.

5. RESULTS

Using the previously mentioned method, the results shown in the following graphs were obtained.

For *muassaʿ* (results included on Figure 1 below), more than 50% of the notes were classified as a level 0 complexity, almost 40% of the notes fell on the level 1 and another 9% on level 2. The level 3 complexity (32nd note position or 16th note triplets) is negligible.
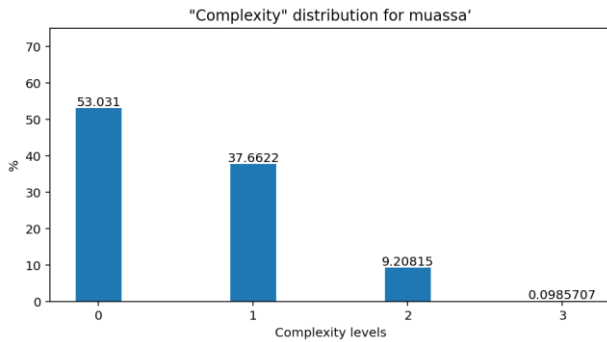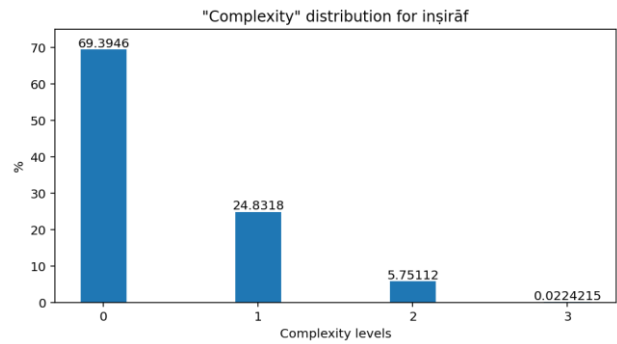

Figure 2. Complexity distribution for the *muassaʿ* form.

For *mahzūz* (results included on Figure 2 below), the results were surprisingly similar to *muassaʿ*. 53% of the notes were classified as a level 0 complexity, 38% of the notes were classified as level 1 and 8.8% as level 2. Again, the level 3 complexity notes percentage is negligible.
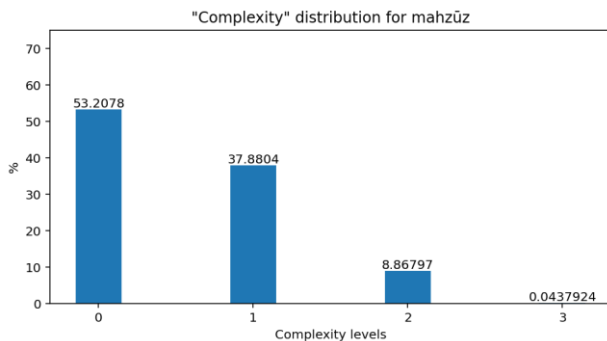
Figure 2. Complexity distribution for the *mahzūz* form.

For *inṣirāf* the results for the complexity distribution (included on Figure 3 below) are much different. Almost 70% of the notes in this tempo range sections were on beat (level 0 complexity); only 25% of them fell on complexity level 1 and close to 6% of the notes were classified as level 2.

Figure 3. Complexity distribution for the *inṣirāf* form.

It is very interesting how *muassaʿ* and *mahzūz* show almost identical complexity distribution while *inṣirāf* shows a distribution leaning much more towards simpler rhythms.

This make sense since *inṣirāf* is the fastest of the three tempo ranges but the analysis suggests that it is also the least complex in terms of rhythmic patterns.

6. CONCLUSION

The results of the study suggest that the different tempo ranges in a *nawba* present different levels of rhythmic complexity. Slower *muassaʿ* and *mahzūz* sections show higher complexity, while the faster *inṣirāf* section tends to be rhythmically simpler.

These results agree with the analysis of the sheet music that show that faster *inṣirāf* sections are often characterized by repetitive simple rhythmic patterns.

The proposed method for complexity measure provides a quantitative approach to analyzing the rhythmic complexities present in different tempo ranges and could be extended to analyze other aspects of Arab-Andalusian music or even be applied to other musical traditions.

The complexity measure could maybe be extended by considering not only the starting positions of the notes but also their duration.

One limitation of the study is the small sample size of the scores analyzed. A bigger sample size would provide a more comprehensive analysis and a better understanding of the complexity of the different tempo ranges.

7. REFERENCES

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