

Annotating Karnataka Music: Encounters Between a Musical Tradition and Computational Tools

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INTRODUCTION

Computational tools, such as automated motif-finding, have been designed for and used in musicological contexts. However, questions can be raised regarding the value and ethical implications of such computational approaches; can they contribute anything positive to the musical tradition being analyzed, and do they have the potential for causing harm? We take up such issues in the context of a specific case, the annotation of Karnataka music audio recordings for the development of motif-finding tools designed specifically for this South Indian music tradition.[2] From our perspectives as musicians and musicologists, we explore the processes involved, document issues that arose and make recommendations based on our experiences.

Although we draw on some music-theoretical sources in this paper, we deliberately adopt a performer-based perspective, founded on knowledge of how musicians learn and conceptualize the music. This is based on both authors' first-hand experience of learning the style and on one author's over twenty years of experience as a professional Karnataka musician, based in Chennai. Our wider concerns regard the social and cultural impact of the technologies to which we contribute and our approach is auto-ethnographic in that we reflect on the process of making the annotations, and more broadly on this encounter between Karnataka music concepts and the needs of Music Information Research (MIR).

The goal of the MIR task undertaken by researchers at Universitat Pompeu Fabra was to create computational tools to find motifs (short melodic phrases) in audio recordings.[3] In order to evaluate the results of this process they needed to be compared to a "ground truth", which in this case was a set of annotations made by an expert musician. Brindha Manickavasakan, a highly regarded professional Karnataka vocalist, created these annotations using ELAN annotation software (Lausberg and Sloetjes, 2009). During the course of this process, she had regular meetings to discuss issues arising with the other author of this paper, Lara Pearson, who has been collaborating with the Pompeu Fabra team since 2021. This paper is the outcome of these processes and discussions.

UNDERSTANDING KARNATAKA MUSIC CONCEPTS

We started the annotation process from the position that Karnataka music concepts should be central in the development of computational tools aimed towards the style, both for ethical reasons and for the tools to give meaningful results. Tradition-specific concepts need to be considered because there are features of Karnataka music that differ from styles that are more typically analyzed computationally, such as Western Art and Popular musics. For example, in Karnataka music, *svaras* (notes) are often performed with *gamakas* (ornamentation) that have a significant impact on the resulting musical sound, such as wide oscillations that don't rest on the *svara* pitch itself (Krishna and Ishwar, 2012; Pearson, 2016).[4] Furthermore, the concept of *svara* includes any *gamaka* performed on it, and so *svaras* are not like "notes", which are typically associated with a relatively static pitch. As *gamakas* are musically meaningful (*rāgas* with the same *svaras* can be differentiated based on the *gamakas* used) flattening out the *gamaka* curves during any transcription process would erase an important part of the musical meaning. For these reasons, the project at Pompeu Fabra starts from audio recordings rather than from simplified transcriptions, thereby taking into account both *svara* and *gamaka* combined into a unified whole, in line with understanding within the tradition (Viswanathan, 1977).

As the task “motif-finding” is framed using the English language musicological term “motif”, we first need to understand how this relates to Karnataka performance practice and structural concepts, the most relevant of which we discuss briefly below.

Melodic Structure in Karnataka Music

In Karnataka music, a *rāga* is a melodic framework that comprises phrases, formed from a limited number of *svaras* (notes) that often incorporate *gamakas* (ornamentation) (see Ramanathan, 2020 for a detailed explanation). All of these elements reside in the collective living knowledge of the *rāga*, as expressed both in compositions and more extemporized formats performed by musicians.

Phrase Concepts: *Piḍi*, *Sañcāra* and *Prayōga*

The term *piḍi* (“hold” or “catch” in Tamizh) or “characteristic phrase” generally refers to a phrase that points clearly to one particular *rāga*, and that would not be found in another (Ramanathan, 2020). *Sañcāra* (from the Sanskrit सञ्चर, meaning “to move”) refers to a coherent segment of melodic movement that follows the grammar of the *rāga*. Defined in this way, unlike a *piḍi*, a *sañcāra* may be found in more than one *rāga*. Therefore, although *piḍis* are also *sañcāras*, not all *sañcāras* are *piḍis*. The term *sañcāra* is similar to the meaning suggested by the English terms “phrase” or “motif”, but with the added requirement that it should conform to the grammar of at least one *rāga*.

Another commonly used term, *prayōga*, means “usage” or “practice”. A *gamaka prayōga*, for example, is an instance of *gamaka* usage. In the context of *rāga*, the term *prayōga* often refers to a phrase (i.e., an example of melodic usage) and so the terms *prayōga* and *sañcāra* are frequently used interchangeably.

For this project, as we aimed to annotate from a tradition-oriented perspective, we chose to use Karnataka concepts when defining the phrase type. We annotated *sañcāras* in order to include a larger number of phrases than would be covered by the concepts of *piḍi* or characteristic phrase.

ISSUES ARISING DURING ANNOTATION

During the annotation process, issues became apparent regarding segmentation, similarity and transcription.

Segmentation

Segmentation of the melodic flow into *sañcāras* was not always straightforward due to there sometimes being more than one plausible option. In such cases, we found that the *sāhitya* (lyrics) could influence decisions regarding *sañcāra* starting and ending points. Namely, there was a tendency to prefer segmentation points that did not split words (see Figure 1, <https://youtu.be/DzVRkvHROc8>).

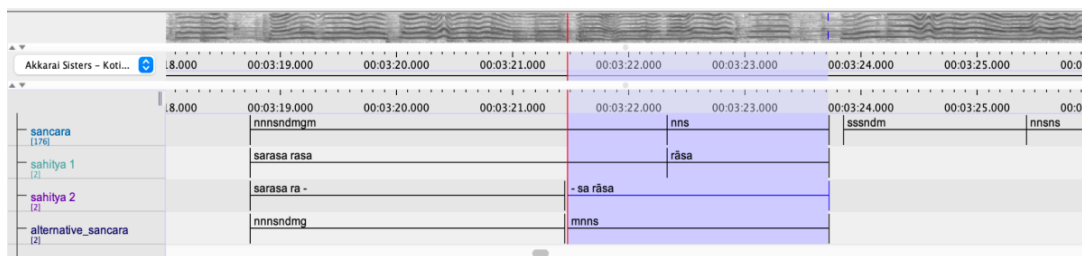


Fig. 1. Annotations in ELAN showing two possible segmentation points for the phrase “nnsndmgnns”: one that aligns with the word breaks in the *sāhitya* (lyrics) and the other that does not. Both work musically, but we noticed that the word breaks can influence the choice of segmentation point. The letters used here to transcribe phrases, such as “nnsndmgnns” are from the traditionally used *sargam* notation – a form of solmization in which *sa* can be placed at any pitch from which the *svaras* ascend as follows: *sa*, *ri*, *ga*, *ma*, *pa*, *dha*, and *ni*. The letters used for the annotations in this project comprise the first letter of each of these *svaras*, so the *sañcāra* in question is actually “*ni ni ni sa ni dha ma ga ma ni ni sa.*”

Furthermore, a given sañcāra may be part of a longer sañcāra. To take into account both the shorter and longer sañcāra we annotated two levels, namely “sañcāras” and “full phrases” (see Figure 2, <https://youtu.be/yLXUcoV7NYo>).

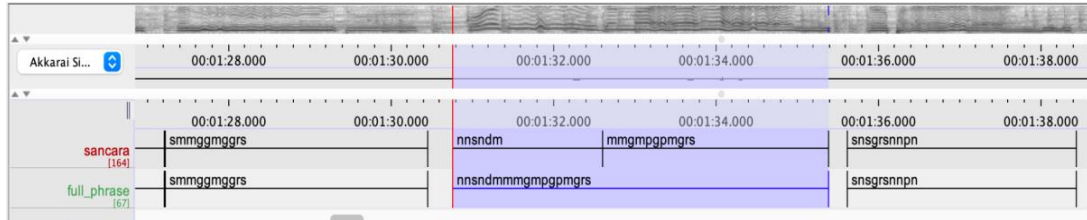


Fig. 2. Annotations in ELAN showing two hierarchical levels at which the melody could be segmented: a higher level of longer segments that we labeled “full-phrase” (often marked at either end by breaks in the vocal melody), and a lower level of shorter segments that we labeled as “sañcāra”.

Existing literature on music annotation has similarly noted that ambiguity regarding optimal segmentation points often leads to differences amongst annotators (Bruderer et al., 2009; Ren et al., 2018). Surveying this literature and based on our own experiences, our recommendation would be to accept that this ambiguity is part of musical experience and find ways to embrace it. Possible approaches suggested include employing multiple annotators and creating hierarchical and weighted annotations (Nieto, 2015; Mcfee et al., 2017; Tomašević et al., 2021). Instead of forcing the idea that there is only one set of correct segmentation points, metrics can be employed that take differences in segmentation points into account (Nieto, 2015; Mcfee et al., 2017; Nieto et al., 2020).

Similarity

In Karnataka compositions, it is frequently the case that some sañcāras are later repeated with elaborations that include additional svaras and gamakas. In order to connect later elaborations to the sañcāra’s first rendition, which is typically the simplest version, we also annotated “underlying sañcāra” and “underlying full phrase”. This enabled us to indicate similarity between sañcāras that are related but not precisely the same (see Figure 3, <https://youtu.be/58INU1eAQqU>).

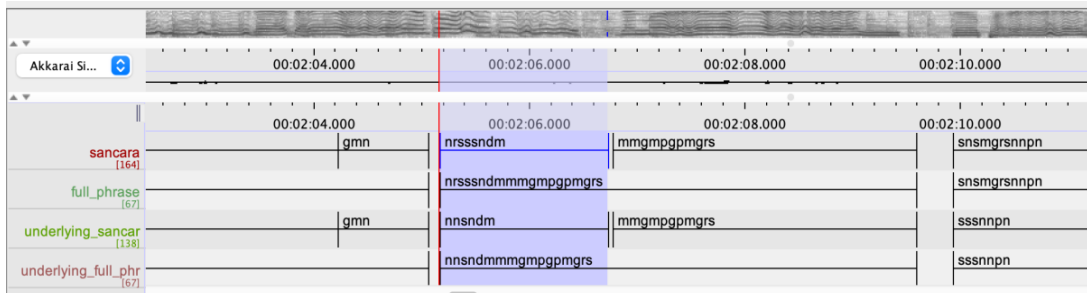


Fig. 3. Annotations in ELAN showing sañcāras, full phrases and the underlying versions of each, thus connecting elaborations on sañcāras back to the first, and typically simplest, rendition of that sañcāra.

Transcription

Transcription from audio into visual notation is notoriously subjective (England, 1964; Ellingson, 1992). Similarly, in Karnataka music there are often different, but still acceptable, ways to notate the same sañcāra (see: <https://youtu.be/K6Oyjnyptls>). Therefore, annotations by different musicians are likely to differ to some extent. Audio recordings can be transcribed with either more or less detail, and so decisions need to be made regarding the level of detail required (see: <https://youtu.be/APrYUspi1xI>).

RECOMMENDATIONS

In conclusion, we make four recommendations based on our experiences during this project, which combine ethical considerations with those relating to research relevance.

a) Understand and use practitioners' musical concepts

For both ethical reasons and to ensure that the research results are meaningful, it is important to create computational tools that take into account, rather than ignore or erase, musical concepts used by practitioners.

b) Clarity regarding the annotation process

In order to avoid misrepresenting the musical style, annotations should be based on concepts that are adequately described. This requires a thorough inquiry into the concepts, documentation of the definitions finally employed and the inclusion of such documentation together with the dataset. Proper documentation should help prevent misunderstandings and the propagation of errors in future research, which could be construed as harms to the tradition.

c) Incorporate naturally occurring ambiguity

Considering that musical segmentation, assessments of similarity, and transcription are all subjective to some degree, it would seem wise to accept this ambiguity and find ways to take it into account both in the annotation process and in the metrics used for evaluating results.

d) Create tools that contribute to the tradition

Computational tools should be designed to positively contribute to the tradition and to those who sustain the tradition through performing, teaching, audiencing and researching. Ideally, the tools created should be accessible to all. These should be genuinely usable by a wide range of musicians, listeners and musicologists, with opportunities for such individuals to provide feedback on the tools.

In these ways we increase the likelihood of creating and contributing to ethical computational tools that respect the tradition and are transparent regarding their assumptions.

NOTES

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[2] The full name for the style is Karnāṭaka Saṅgīta. It is also referred to as Karnataka music, Karnatak music and Carnatic music.

[3] See https://github.com/MTG/searching_for_sancaras

[4] In keeping with APA style guidelines, non-English terms in this paper are placed in italics on first mention, and then without italics on subsequent mentions.

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