

# Notre Oiseaux:

## A Computational Study of the Messiaen Birdsong Transcriptions of New Caledonia

Luke Poeppel

Undergraduate ('22), New York University

Research Assistant, Max Planck Institute for Empirical Aesthetics, Frankfurt, Germany  
(Computational Auditory Perception Group, PI: Dr. Nori Jacoby)



Fig. 1. Messiaen, at rest.

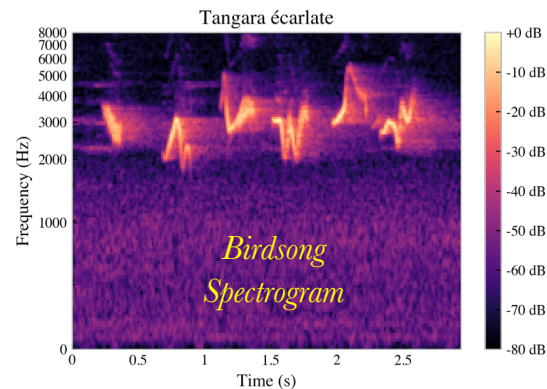


Fig. 2. A spectrogram of the Scarlet Tanager. Messiaen collected thousands of pages of birdsong transcriptions in his *Cahiers de notation des chants d'oiseaux* (*Birdsong notation notebooks*).

### Overview

- Carnatic and Greek rhythms are pervasive in Olivier Messiaen's (1908-1992) compositions.
- Some of these rhythms were **annotated** by Messiaen in his scores, others not. I propose an **algorithm for rhythmic annotation** that recreates his analyses with high accuracy.
- The model used reveals his compositional priorities.
- The study shows the influence of his *langage musical* on his 103 (purportedly naturalistic) transcriptions of New Caledonian birdsong.

## The Rhythmician

- Messiaen frequently integrated Greek and Carnatic rhythmic fragments into both his compositions and his transcriptions of birdsong. These rhythms include:
  - Greek Prosodic Feet (Iamb, Anapest, Bacchius, etc.)
  - The Deçī-Tālas: 130+ rhythms collected by Śārṅgadeva in the Saṅgītaratnākara (a 13<sup>th</sup>-century Sanskrit musicological treatise). See Fig 3.
- The presence of these rhythms in his works is known from *rhythmic annotations*: the textual indication of a fragment's appearance, as given in compositions themselves and in theoretical writings (*Technique* 1944; *Traité* 1994). See Fig. 4.
- How can we understand Messiaen's use of these rhythmic corpora in works that are *un-annotated*? Are there undiscovered patterns, consistencies, or fragments?

luke.poeppl@gmail.com

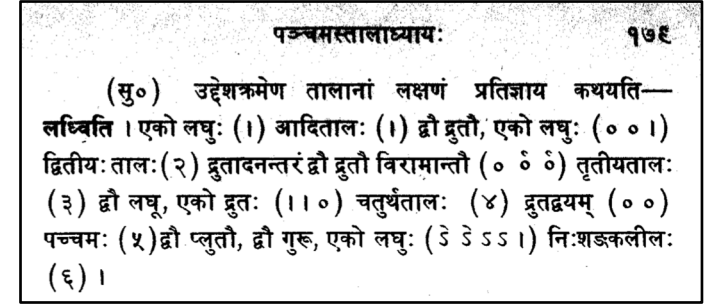


Fig. 3. Sudhākara's commentary on the first deçī-tālas introduced in the Saṅgītaratnākara.

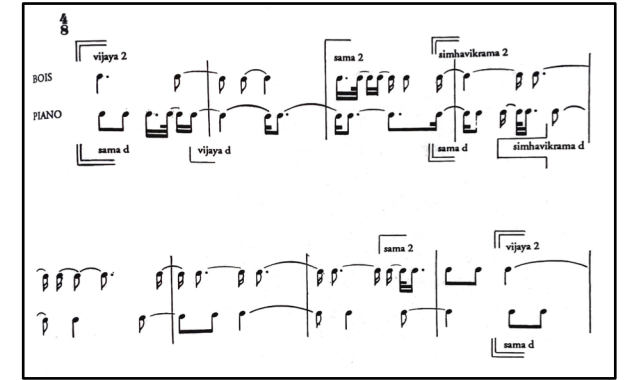


Fig. 4. Messiaen's rhythmic annotation of Sept Haikai (1952) in the *Traité*.

# An Algorithm for Annotational Reconstruction

- I treat Messiaen’s collected rhythmic annotations as a form of training data from which to glean structure. (Understanding these annotations is complicated by his frequent altering of the corpus fragments before use.)
- Algorithm outline:
  - Provide an input score (**A**). Generate and store a large number of modifications of the corpus fragments (**B**).
  - Exhaustively extract all fragments from a score using a brute-force search algorithm. (**C**)
  - Apply a path-finding algorithm—the Dijkstra algorithm—to the detected fragments with a cost function optimized by the ‘training data’ (**D-E**).
  - The optimal path is a fully annotated version of (**A**): (**F**).
- Accuracy:
  - 100% (136/136) for 5 annotated compositions.
  - 77% (200/261) for 45 partially-annotated transcriptions.
- A Python implementation is available at: <https://github.com/Luke-Poepfel/decitala/tree/master/decitala>
- Complete method details in manuscript under review (available upon request).

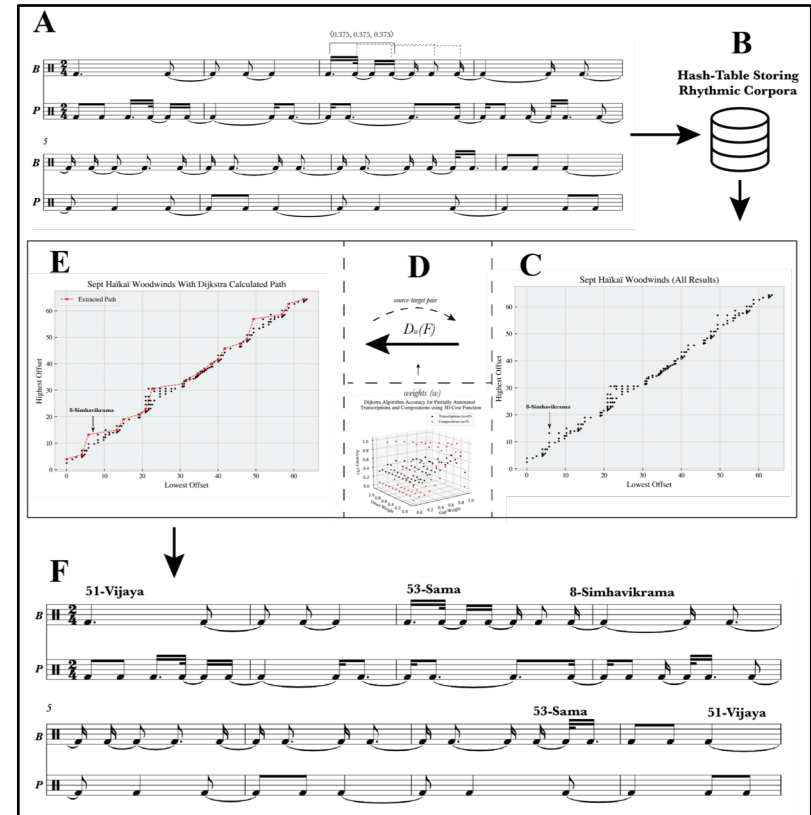


Fig. 5. Outline of the proposed algorithm.

## Results (1/2)

- The algorithm demonstrates that transcriptions from two New Caledonian species presented in the *Traité* make ample use of Carnatic Fragments.
- Le Coucou à éventail (N.C. Ex-60). See Fig. 6.
  - Uses the deçi-tâla 54-Nandana.
    - Messiaen describes this fragment as follows: “This tâla is based on the number 5, the number of fingers on the hand. This hand is the greatest toy for the child, and it is from it that he will gain conscience of the numbers” (*Traité*, Vol. I, 287).
  - Uses a Mode of Limited Transposition.
    - “It will be noticed that Messiaen’s bird restricts itself to what is uncommonly like the 2nd mode of limited transposition— a phenomenon of which the nightingale is hardly likely to be aware” (Hold 1971, 119).
- Le Cagou huppé (N.C. Ex-52). See Fig. 7.
  - Uses deçi-tâlas including 6-Nihçankalila (closely related to 33-Turanggalila, one of his favorite tâlas), 104-Candatala, and 55-B-Manthika.
  - Common sequence is Greek + Carnatic + Greek.

Le Coucou à éventail (Ex. 60)

Olivier Messiaen

Fig. 6. Transcription of the fan-tailed cuckoo.

Le Cagou huppé (Ex. 52)

Olivier Messiaen

Modéré

Fig. 7. Transcription of the crested Cagou.

## Results (2/2)

- This computational approach allows us to investigate broad claims from the literature about the Messiaen birdsongs that would otherwise be extremely difficult to address (due to the size of the rhythmic corpora.)
- Contour
  - Question (Wai-Ling Cheong, 2008): Is there a relationship between Greek fragments and contour, more specifically neumes?
  - Answer: One finds consistent CASs (Contour Adjacency Series; Friedman 1985) in instances of fragments on an intra-species level, as well as examples of *intervallic stretching* across the iterations. See Fig. 8.
- Syllabic Repetition
  - Question: Birds sing syllables (short vocalizations of 50-300ms) repeatedly. How does Messiaen capture this repetition, e.g., how many times are syllables repeated?
  - Answer: Despite Messiaen writing in his *Traité* that birds sing in “incant[atory]” collections of three, we find a varied distribution of repetition lengths, including collections of length 6, and even 21. See Fig. 9.

luke.poeppl@gmail.com

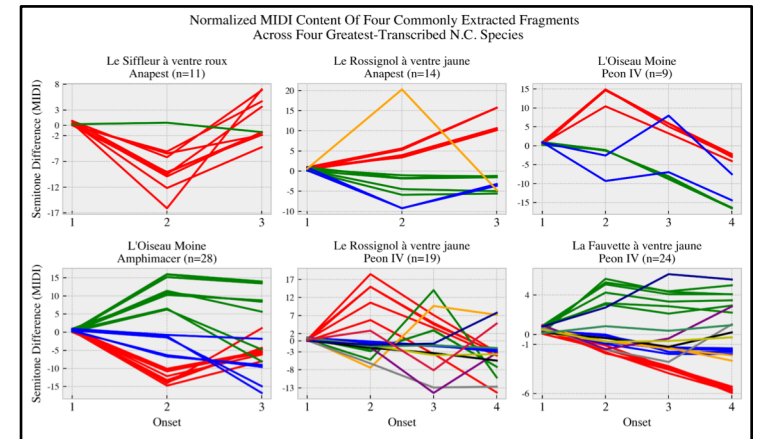


Fig. 8. CAS contours (normalized pitch content) for instances of different Greek rhythms across species.

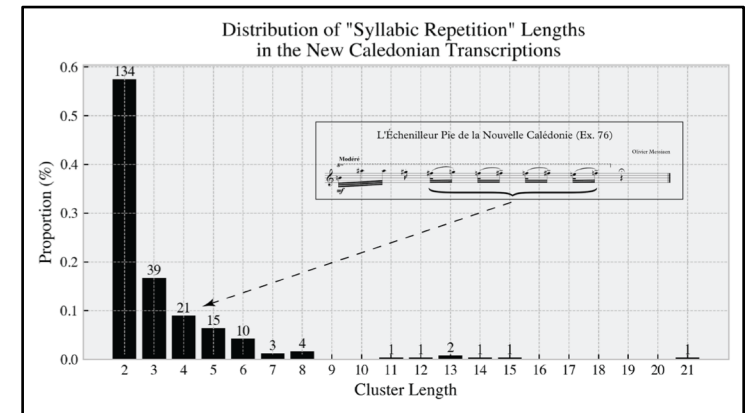


Fig. 9. Distribution of the length (i.e. count) of syllabic repetitions in the New Caledonian transcriptions.