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A Revaluation of Learning Practices in Indian Classical Music Using Technological Tools

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A REVALUATION OF LEARNING PRACTICES IN INDIAN CLASSICAL MUSIC USING TECHNOLOGICAL TOOLS

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ABSTRACT

Each *khyāl* performance of Indian classical music is unique and unreproducible because it is mainly based on improvisation. As for most orally transmitted musical repertoires, learning practices are essential as they guarantee that the musical codes are properly reproduced from one generation to another. In Indian classical music, practice, tightly imbricated in the pupil – teacher relation, favors clearly the imitation. Students tend to reproduce more or less successfully their master's style. That's why in order to be creative, it is necessary that each musician develops his own skills of understanding, experimentation and invention.

Today, technological tools have considerably transformed our way of learning. From now on, it is possible to have access to considerable data for the understanding of traditional music, and to listen, record and analyse them via numerous audio softwares. Indeed, works by visualization allows reporting know-how common to all these musics (fingering, musical process, improvisation, patterns…). Through various softwares and practice examples from Rajam's dynasty (hindustani violinist players), hindustani violin lessons and *rāg* performances, we will present a "toolbox" useful for all musicians and musicologist to improve their self-study.

If the pedagogy and teaching can give us comprehension keys, the apprenticeship, such as it is practiced in North India and in the long master to pupil's tradition, favors clearly the imitation at the expanse of the assimilation. The pupil learns above all by imitation and by impregnation, without taking the time to understand or to write.
He learns to know a number of ingredients, but does not inevitably learn how to use it. In this way, the pupil tends inexorably to reproduce with varying degrees of acuteness the master's style. His space of creativity is extremely reduced even non-existent. The musician will feel difficulties finding his own style. For that purpose, it is necessary to him to be able to stand back, to be able to experiment, invent and understand.

The technological tools really transformed our way of learning in our daily practice. So the analysis via a number of IT data and software allows to understand and to learn musical processes, specific ornamentations, rarely taught. In addition, it is possible to question the relationship between what is taught by the master and what is produced on stage. Through the comparison of different performances, different performers and different learning lessons, one can clearly dissociates the stored material from the improvised material, i.e. the fixed components from the modular elements. This current work aims to study this question, focusing on different *rāg* according to the vocal tradition of *khyāl* within the Rajam's Dynasty, violinist descendants.

In this communication, we investigate the possibility of using modern computer-based technologies as a teaching assistance system for Indian classical music. Due to its improvisation nature, a comparative approach is necessary to analyse it. For example, by comparing recordings between Hindustani violin lessons at the Hubli-Gurukul (India, August 2010-2012) and Hindustani *rāg* performances, it is possible to show up the way(s) Rajam Dynasty musicians transform the structural and structuring[1] elements of a *rāg*. At a larger scale of analysis, by multiplying the interpreters on a same *rāg*, we could quantitatively compare their different improvisation strategies, and better understanding the fundamental elements of a *rāg* that need to be properly taught to every musician.

1. LINKS BETWEEN PERFORMANCES AND APPRENTICESHIP

We notice that it exists a correlation between Rajam's lessons (Gangubai *Gurukul*, Hubli, India, August 2010-2012) and musical performances. Indeed, we can observe that a number of formulas, that Julien Debove learned in Gangubai *Gurukul,* are repeated in the musical performances. It means that during the performance, the musicians dig into his memory bank and add it formulas transposed from another *rāg* or improvised formulas.
As we can observe on the figure 1, the cycle is structured in the following way :
- establishment of a formula -red oval-
- suite of variations -oval yellow if it is played by one musician and orange rectangle if it is played by two different musicians-
- resolution on C medium -fuchsia rectangle- and chorus[2] -light pink rectangle-.
The chorus serves as a link from one cycle to another.

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[1] The structuring elements are useful elements for the continuity of the structure. These elements are generally signals allowing the passage from a subsection to another or from one part to another. The structural elements are the elements forming part of the structure.
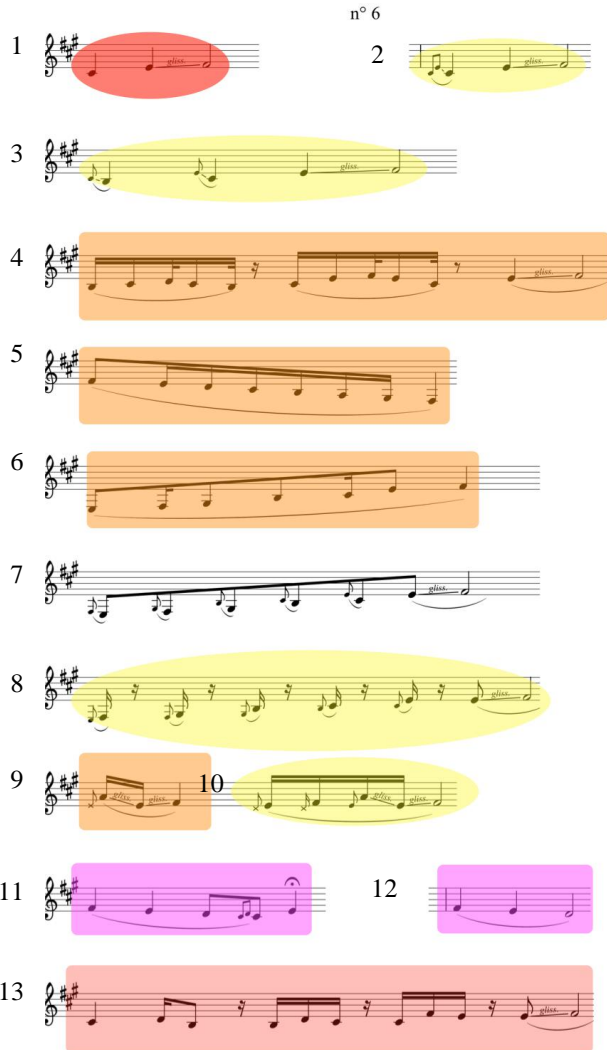[2] Sometimes, the chorus can be substitute by a melodic phrase repeated three times (*tihāī*).

Figure 1. Scores of the 6th rhytmic cycle of *vilambit ektāl* (slow 12 beat cycle), *rāg* Yaman, N. Rajam lessons, August 2013 realized with ianalyse.

	Introductive formula		Variation play - by one musician
	Conclusive formula		
	Chorus		- by two musicians
Musicians	N. Rajam, 2012	R. Shankar, 04/06/13	J. Debove 08/16/13
Formulas & variations	1,5,6,9	1,2,4,7,11,13	1,3,4,5,6,9, 10,11,12,13

2. TYPE OF IMPROVISATION AND SOUND REPRESENTATIONS

2.1 Thematic variations

If learning topics are strictly teached from master to student, during the performance, some rhytmic and timespan variations can be made. Thus, we perceive a slight difference in thenotion of composition, that can be used to talk about music of oral transmission or western music. The difference lies mainly in the medium used:
· external memory for music written
· internal memory for music of oral transmission.
Indeed, when we use the term composition to describe melodies laid down by oral transmission from individuals to individuals, internal memory to internal memory, whatever audio message's quality of memorization or assimilation, we can not imagine that the audio message will be transmitted from one generation to another without a slight modification, even if the references to earlier records can avoid excessive transformation.

So we can perceive within the various examples below duration or rhythmic's variations within theme's modules (transmitted orally in a strictest way).

Figure 2. *Vilambit Ektāl* (slow 12 beat cycle), theme, *rāg* Yaman, N. Rajam, 2012, Hubli

Figure 3. *Vilambit Ektāl* (slow 12 beat cycle), theme, *rāg* Yaman, Ragini Shankar, 04/06/13, Lille

Thematic modules	
Chorus	

2.2 Structural improvisation

As underlined by Nettl (1974), we consider a musical repertoire, composed or improvised, as the realization of a system. One of the approaches to describe such a system is to divide it into theoretical component units. These units are, so to speak, blocks of construction accumulated by tradition and of which the musicians (within the tradition) make use, by choosing, combining, recombining and rearranging them. These blocks of construction are, even in a single directory, of various types.

This type of improvisation is seen in action in North Indian classical music. So, in the *drut tintāl* (fast cycle of 16 beat), whatever performances, we find in each performance the same ingredients placed in a certain order and transposed according to the *rāg*. We notice also some fundamental processes of development defined by Widdess (2006) as melodic expansion & rhythmic intensification.

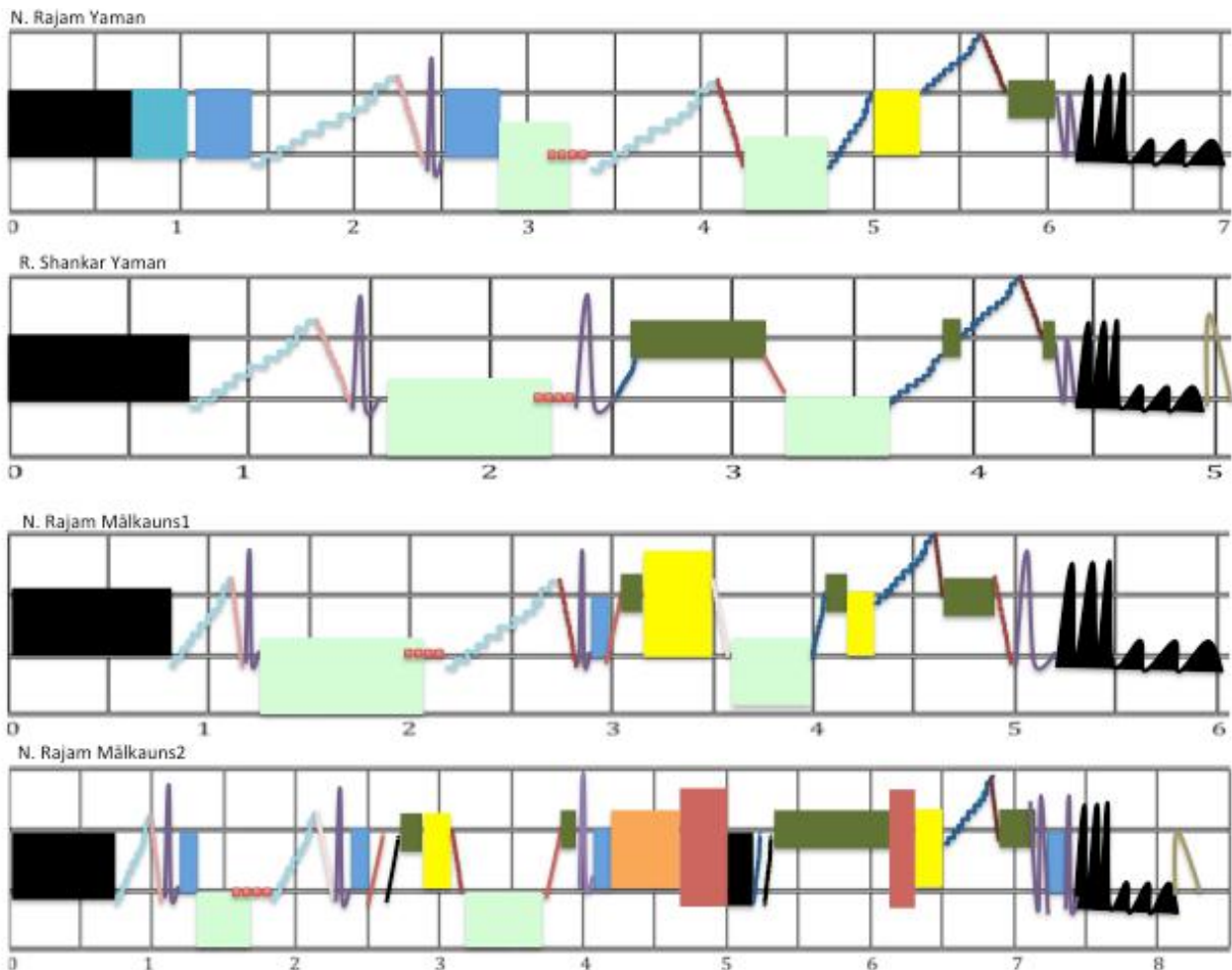|			
Progressiv ascent		Specific bowing	
Trembling ascent		Changing octave	
Specific descent		Simple and complex *Tān*	
High *Alāp*		High rhythmic variation	
Theme		Musical phrases repeted three times (*tihāī*)	
First part of the theme			
Thematic variations		Low rhythmic variation	
Suite of *tān*[3]		Inflexion	

Figure 4. Structural evolution of *drut tintāl* (fast 16 beat cycle), *rāg* Mālkauns & Yaman (with Excel).

2.3 Melodic variations

Combined together, Sonic visualizer[4] and Acousmographe[5] can build genuine listening guides, associating music

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playback, sound visualization and precise and fine analysis of various extract. They allow to perceive melodic inflections difficult to hear, to highlight the notes and ornamentation and understand the overall shape of the different musical passages.

The only drawback is that the implementation of these tools requires a lot of time and work because all additions (image, text, scope, notes, ornaments) are done manually.
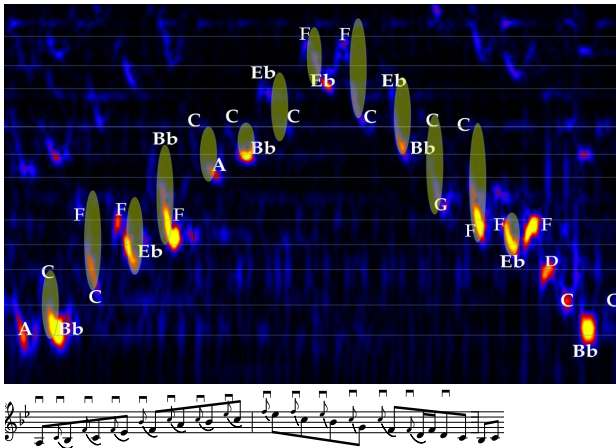

Figure 5. N. Rajam, fast melodic line, *rāg* Bāgeśrī Kānadā, 1991

Here, we perceive thanks to the visualization and annotation, the particular fingering of a fast melodic line feature. If they are played frequently with ornamentations from the bottom upward, in this case, it is inverted, what gives a particular effect.
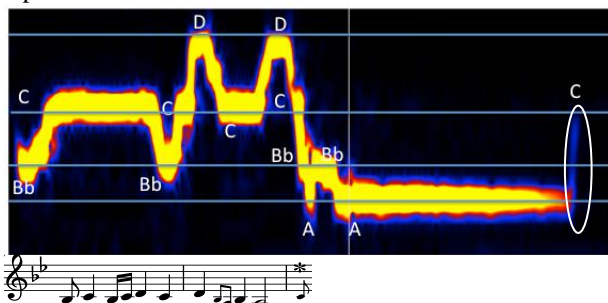

Figure 6. H. Chaurasia, improvised introduction (*ālāp*), *rāg* Bāgeśrī, 1994

In this example, it is possible to perceive an inflection of an almost inaudible sound upward played at the beginning or at the end of musical sentences

3. COMPREHENSION & THEORIZATION

3.1 Monika[6] & Carnet de Notes
(**http://carnetdenotes.paris-sorbonne.fr/**
So, it is possible to perceive some inflections of an almost inaudible sound upward played at the beginning or at the end of musical sentences

For the needs of intelligent practice respectful of traditions, it is advisable to set out fixed recordings[7] and diverse analyses to allow, by the empirical practice, access to many data. From file XML, the Monika software allows to do numerous statistics that are very useful for musical analysis (as for example, upper or lower melodic peaks, number of occurrences of each note, intervals most used, internal finales[8] etc.).

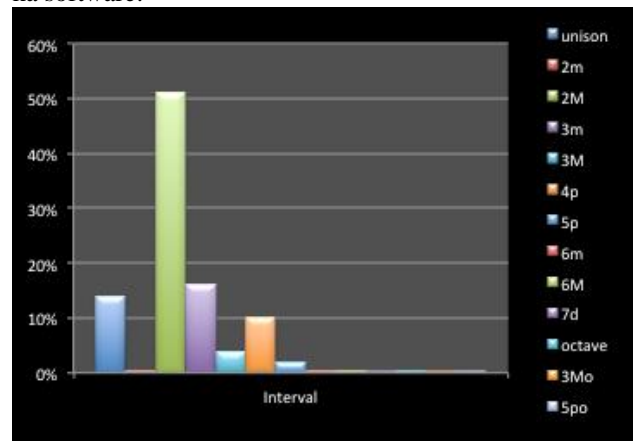Here are some of these diagrams drafted thanks to Monika software:

Figure 7. H. Chaurasia, *rāg* Mālkauns, interval, *Live in Stuttgart,* 1988
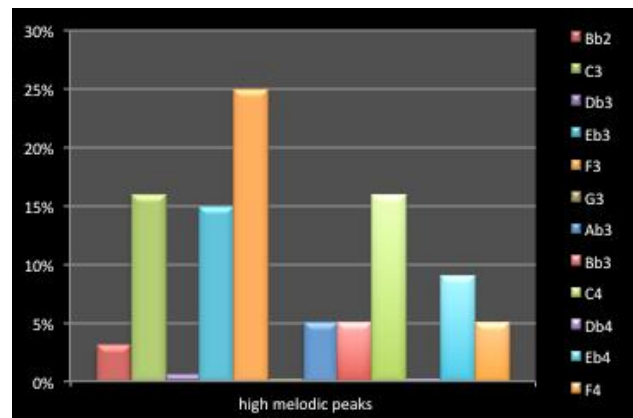

Figure 8. H. Chaurasia, *rāg* Mālkauns, high melodic peaks, *Live in Stuttgart,* 1988

The first diagram allows to show clearly the linearity of the musical way because the intervals superior to the fifth are almost non-existent. Furthermore, the musical way is mainly made by joint intervals. In a practical way, the analysis of the superior melodic peaks is very important for understanding the hierarchical organization of notes. So, F, although it is not strongly present in the *rāg* Mālkauns, is an important melodic pole because notes go there. All these data are in free access on the site "Carnet de notes".

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[6] Monika is a software of description of monodies drafted in VBA for Excel. Developed by N. Méeus, professor at the University Paris Sorbonne

[7] These recordings are obviously a version among many others and don't represent models. It is thus that by the depth and comparative analysis we can have a minimum of objectivity.

[8] Monika software considers internal finals in its widest release. These are the notes preceding silence.

3.2 Musical strategy on rajam's style in *ālāp*

Melodic analysis of various *ālāp*[9] via a synoptic view can distinguish different melodic phases and better understand the way of improvising (see figure 9). By listing all internal finales in order chronological the first time when they appear (defined here as notes finishing a melodic sentence of a duration upper at three seconds) as well as the set of the internal finales on C, it is possible to distinguish four essentials phases. (symbolized by the grey sinusoidal curve).

These phases correspond to the various possibilities which offer themselves to the musician. None of these phases is compulsory, but the phases 1 and 2, 3 and 4 are consecutive (Gorakh Kalyān, Māru Bihāg, Mālkauns, Jog 1 & Bāgeśrī).

We also notice that the musicians can play solely phases 3 and 4 (Yaman & Jayjayvantī) or 1 and 2 (Jog 2 et Bāgeśrī Kānadā) or none of these phases when the *ālāp* is very short (Desī) by stressing only the tonic (C).

3.3 OpenMusic[10]

New technological tools like OpenMusic allow us to create musical processes modeling. So I have create a fast melodic line of synthesis. (see figure 10)

It consists of groups of 4 ratings whose first note is accentuated (represented by the sub-patch "segmentation 4") groups of 3 notes that the first note is accentuated (represented by the sub-patch "segmentation 3") , groups of 2 ratings whose 1st note is accentuated (represented by the sub-patch "segmentation 2").

These modules are played consecutively. Notes within these modules are played randomly, but linearly. *Tān* begins with an onset formula and ends with fixed phrases repeted three times (*tihāī*) on the right side of the diagram. The scale of the *tān* is fixed on the left side of the diagram. Each time the object is revalued, music notation and music changes.

What is very interesting is that it corresponds perfectly to a *tān* as could play musicians in the performance.

4. PERSPECTIVES TOWARDS AUTOMATIC MUSIC TRANSCRIPTION

In this paper, we presented the use of audio software for the analysis of improvisation styles in Indian classical music. These software could be more efficient by implementing new methods from automatic music transcription (AMT). However, despite a large enthusiasm for AMT challenges, and several audio-to-MIDI converters available commercially, perfect polyphonic AMT systems are out of reach of today's algorithms. This lecture will be started from our previous works (Cazau et al., 2013 ; Cazau et al., 2015) to present

a new multichannel capturing sensory systems of traditional acoustic plucked string instruments, including the following traditional African zithers: the marovany zither (Madagascar), the Mvet lute (Cameroon), the N'Goni harp (Mali). These systems use multiple string-dependent sensors to retrieve discriminatingly some physical features of their vibrations. For the AMT task, such a system has an obvious advantage in this application, as it allows breaking down a polyphonic musical signal into the sum of monophonic signals respective to each string. The development of this technology has already allowed the constitution of a new sound dataset dedicated to AMT evaluation for plucked-string instrument repertoires, used in Cazau et al. (2015), and including audio recordings, MIDI-like transcripts and sound samples over the instrument pitch ranges. This technology is very convenient to develop extensive sound corpus for repertoires without written supports, including orally transmitted repertoires, as well as improvisation.

5. REFERENCES

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[9] Slow intoduction where we discover the *rāg* and all its features. *Ālāp* also refers by extension slow improvised melodic phrases.

[10] OpenMusic (OM), developed by IRCAM Music representation research group (Paris) is a visual programming language based on Lisp. Visual programs are created by assembling and connecting icons representing functions and data structures.
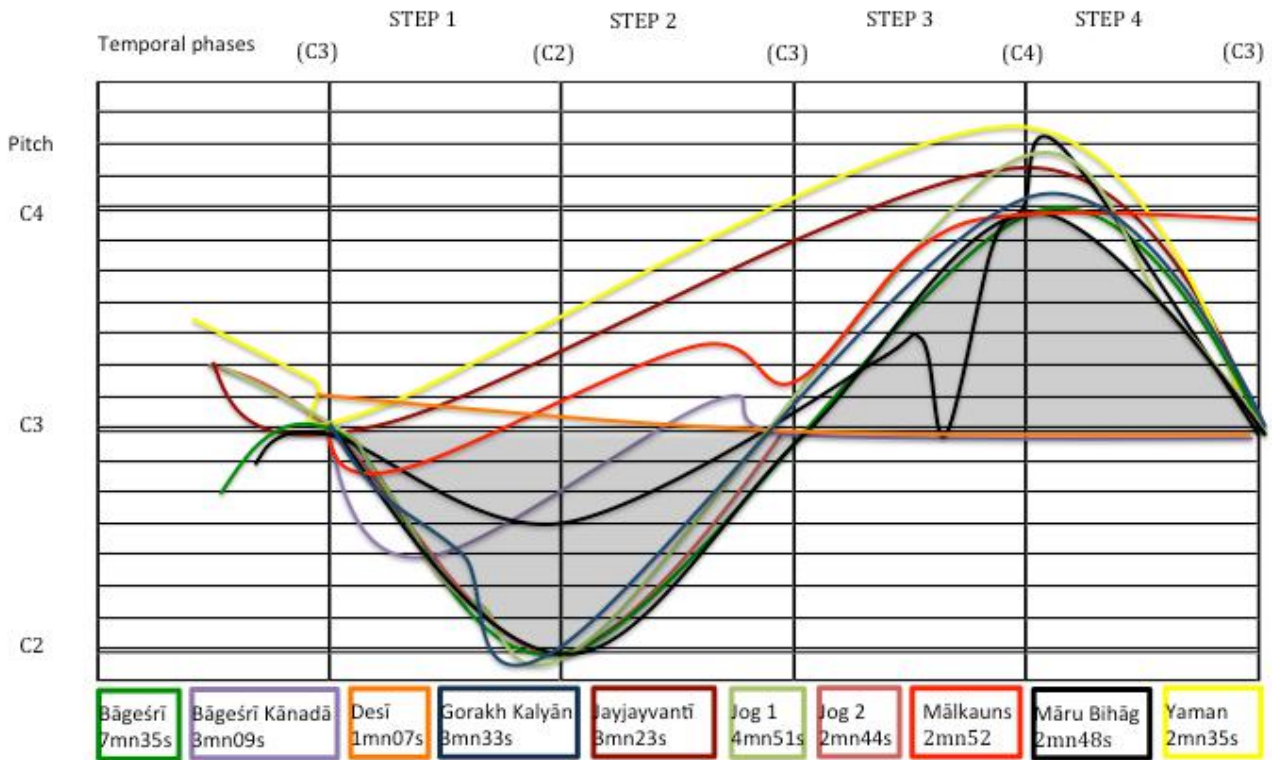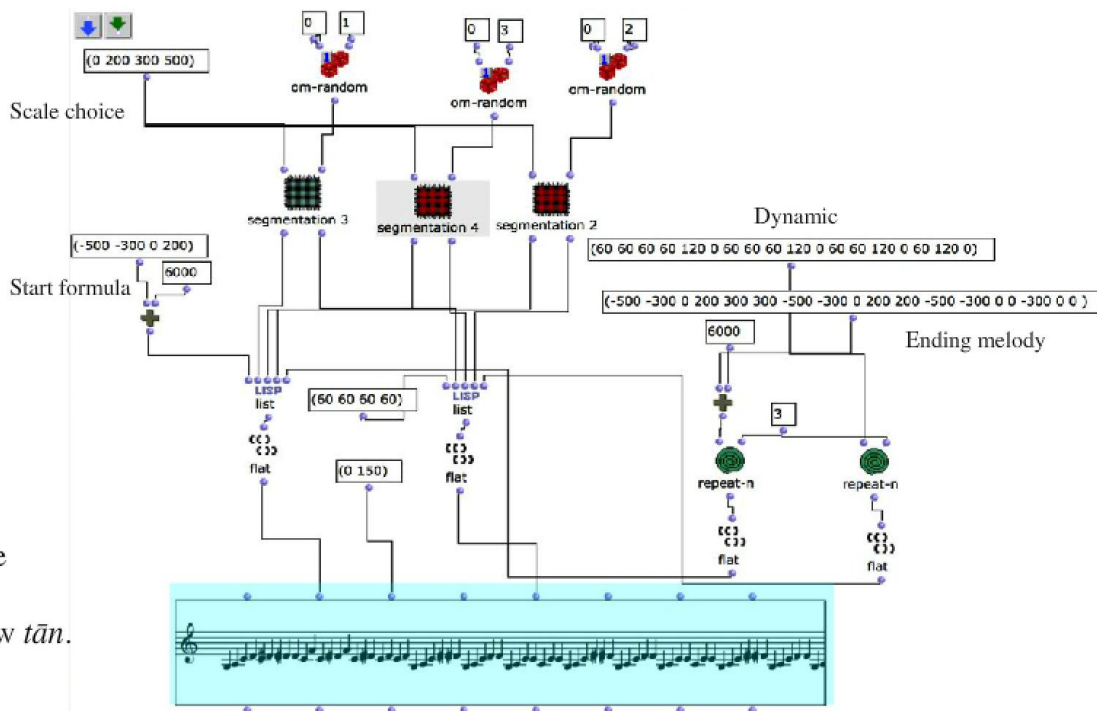
Figure 9. Melodic ways of *ālāp*, N. Rajam & R. Shankar

Figure 10. Creation of a synthesis « *tān* »