

Virtual Labs for Learning, Curating, and Research in Hindustani Classical Music

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This document a proposal for a Virtual Lab for Music. This is a web-based application to provide anybody who is interested in Hindustani music a broad and comprehensive resource containing live experiments to test and hone their abilities; repositories to refer to and obtain material from; and all this in a way that enhances a multi-modal web experience across many domains within music. In this document, we describe the motivation behind setting up such a lab, the model of integrating experiments, repositories and semantic connections as a complete way of setting up a learning experience that will benefit not just learners of Hindustani Classical Music (hereafter referred to as HCM), but also will function as a resource for other applications such as computation and cognition of music.

Introduction

This report deals with building an on-line learning resource and repository for Hindustani Music. Although there have been some attempts to include musical material on the web, we highlight some ways in which these fall short and propose some new methods to bring up a single resource including experimentation and learning, repositories, and semantic linking. We also explain some implications of this on the field of musical research as a whole.

Changing Modes of Pedagogy in HCM

Hindustani Music traditionally evolved as an art form requiring years and years of guided practise. In ancient times, students of classical music would spend several years with their teachers studying under their scrutinized guidance and slowly absorbing the intricate nuances of the musical performance from the guru.¹ Artists were often patronized by princely states and kings and taught students in this system called the *gurukul* system. This started to change towards the end of the 19th century when music reform and education were taken up as a cause by several conferences of music and scholarly musicians of the time.² At the time of reform of Indian universities, musical education paradigms changed drastically and musical education was restructured to fit the bounds of a degree education. This meant that the years that could be spent on slowly cultivating musicality and other skills needed to be condensed in a much shorter span. The pedagogical methods changed and the restructuring of courses around study material was a huge challenge of the times. As

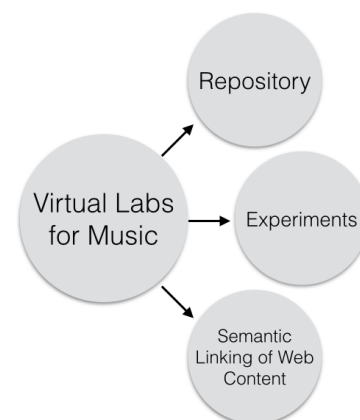


Figure 1: Sections in the Virtual Labs

¹ Daniel M Neuman. *The life of music in North India: The organization of an artistic tradition*. University of Chicago Press, 1990

² Lakshmi Subramanian. *New mansions for music: Performance, pedagogy and criticism*. Berghahn Books, 2008

the twentieth century progressed, both these modes of learning - the traditional way and also the way of classes and tuitions - grew side by side.

Twenty First Century

After several changes in musical education, we now have come to the time when musical content isn't learnt continuously by being around music, but in shorter lessons, which are sometimes conducted with multiple students learning together. Lessons are usually structured to be once in a week, and the students are expected to prepare a lot of material by themselves with un-aided, unaccompanied practise. This means that several critical skills, that earlier were absorbed by students by being around music a lot, are expected to be naturally developed by them either as time passes or through their own practice. This calls for students being able to arrange for their own practise without the presence of other musicians. To support this, several modern electronic instruments have been invented as replacements for accompaniment in the last twenty years, aiding musical practise greatly. Electronic Tanpura, Tabla, Lehra and Shruti box are now commonly seen not just in practise settings but also on the performing stage. Despite this being true, the methods of learning musicological concepts haven't been truly exploited through electronic and computer methods. Having said this, there is no parallel development in music learning applications for students of Hindustani Music.

Notation and Musicianship at odd angles

V N Bhatkhande developed a comprehensive scheme for notation of classical music in the early 1900s.³ His contemporary, V D Paluskar developed a parallel style of notation which is slightly similar to Bhatkhande's. Since then, there have been several notation systems that extend these and bring out more nuances. Bhatkhande's system remains to be the most popular one and is widely used. This has changed musical study greatly. It is now common practise now for students to write the new compositions they have been taught. Composing new structures on paper first is also exceedingly common. However, there haven't been comprehensive and accessible repositories of such music that are available to everyone. Resource books that contain western notations of HCM have also been produced for reference and learning.⁴⁵ Most of this music is written so long ago that it is sung simultaneously in different ways across several *gharanas* and several different composers at the same time, and all of these renditions and years of practise have lent their own modifications

³ Vishnu Narayan Bhatkhande. *Hindustani sangeet paddhati*, volume 1. 1990

⁴ Walter Kauffman. *The ragas of hindustani music*. Nimbus Records with Rotterdam Conservatory of Music, 1999

⁵ Suvarnalata Rao, Joep Bor, Wim van der Meer, and Jane Harvey. *The raga guide: a survey of 74 hindustani ragas*. Nimbus Records with Rotterdam Conservatory of Music, 1999

to those compositions.⁶ New students of music often learn to compose their own music by writing down, in this form of notation, their own drafts of improvisation and so forth. Several scholars dismiss notation and writing down, saying that Hindustani Music is meant to be assimilated and never written down. Despite this insistence, it is important to acknowledge the social changes that have led to a changing lifestyle for musicians and music learners, who devote time and resource towards the study of music a lot differently than what they had been doing.

Given this background, it is only natural for the development of musicianship to train for these singular skills with drills that are suitable to the constraints of time that they have.

On-line Repositories

Resources for other genres There is a great deal of resource material available on the web for several genres of music, including Western Classical⁷, Jazz and Folk⁸. These include resources and websites that help practice ear training skills, or provide repositories for compositions from different time periods, databases of lyrics of various arias, right up to recognising the versions of different compositions and publications of musical material. Sadly, this isn't true for Hindustani music.

Web music resources for Hindustani and Carnatic music Currently, the resources on the web for Hindustani music are scattered and disorganised⁹. Descriptions of ragas and performances or performers have been blogged about¹⁰. Youtube videos of different performances form a sizeable chunk of the material available for listeners. The material is often poorly annotated. Other sites keep information only available behind a pay-wall¹¹. There is a need for organising and inter-linking existing material so that Hindustani music along with annotations, commentaries and other related content are made more openly and widely accessible. There is also a need to create repositories for listeners so that they can self-learn to listen to classical music and appreciate the nuances of this style.

Cultivation of Musicianship skills

Critical musicianship abilities are a prerequisite for becoming a learned singer in HCM. These include the ability to identify notes and note names from hearing music. A musician is expected to be able to identify and notate rhythm, to be able to work with laya, to be able to be a good presenter and so forth. All proficient performers

⁶ Nazir Ali Jairazbhoy. *The rāgs of North Indian music: their structure and evolution*. Popular Prakashan, 1995

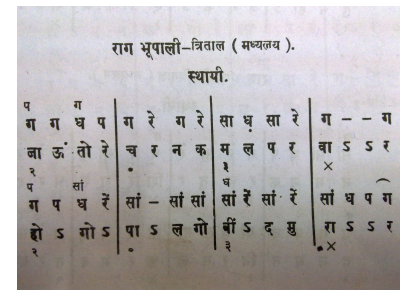


Figure 2: Sections in the Virtual Labs

⁷ Crowdsourced. *Petrucchi Music Library*. 2014. URL <http://imslp.org/>

⁸ Smithsonian Institution. *Smithsonian Folkways*. 2014. URL <http://www.folkways.si.edu/>

⁹ ITC-SRA. *ITC Sangeet Research Academy*. 2014. URL <http://www.itcsra.org/>; and W van der Meer and S Rao. *Music in Motion*. 2014. URL <http://autrimncpa.wordpress.com/>

¹⁰ Rajan Parrikar. *Rajan Parrikar Music Archive*. 2014. URL <http://www.parrikar.org/>; and Deepak Raja. *Deepak Raja's World of Hindustani Music*. 2014. URL <http://swaratala.blogspot.in/>

¹¹ Swarganga. *Swarganga Music Resource*. 2014. URL <http://www.swarganga.org/>

are expected to be comfortable with these skills, although there is no systematic method to cultivate them. Skills like swara identification and being able to notate and identify musical patterns, although required, is a hard skill to develop on your own. For vocalists who don't play an instrument, for instrumentalists who don't sing or aren't required to notate, this task is challenging. Without guidance, through pure listening, these skills take years to come to grips with *Swar-Jnyan* (Knowledge of pitch). Another area that is typically required and often very hard to develop is the proper knowledge of intonation. Hindustani Music uses microtonal scales, and something as simple as tuning a *Tanpura* requires immense expertise and very finely developed ears. It typically takes students years to master this if they are taught. If they are never taught these skills, which happens many a times in tuition-class like model of teaching Hindustani music, these skills remain undeveloped. This challenge is faced by several new students who study music using new methods such as reading from texts, learning with teachers over the internet and so forth. These abilities need to be developed and taught in new way.

Propositions for Novel Methods to introduce musical material

We propose a drill-based practice approach towards learning these critical skills of musicality. Ours is a tripartite approach towards archiving, learning and distribution of classical music. This includes both musicians and non-musicians being able to experiment with music in all capacities. The experiments will enable musicians to be able to engage with experiments to hone their musical skills as well as understand finer and finer nuances of musical listening.

Power of Drilling Battery of tests and a system adapting to the ability level of the student is what is needed in such a case, for teaching these specific skills to students.

Computational and Cognitive Aspects of HCM

Computational research in musical creation and cognition have become established fields for study of music in pedagogy, therapy and for its cognitive effects. This approach towards the study of music is becoming popular even for Hindustani music, and has tremendous applications for use in pedagogical, and educational contexts. The forms and function of music beyond its aesthetic value, its contribution to other cognitive systems such as visuo-spatial abilities, language learning potential and so on. Systematic studies regarding Hindustani music could become easier after systematizing the

methodology for musical categories, and ease in recording and analysing the performance of a general population in different music-related abilities. Research work with regards to these various aspects of cognition and computation could be carried out easily through such a lab. Some examples are: understanding the generation of mood of *rasa* or *raga* becoming alive, pedagogical methods to enhance learning and practice, generative structures of *raga* and so on and so forth. It would also be an important task in this project to generate a formal ontology of Hindustani music which would make it easy to understand not only the structures of music, but also meta-tag and retrieve more data from the new musical uploads that are generated.

Research in pedagogy Learning Hindustani music on the internet is a recent phenomenon. With the help of technology, we can enable a student to access guided practice, simulate drilling and give feedback about intonation, provide analysis for practice etc. There is also the scope for learning patterns from large data which can be mapped to student performance for further analysis and feedback. This might help us understand the actual context of musical learning and how it can be best adjusted to help most people learn seamlessly.

Three Fold Approach Structure

A 3-Fold Approach to Musical Learning The objective of this lab would be to provide material in the following ways:

1. Content Aggregation

This would involve creating a repository for notated classical music. This would include renotating openly available material on classical music, and putting up old material that is still used as a reference and sung - online. Some of this material could also be crowdsourced. Stylistic instruction and para-musical features would also be enumerated.

2. Experimenting with musical Concepts

This section would include experiments that visitors can perform to experiment with musical ideas and enhance their knowledge and understanding of classical music.

1. Listener perspective

The appreciation of any musical genre is greatly enhanced by understanding. In this section there would be experiments to increase the understanding of musical form, notes, moods, and so on. This may be in the form of discrimination tasks, identification or memory tasks for small musical samples. The visitors would

also be allowed to change some variables and experiment with the musical form.

2. Student perspective

For a student or a prospective performer, it is important to experiment with different concepts of composition. Creating a grammatical phrase in a raag, then an aesthetically pleasing phrase, and then recombination of phrases in an aesthetic manner - these are some examples of critical practice that a student has to undergo while studying music. We will create some experiments to enable users perform such practice easily through this lab.

3. Annotation and re-narration of web content

As mentioned above, the current state of the content is in the form of youtube videos, annotations on blogs and so on. When music is written down in the blogs and talked about, it is very hard for an uninitiated listener to understand the nuanced language of describing music. Here we plan to use a framework for re-narration and annotation of musical content from other sources such as links to other pages, audio re-narrations, explanations in simpler language and so on. This would make the experience of the web for music truly multi-modal and rich.

Deliverables

The following will be the deliverables for this project:

- Experiment Portal

This portal will contain a complete list of experiments in two sections:

 - Music Learning Experiments

These experiments will be designed for teaching students of music some elements of musicianship and providing them with drills for learning.
 - Music Appreciation Experiments

These experiments will teach the users how to appreciate musical nuances and what to look for in HCM.
- Repository

This section will contain resource material for popular khyals in HCM, notated. It will also contain the following:

 - Repository of Khyals
 - Raga-Net: A graph visualization of Concepts, Ragas, Gharanas, Artists and so forth in HCM

- Links between
- Behavioral and Cognitive Science Experiments for Music
 - Analyzing data from demographic - Musical abilities of music learners
 - Vocalization and native language - How do vocal habits and articulation of the mother tongue language affect and change the singing voice
- Linked Resources

Timelines

Version 1	Contents
Experiment Portal	All Pitch-Related Experiments
Repository	Database
Ontology	Semantic ontology consisting of raga distances and definitions

Table 1: Version 1. Release date: October 30

After obtaining feedback from the users of this portal, the experiments will be updated

Version 2	Contents
Experiment Portal	All Rhythm and Instrument Experiments
Repository	Crowdsourcing khyal documents
Ontology	Visualization of Raga Ontology
	Queriable ontology create

Table 2: Version 2. Release date: January 30

Version 3	Contents
Experiment Portal	Raga and Khyal relation related experiments
Repository	Releasing bandish databases from collected repositories
Ontology	Mapping contemporary compositions to ontologies

Table 3: Version 3. Release date: March 30

Version 4	Contents
Experiment Portal	Gamification of All Experiments
Repository	Provide a searchable database of bandishes Collecting private Bandishes from people
Ontology	User Privileges to add content from other sources

Table 4: Version 4. Release date: May 30

*Budget and Resources**HR*

Item	Cost (L/y)	No.	Total
MS Student	3.5	1	3.5
Engineer	4.5	1	4.5
Research Asst (S/W)	1.5	1	1.5
Total			9.5

Equipment

Equipment	
Field Recorder	.20
Mic	0.05
Mixer	0.15
Mac Laptop	0.80
Total	1.2

Consumables

Server hosting	0.20
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Travel

Visits to Music Colleges and Museums	1
National Conference	0.5
International Conference	3
Total	4.5

Total

	9.5
	1.2
	0.2
	4.5
Total	15.4
@0.15 contingency	2.31
Total	17.71

Conclusions

There is thus an immense potential to channel the information in Hindustani music into a computer based resource for education, deepening cognitive understanding of music, as well as developing web architecture that supports the multimodal requirements of musical material.

The lab will support drills in musicianship, fitting into the ever changing pedagogical practises of Hindustani Music. A repository that will also enable computational experiments in extending the bounds of experimentation in Hindustani Classical Music.

This will be the broadest attempt of its kind to fit the missing pieces together, and will serve as a massive source of information.

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W van der Meer and S Rao. *Music in Motion*. 2014. URL <http://autrimncpa.wordpress.com/>.

Appendix - Description of Some Concepts Mentioned

Sample Set of Experiments

Expt 1 Pitch discrimination This experiment will focus on students being able to distinguish between two pitches that are played consecutively. The students will only to answer whether the two pitches played are the same or different.

Expt 2 Pitch Direction This subsequent experiment focuses on being able to identify the direction of difference of the given pitches. After the student is comfortable telling two tones apart, this experiment will help them understand whether the subsequent tone is lower or higher than the first.

Expt 2.5 What are notes? This experiment will explain the concept of notes and octaves. Students will learn to identify octaves and figure out how notes played in a row sound. Different instruments can be used to elaborate this. For vocalists, this may include clicking on the names of svaras / intervals and then listening to them. Students will also be able to play notes as scales with note names to familiarize with the concept of naming notes.

Before we move to interval identification, this experiment is a free exploration of musical hearing.

- 1. Free exploration with instrument and note names
- 2. Free exploration hearing different scales and note sequences

Expt 3 Pitch identification from same tonic Here we start to move to interval hearing and tone training.

Before being able to train the ear for identifying pitches, this simple experiment will help students distinguish between

1. Levels

- (a) Level 1: Sa, Ma, Pa
- (b) Level 2: + Ga, Ni
- (c) Level 3: + Re, Dha
- (d) Level 4: All Shuddha Notes
- (e) Level 5: + Re Dha Komal
- (f) Level 6: + Ga Ni Komal
- (g) Level 7: + Tivra Ma
- (h) Level 8: All notes

2. Number of Questions

Expt 4 Pitch identification from separate tonic While the tanpura is playing in another key, a different reference note will be given to judge another pitch interval from.

This experiment is to build hearing independence outside the tonic, as may be required in some forms of light classical singing.

Expt 5 Identifying a chain of pitches In this experiment, the experimenter will have to name the notes in a row of pitches in a single tonic. This experiment will develop the knowledge of 'svar-sthan' in the users.

1. Levels

2. Number of Questions per level

6 Tabla Simulation The goal of this experiment is to simulate a tabla skin on a computer, and choose and handshape, and simulate the sounds that a tabla makes if it is struck at different points.

Understanding tabla bols also requires an understanding of how it is played on the skin membrane. This experiment will help people who don't have access to tablas to explore the instrument in detail.

1. Hearing bol and location of playing
2. Composing new taals

Expt 7 Khali and Taali This experiment is to explain the polarity between these two events in Taal. The rhythmic and motional feeling of a downbeat and an upbeat will be explained. Participants will get to freely explore and listen to tabla sounds, and figure out the presence of khali and tali in the taals.

1. Analyzing khali and taali in visual form
2. Building larger metrical structures for khali and tali
3. Splitting These structures into different laya combinations - aad, kuaad, bayaad

8 Singing and melograph plotting Dynamic capture of musical voice and generation of melographs dynamically with

Melographs are a visual representation of the sung music. This experiment will help people familiarize themselves with a visual scheme to understand music. This scheme will be taken forwards

1. Matching own melograph with template melographs
2. Difference measure for melographs

Sample Research Questions

- Musical Proficiency in General Population
There are no real numbers to determine the musical proficiency of a general population. Often, the tests undertaken fail to get contextualized to an ethno-cultural demographic. This portal will enable us to create a space to easily experiment with the data on musical proficiency through the tests built on it.
- Pedagogical Research on Repetitive Learning
What is the best method of teaching somebody to listen to nuances of music? Through this portal, we can try various styles of teaching and see how they perform on an average for a general population.
- Musical Absorption and Rasa Theory
Experiments can be built to check the involvement of musical listeners and musicians in the emotional content as described in the Rasa theory, and to better map it to ragas, raga times and so on.