

SPECTROMORPHOLOGICAL NOTATION: EXPLORING THE USES OF TIMBRAL VISUALIZATION IN ETHNOMUSICOLOGICAL WORKS

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ABSTRACT

Ethnomusicologists often face problem in precisely describing characteristic of a sound recorded in the fieldwork. Written explanation normally use metaphoric words to represent the timbral characteristics of a sound produced by ethnic musical instruments. But to what extent will the reader understand and perceive the sound based on the writer's explanation? This study will explore the possibilities of using timbral visualization in the recognize of Malaysian traditional musical instruments. We introduce an instrument recognition process in solo recordings of a set of Malay traditional instruments (*gedombak*), which yields a high recognition rate. A large sound profile is used in order to encompass the different sound characteristic of each instrument and evaluate the generalization abilities of the recognition process.

INTRODUCTION

Ethnomusicology is a field of music which dealing with any musical activities and perspectives related to the specific music in a certain ethnic group. One of the perspectives of the study in this field is the organology of traditional instruments, and an evaluation of the sound produced by the instrument. Researchers who study in this field will normally describe in details about the sound and music performed with any particular instrument in a community.

Qualitative data gathered or recorded during the fieldwork is often be presented in scholarly printed publications in descriptive way. Researchers will try to describe the characteristic of a sound and try to make the reader to understand the sound without listens to the recording materials. Often the readers misunderstood the sound and perceive it differently from what the

researcher mean. In short, the sound which is described in writing maybe perceived differently from the actual sound that the readers listen to. This project is a part of a larger research project (Spectromorphological notation: Notating the UnNotatable) exploring the creation of possible models of timbral notation. Using spectrograms allowing specific quantitative information of the timbre of traditional Malaysian instruments, relating them to the instruments organology has not been undertaken.

PROBLEM STATEMENT

For the past few decades, many ethnomusicologists had been trying to precisely describe the sound of any musical activities in many different ways. Some of them describe the sound of music in narrative way while some of them giving some meaning and using metaphor or other type of sound representation to describe the characteristic of a sound. Being as an ethnomusicologist, I also face difficulty in describing a sound of music from my fieldworks. The sound that I describe based on my understanding maybe perceived differently by other people. How could I overcome this situation? Spectrogram have been used to objectively describe the organology of instruments of other culture but not in Malaysia.

In the field of ethnomusicology, we, the researchers are normally describing a sound base on what we perceive or using a local terminology to describe a particular sound. Most of the indigenous musical instruments are not constructed to any standard pic. Generally, almost all the ethnic musical instruments have different timbre and pitches. For example, in the *Kompang* (frame drum) ensemble of the Malay people, the sound of the *kompang* depends on the tautness and thickness of a skinhead as well as the size of the instrument. However, the *kompang* is also need to be tuned to the "*Bunyi yang diterima*" (acceptable sound) before it being played. A *kompang* ensemble normally consists of 15 to 25 players who performed on the similar instrument in interlocking rhythmic patterns to celebrate joyful occasions in the Malay community.

All the kompangs used in an ensemble is tuned to a certain pitch as closest possible from one to another. Even though there is no standard tuning set for the kompang, but an experienced kompang player is able to tell the “acceptable sound” of a kompang. The “acceptable sound” of a kompang to the players is described as (*kuat*) loud, (*gemersik*) penetrating, (*tajam*) sharp and (*tegang*) taut. How can one precisely understand and perceive the sound of a kompang as loud, penetrating, sharp and taut? Can one precisely describe the sharpness sound of the kompang? As the sound of any indigenous musical instruments are mostly not standardize in nature, there is a need to find ways on how to identify and recognize the “acceptable sound” of any particular musical instruments especially for the beginners and who are not expert in that field.

Moreover, contemporary Western arts and traditional music notation is usually linked to an analysis and the semiotic representation of the musical elements of melody and harmony (vertical and horizontal pitches) using common music notation. Precise pitch indications are “rounded out” into the twelve semitones of this system, unable to accommodate more the precise subtleties of sound that are inherent in all music tradition. Further, Musical parameters such as articulation (attack, decay, sustain and release) and dynamics (volume or intensity) are loosely indicated through the use of staccato or phrase markings for articulations or dynamic marks (*forte*, *piano*, *crescendo*, *diminuendo*, etc.).

Representation of other significant musical elements such as tone and colour (*timbre*) are largely limited to instrumental naming or specific performance directions (*sul ponticello* – play near the bridge for string instruments). The lack, along with the difficulties of definition and understanding of *timbre* are increasingly recognized within both new music and traditional music fields.

AIMS OF RESEARCH

This project will explore the creation of a model for the timbral and performance notation of acoustic music that notates more content details of the various elements of sound. Of significance for ethnomusicologists who working in this field, will be the use of spectrographic notation leading to the creation of an authentic and precise transcription library and catalogue inclusive of all musical elements. Such a catalogue will lead to a greater understanding of the individual and unique spectral and tuning characteristics of traditional Malay musical instruments. This method will be applied to instruments such as kompang, gedombak, gendang, serunai, and rebab. Knowledge and experience of creating spectrograms of the Malay traditional instruments

will then be applied into forefront of music making using these possible model and system.

RESEARCH QUESTIONS

In exploring the possibilities of using the spectrographic features in ethnomusicological study, there are many related questions can be addressed.

- i. How can an ethnomusicologist describe the sound of a musical instrument?
- ii. What are the elements that ethnomusicologists require from a notation system and how can these be represented?
- iii. What kind of notational/transcription system can possibly describe precisely the musical sound of traditional instrument?
- iv. What organological elements are common or exclusive to each instrument and how can they best be identified and analyzed?
- v. Can spectrographic analysis and software be used to provide a method for defining and identifying unique qualities of Malay traditional Instruments?
- vi. Can this information be used to describe and notate the specific individuality of sounds materials and performance methods in ways that expand the range and musical vocabulary of the ethnomusicologist?
- vii. What parameters of analysis can be defined to provide useful and universally understood symbols using spectrographic software?
- viii. How can this notational system help scholars, musicians, instrument makers and others in identifying a prefer *timbre* for any particular Malay traditional instrument?
- ix. What other knowledge can be drawn from this?

METHODOLOGY

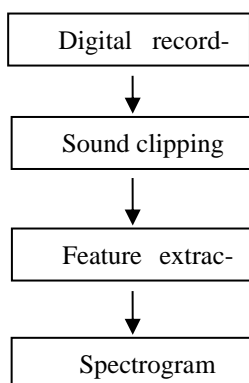
In conducting this study, various methods will be utilized in getting the useful data and information to answer the research question. Generally, methods will be grounded in practice. While exploring all the possibilities of using spectrographic as a tool to describe the characteristic of a sound, researchers will analyze and think through practice. This method is also always referred as practice-led research. Three phases will cumulatively document, analyze, apply and reflect on project activities and outcomes. Critical reflection is a

key criterion of the research, supported by textual analysis.

Research activities include identifying the sound characteristic of a few selected Malay traditional musical instruments such as *gedombak* (goblet drum), *gendang* (cylindrical drum), *kompang* (frame drum), *serunai* (double-reed oboe type instrument), and *rebab* (spike-fiddle). Each of them will be performed by the expert players for the recording purpose. A few software packages will be utilized to visualize the sound characteristic of each instrument. From the spectrograms, the researchers will then think on how it can be applied in ethnomusicological works.

THE RESULT

Many samples of Malay traditional instrument sound have been recorded in the form of wave file. The instruments include the *gedombak*, *gendang*, *serunai*, *geduk* and *gong* have been performed by the expert players both solo and ensemble for the recording purpose. Three software packages – Eanalyse, Sonic Visualiser and Praat- have been utilized to visualize the recorded clips.



A series of recording done on the instrument demonstrated that the underlying phonetic representation of an unknown utterance can be recovered almost entirely from a visual examination of the spectrogram. The most common format is a graph with two geometric dimensions: the horizontal axis represents time; as we move right along the x-axis we shift forward in time, traversing one spectrum after another, the vertical axis is frequency and the colors represent the most important acoustic peaks for a given time frame, with red representing the highest energies, then in decreasing order of importance, orange, yellow, green, cyan, blue, and magenta, with gray areas having even less energy and white areas below a threshold decibel level.

Figure 1 shows the spectrogram of a *gedombak* beaten in a series of single tapping in the middle of the skinhead. What can we learn from this spectrogram ?

After receiving clarification from the expert player, the 4th beat of the sound is the most preferred sound by the expert player. One can analyze from the colours and density of the spectrogram to tell the characteristic of the preferred sound.

Different filters have been applied to the one recording of the *gedombak*. The results show different features of the sound performed on the same instrument. Below are the example of different spectrograms show different features and characteristic of a sound performed on Malay traditional instrument.

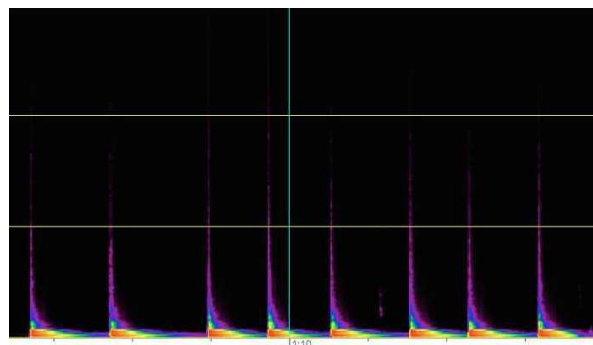


Figure 1. Spectrogram of a gedombak

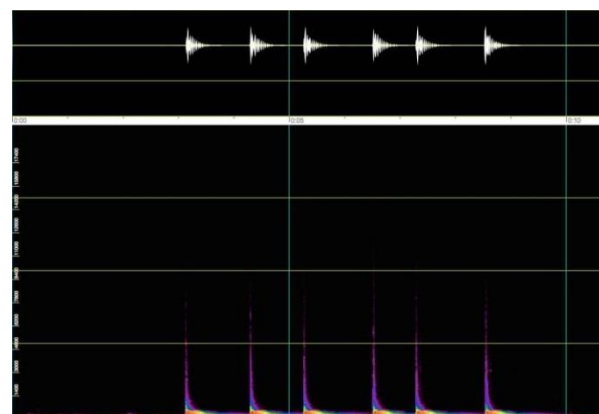


Figure 2. Spectrogram of a Gedombak with waveform.

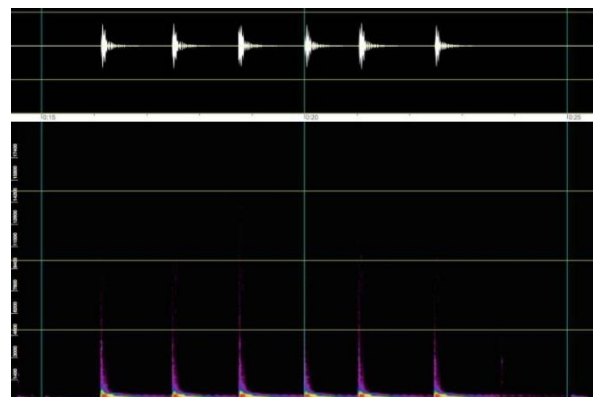


Figure 3. Spectrogram of a smaller size of Gedombak.

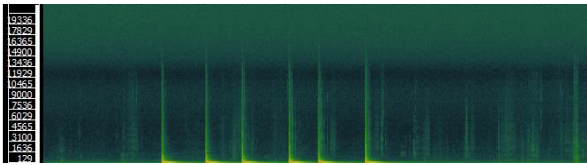


Figure 4. Zoom in Spectrogram of a Gedombak

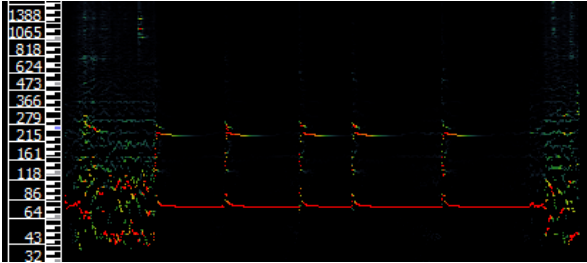


Figure 5. Spectrogram of a Wayang Kulit ensemble

DISCUSSION AND SUGGESTION

The spectrograms of gedombak (goblet drum) in Wayang Kulit ensemble (Shadow puppet play) above are an initial attempt to explore the potential of a spectrogram as a performative notation. The gedombak is indicated as the large regularly spaced columns of Figure 4. In Figure 5, the horizontal lines represent the melodic lines of the serunai. The pitch variations and arabesque ornamentation so characteristic of the instrument is also visible. This begins to plan to use spectrograms of individual instruments to identify preferred timbral quality of instruments for use in specific musical/dramatic contexts—why a Wayang Kulit ‘master’ selects one instrument over another in a given performance ?

Just what is timbral notation - gestural, purely tonal, semiotic etc. ? This opens the potential for different forms and styles. In the ethnomusicological context - instrumental profiling of timbre, linked to the organology of the instrument is both applicable in Malaysia and opens ideas that appear to inform ideas and practices in the other sub-projects of the overall research project.

CONCLUSION

In this paper, we dealt with recognition of sound samples and presented several methods to improve recognition results. Tones are extracted from a database of Malaysian traditional musical instruments (gedombak, gendang, serunai, etc.). We use two different parameters in the analysis. From the experiments, we could observe evident results for spectrogram and autocorrelation. Maximum and minimum values of amplitude for autocorrelation for all musical instruments have different ranges. Spectrogram of gedombak is much larger than those of gendang and serunai. Result shows that the

estimation of spectrogram and autocorrelation reflects more effectively the difference in musical instrument.

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