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Reviewing the Recording Quality of a Local String Instrument (Sape) from the Perspective of Sound Preservation

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Abstract

Although technologies have rapidly advanced in the modern world, musicians and music scholars rarely understand new technologies and hence cannot comprehend the impact of recording technologies on their careers. Recordings of ethnic instruments that are available in the marketplace today show various types of timbre determined by different sampling rates, choice of microphone placements and acoustic environment. In many cases, the timbre produced in recordings of one ethnic instrument called sape is highly diversified. Music recordings available for ethnic instruments such as the sape of the Orang Ulu, Kenyah and other ethnic groups were manipulated either through the sound of the instrument itself or through the original recording that was extracted from various recording mediums, or recorded in a "mock-up" context created by producers. The effects of all these manipulations have misled listeners into thinking that what they are hearing are the original sounds of instruments such as sape. This situation is similar to a live performance. Many audience members are unaware that the final acoustic outcome for the audience is not only the sound produced by the instrument but also through the main speaker monitors of a performance venue. Local folk music instruments such as sape are traditionally played in a rural and/or communal setting with its unique sound environment. This contextual sound environment however tends to be ignored in the sound reinforcement of live performances as well as in audio recordings. All of the above affects the quality of audio recordings. The intention of this article is to compare, analyse and review the quality of audio recordings of sape from various perspectives, including wave analysis and audio signal audibility. This article suggests for a more advanced sound preservation approach through a constructed scheme for recordings.

Keywords audio analysis, contextual sound, field recording, microphones, sape, sound preservation

INTRODUCTION

Local folk music instruments such as sape are traditionally played in a rural and/or communal setting with its unique sound environment. This contextual sound environment however tends to be ignored in the sound reinforcement of live performances as well as in audio recordings. Even "plug and play" is not a solution in bringing contextual sounds from the village into recordings of a compact disc or to live performance settings. Although the demands of live performances change the contextual sound of sape, issues still arise as to the best ways sounds can be produced during live performances. Concerns about the sound of sape also arise in the production of an album for traditional musical instruments. Isolation, as well as making individualised recorded tracks within a multitrack recording seems to be a common procedure in conventional studio recording practices. In every recording studio, the live room or performance space is well set up in terms of providing desired room acoustics. The live room is normally equipped with an isolation booth, sound proofing to diffuse low frequency rumble, acoustic panelling to absorb any potential presence of 'standing waves', which in turn alters the timbre of selected string instruments such as the sape. Timbre can be best described as tone color. Hopkin and Scoville (1996) stated that, "tone color is a blend of frequencies present" (p.2). Schouten (1968) notes that, "in reality timbre is impacted by more than the mere composition of overtone series; it involves the spectrum and envelope of the frequency as well as its amplitude (pp.35-44). Chan and Musib (2010) however stated that timbre preferences are very much a cultural issue. This is shown through constant modifications of musical instruments in order to fit timbral preferences, discussed in organology history.

As such, audio production is even more critical when recording producers create their own 'context' based on a conceptual idea through multitrack recording techniques. In the search for methods to use for audio field recordings of ethnic instruments such as sape, along other ethnic instruments that are played with sape, the longhouse setting and its surrounding within innovative recordings of multiple highlights and angles conceptualized as 'contextual sounds' are yet to be discovered (Jähnichen, 2011; Musib, 2012).

OBJECTIVES

This article reviews the quality of music recordings of a local string instrument called sape. First, I will identify the characteristics of timbre produced by recordings of local string instruments. Secondly, I will review the quality of selected audio recordings of the sape acquired from museum archives, recording studios and field recordings. Selected commercial products compact discs (CD), digital video discs (DVD), video compact disc (VCD) and cassette tapes available at cultural centers as souvenirs for tourists will also be reviewed. Third, I will discuss the appropriateness of recordings produced from the perspective of sound preservation. I will begin with a brief description of the sape.

THE SAPE

The sape (sampeh, sampet) (Figure 1) is a stringed instrument of the Orang Ulu groups including the Kenyah, Kayan, Penan, Iban and Kelabit among others, who are indigenous to Sarawak, Malaysia. In the classification of musical instruments by Hornbostel and Sachs (1961), the sape is a simple board zither without a resonator. The sape is classified under the chordophone family. The musical instrument is carved out of a single wooden trunk by the maker. Sape comes in various shapes with differently crafted headstocks and in various dimensions. A sape is attached with three or four strings. The frets are moveable with bees wax used as an adhesive. This allows sape performers to reset the frets according to the music pieces, as the tuning varies from one piece to another. The sape is usually played by men to accompany dance performances (Galvin 1962, p. 501; Gorlinski 1988, p. 101; Gorlinski 1992, p. 8), during a wedding ceremony (Gorlinski 1988, p.81) and during shamanic healing rituals (Prattis 1963, p.72; Whittier 1978, p.106).

Figure 1 Matthew Ngau Jau with his sape at a longhouse in Bau, Sarawak (photo by Ahmad Faudzi Musib, 2013)

IDENTIFYING TIMBRE CHARACTERISTICS OF LOCAL STRING INSTRUMENT RECORDINGS

In order to identify the ideal sound characteristics of the sape for audio preservation, one must first understand the sape from the perspective of the performer (the player of the sape musical instrument), the archivist (preservationist), and the sound engineer (recordings). Most of the recordings collected and evaluated in this research were a mixture of the common acoustic type of sape and the electric versions produced in various of contexts such as the communal longhouse and recording studios. Other materials that will be reviewed are sound recording products that were extracted from various recording mediums. The view of the performer, archivist, sound engineer, as well as the assessment and interpretation of related literatures toward what is expected in an audio recording of the sape that is of good quality, are taken into consideration in the construction of an evaluation scheme in order to review the recording quality of local string instruments (sape) from the perspective of sound preservation. The content of the scheme will be constructed based on three main principles: 1) what is 'preferred', based on the judgment of the recorded materials; 2) the 'importance' or 'significance' of the substance, as well as; 3) the 'experience' or 'understanding' of the three parties mentioned earlier towards sound preservation of the local string instrument. An abbreviation of these three terms—P.I.E. (Preferred, Importance, Experience) will be used throughout the paper. Each discipline will have a set of P.I.E. to deal with in weighing the quality of sound recording. Opinions, issues and views from each of the respective participants, performer, archivist and sound engineer, will be considered and discussed.

As a Performer

The Orang Ulu native player of traditional sape music demonstrates that the elements of P.I.E. are conveyed through what one understands best from what was taught by one's mentor. This was mentioned through informal discussions with informant Matthew Ngau Jau during studio recording breaks. The importance of what is perceived as "quality" is influenced by the mission of the performer to safeguard heritage through documentation of repertoire in the form of audio recordings.

As an Archivist

For an archivist, field notes are not adequate in safeguarding heritage. Though sound recording is an auxiliary to safeguarding heritage, recording is an important form of evidence that supports and justifies fieldwork documentation. The availability of the lightweight, portable digital stereo recorder was a great technological advance for archivists who previously had to carry the bulky Nagra[1] during their field work. With the transformation of audio files into digital formats of high resolution, recording became much easier. The transformation from analogue to digital format was one of the major evolutions in safeguarding heritage. However, at times the archivist overlooked many technical aspects in sound recording. Therefore, the quality of recordings became inconsistent. Despite other tasks performed by an archivist such as documentation and preservation, the importance of signal aqcuisitions was often overlooked. Often times, signal aqcuisition in conventional field recordings, is aimed only at the sound source, regarding other sounds as less important. The main focus of P.I.E. elements is on the importance of the sound source in this discipline. Treating sound as knowledge is not limited only to the instrument and musician, but the soundscape itself, and therefore should also be part of an archivist's field of view. The following (Figure 2) is an excerpt of an interview with Kevin Bradley from the National Library of Australia as well as the Head of the Technical Committee of the International Association of Sound and Audiovisual Archive (IASA) commenting about ethnographic recording. The interview took place on 10 October 2012 at the 43rd IASA Confrence held in India International Centre, New Delhi, India.

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Me:	What about those additional stuffs, putting into traditional instruments like *sape*, going into the studio record with reverb, flanging and all those processing – what do you have to say about that?
Kevin:	*(Laugh) it depends on the purpose of your recording. If the recording purpose is to do an authentic recording then you failed (little laugh). But if your purpose is to make a* <u>*record*</u> *of that thing (authentic instrument) then it is a good thing. For instance, is about what you appraise. If you are doing an ethnographic recording, you wouldn't do any of those things (processing, adding effects). Just try to get a clean, accurate and best quality recording you could manage.*

Figure 2 Excerpt of an interview with Kevin Bradley (ARCPA No:1590)

The side sound that includes spatial information and other surrounding sounds captured are not only meant for today's research in sound studies but also for future use. However, there might be certain technologies or instruments in the future that could analyse these components of sound that we have not yet discovered. A very good example is the capability of spectogram analysis, conducted in 1951 by Kay Electric Co2 under the trademark of Sonagraph. The 'narrow band' and the 'wide band' analysis produced by the sonagraph were inconsistent in the aspect of amplitude versus time domain. It was not until 1995, when the Sonagraph was replaced by the Spectogram in the digital era that the Spectogram proved much more precise, finer and faster adjustable function in realtime. The importance of substance from the perspective of sound preservation is not only meant for ethnomusicology, but for other social scientists sharing sound knowledge. As David Nathan archivist noted, on the importance of audio documentation, "audio provides an unbroken path between the information provider and the final user".

As a Sound Engineer

The quality of recording would best be described as an experience in 'sculpting' the output. At times, the experiences go hand in hand with habit. In treating a raw sound whether in a studio or during live performances, a sound engineer will use his or her ability to 'makeover' what is missing based on the reference of experience. In this field, the P.I.E elements only focus on preference and experience as the means of producing 'quality sound'. The following (Figure 3) is an excerpt taken from an interview with Toby Seay that took place on 7 October 2012, at the 43rd IASA Confrence held at the India International Centre, New Delhi, India.

Me:	Can I say that music in context can be best viewed through localization or highlights of certain component in the element of the music in context as a whole in the rural environment?
Toby:	*Localizations, I remember once I did a live jazz band project. I had it all at closed miking, and a few meters I had a stereo microphone in place picking up the whole band. Again during the mix-down session, I am able to reconstruct (sculpt) certain instrument to be loud or soft, as well as using different microphone to make it not so loud (through positioning, pick-up patterns, as well as its sensitivity which condenser or dynamic). Again this is based on judgments, which is not the truth.*

Figure 3 Excerpt of an interview with Toby Seay (ARCPA No: 2018)

Most professional sound engineers will begin the recording process by choosing the preferred type of microphones based on criteria such as frequency response, polar pattern, uncoloured, and microphone placement techniques. Treating every raw sound signal, occurs in the frequency spectrum of the instrument without any equalizations or enhancement. In many aspects of sound recording, sound engineers will often express their concerns on how to maintain the actual sounds of the instrument. Other sound engineers who have less experience will treat sound differently based on their set of P.I.E. (Preferred, Importance, Experience). They might treat the buzzing sound produced by rattling wooden frets (due to dried beeswax) of the sape as a disturbance rather than preserving it, hence they will use an equalizer to 'cut or attenuate' the unwanted buzzing sound. Overlooked by habit, the actual sound of the native sape is now altered. The goal of sound reproduction in a manner of 'clean, enhanced and beautified' sound through commonly used and abused approaches, changes the quality of the natural sounding sape.

My view

What is the quality of recordings with regard to the native sape of the Orang Ulu? When recording is conducted in order to preserve the actual timbre, what is produced? The focus on quality in recording for preservation, will have to be based on what is produced by the actual source. This leads to the study of what is the actual sound source of sape and how it is sounded in its natural environment. Prior to the understanding of the actual sound source, we have to investigate and trace what happens in the mastering, mixing, recording where certain sound elements might have been lost, distorted, isolated or even enhanced. Based on these aspects just mentioned, samples will be utilised with each sample tested according to the structure scheme and its various references in related areas.

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CONSTRUCTING A SCHEME

Sound preservation is not limited only to the recorded materials. The quality should also be well preserved upon playback. Figure 4 is a simple illustration in understanding the process of maintaining sound preservation through quality recording, storage and the playback system.

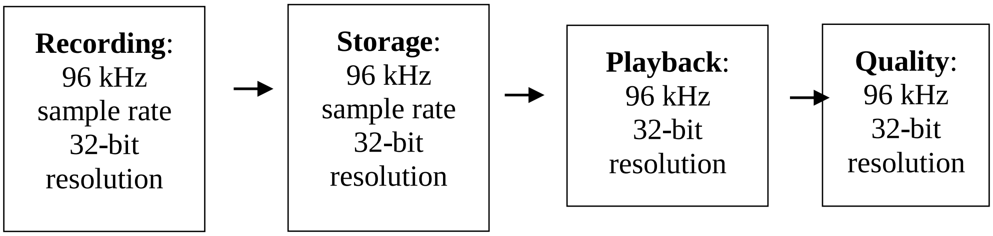

Figure 4 The sound quality is well preserved provided that the recording, storage and playback is of the same format. (Illustration by Ahmad Faudzi Musib 2013)

Table 1 Four main elements required in evaluating the quality of recording (source) (Source: Nathan, 2010)

No.	Descriptions	Definitions
1	Signal	▪ Content
		▪ Fidelity
		▪ Spatial and contextual information
		▪ Comfortable to listen to
2	Noise	▪ From environment
		▪ near: people, animals, activities
		▪ far: traffic, generators, planes
		▪ machines: refrigerators, fans, computers
		▪ not hearable: mobile phones, electrical interference
		▪ acoustic: reflections/resonance
		▪ Generated by event (unwanted)
		▪ shuffling papers, clothes
		▪ table banging
		▪ backchannel from interviewer
		▪ equipment handling, especially microphones and cables
		▪ Generated by equipment
		▪ wrong input levels
		▪ circuitry noise (cheap or incompatible)
		▪ compression loss or distortion
		▪ ALC[3]/AGC[4] effects (pumping)
		▪ video camera motors
3	Listenability	▪ Comfort
		▪ Consistency
4	Fit for Purpose	▪ Commercial/ Archive/ Documentary/ Teaching Material

In constructing a scheme which will be used to review the recording quality of local string instruments from the perspective of sound preservation, related studies were considered. David Nathan, director and archivist for the Endangered Languages Archive (ELAR), listed the requirements of quality recordings that are acceptable and that are not limited to oral materials. In Table 1, four main elements described as the requirements in evaluating the quality of recording (source) was categorised by David Nathan (2010).

Another important aspect to be considered in reviewing audio recording quality is the playback device. In Figure 5, A.J. van den Hul, founder of a Dutch company that specialises in quality signal transmission in audio stereo systems, listed the eight elements that are to be considered as a method to maintain the recording quality of a playback system. Each device will undergo a structured test by A.J. van den Hul (n.d.). This test is conducted to make sure that the playback system reproduces all recorded material at the best quality.

1	Details
2	Dynamics
3	Lack of Distortion
4	Balance in Timbre
5	Depth
6	Spatial Impression: Width and Height
7	High Definition
8	High Resolution

Figure 5 Important variables to be tested on audio stereo system focuses on the quality signal transmission [Source: van den Hul, A.J. (n.d.).]

For example, the CD audio is limited to 44.1 kHz sample rate at 16-bit resolution. If a field recordist records a piece of music during his field work at a sample rate of 48 kHz in 24-bit resolution, in order to hear the recording back in the same quality, the playback system should support this format. In this research, an amplitude statistic test was conducted on a similar sound source through two different recording devices. In the test, a similar sound source was encoded at 96 kHz sample rate with 32-bit resolution and the other encoded at 44.1 kHz sample rate with 16 -bit resolution. The result showed that playing the same material on a lower reproduction machine alters the sound quality. One of the components was variation in output of the specimen's amplitude statistic, particularly the peak amplitude (Table 2). Another important factor to consider in using the reproduction system (playback machine) before evaluating quality recording, is that if the recorded materials is to be played back on a personal computer, one should be aware whether or not the soundcard is capable of supporting a 96 kHz sample rate with 32-bit resolution data.

Table 2 The table shows the amplitude statistic comparison at peak amplitude measurement of actual signal sample at 32-bit and playback on 16-bit system (Source: Ahmad Faudzi Musib, 2013)

	Description	**32-bit 96 kHz Playback Machine**		**16-bit 44.1 kHz Playback Machine**	
1	Stereo dimension	**Front Left**	**Front Right**	**Front Left**	**Front Right**
2	Peak Amplitude	**-0.91 dB**	**-1.20 dB**	**-1.73 dB**	**-1.73 dB**
3	Maximum Sample Value	**29497.42**	**28550.86**	**26840**	**26840**
4	Minimum Sample Value	**-28854.43**	**-28042.20**	**-26840**	**-26840**
5	Possibly Clipped Samples	0	0	0	0
6	Total RMS Amplitude	-13.08 dB	-13.27 dB	-13.08 dB	-13.27 dB
7	Maximum RMS Amplitude	-8.80 dB	-9.17 dB	-8.80 dB	-9.17 dB
8	Minimum RMS Amplitude	-90.69 dB	-89.53 dB	-90.69 dB	-89.53 dB
9	Average RMS Amplitude	-14.37 dB	-14.47 dB	-14.37 dB	-14.48 dB
10	DC Offset	0.00 %	0.00 %	0.00 %	0.00 %
11	Measured Bit Depth	32	32	16	16
12	Dynamic Range	81.89 dB	80.36 dB	81.89 dB	80.36 dB
13	Dynamic Range Used	81.40 dB	79.85 dB	81.40 dB	79.85 dB
14	Perceived Loudness	-12.70 dB	-12.55 dB	-12.70 dB	-12.55 dB
15	Perceived Eq Loudness	**-7.81 dB**	**-7.91 dB**	-7.77 dB	-7.90 dB

Based on an archiving recording scheme as well as the technical aspects of the audio reproduction system scheme, the content of elements was found to be similar and in demand particularly in preserving the ‘quality’ of the sound. In addition to sound preservation that begins with recording and playback systems, the materials used are important. The role of materials is of equal importance to the recording device and the playback system. Anthony Seeger is a professor of ethnomusicology at the University of California at Los Angeles. As a trained archivist as well as research associate of the Smithsonian Institute he conveys concerns regarding audio preservation and the future of recordings. As a former director of the Smithsonian Folkways Recordings he is concerned that the collection of recorded history in the time period of one hundred years is at risk. This is due to the fact that the materials used to record music, such as tape and disc, are very fragile. The rapid growth of recording formats over the past ten years has made archive materials obsolete. Materials recorded in the twentieth century might not be able to be played back in the twenty-first century due to new systems and the format incompatibility of playback and recording devices. Therefore sound quality from the perspective of preservation can be structured based on three main elements: the recording settings, playback systems and materials that can be played back in the same quality as the recordings made. Although archivists and technical device experts differ in their roles and functions, both aim for ‘quality’ sound preservation. The table shown in Figure 6 is the research scheme structured as a result of merging core ideas of two respected disciplines in sound preservation. Prior to this structured scheme, five specimens were taken from five different outfits. Investigations on various aspects of audio and wave analysis in justifying the recording quality of local string instrument from the perspective of sound preservation were carried out. As such, the cases will be discussed below.

<table>
<tr><td colspan="6" rowspan="2">Title:</td><td colspan="2">Material</td><td colspan="2">Recording date</td><td colspan="2">Recorded by</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="6" rowspan="2">Group:</td><td colspan="2">Source</td><td colspan="2">Reviewed date</td><td colspan="2">Reviewed by</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="6">Signal consistency</td><td colspan="2">Context</td><td colspan="2">Fit For Purpose</td><td colspan="2">Test category</td></tr>
<tr><td colspan="2">Degradation</td><td colspan="2">Acceptable</td><td colspan="2">Alteration</td><td>Studio</td><td>Field</td><td>Ethnology</td><td>Commercial</td><td>Content</td><td>Physical</td></tr>
<tr><td>Yes</td><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>No</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="12">Notes:</td></tr>
</table>

Figure 6 Research scheme structure based on merging the core ideas of two respected disciplines of archivist and technical expert in sound preservation. (Source: Ahmad Faudzi Musib 2013).

Though the definitions of the said description (variables) comply with certain meanings, there were no instrument designs, suggestions or methods to test these variables. Taking the example of the first variable, signal consistency, considerations were made with regards to degradation and acceptable/alteration. These refer to variations in the quality of the evaluated materials. Another aspect was considered by looking at the context, whether in the studio or a field recording. Spatial, from the perspective of recording, refers to what will be the acceptable depth, distance or spots from the sound source, microphone polar pattern, positions such as NOS5, ORFT6 and the BLUMLIEN7; all being references and techniques that were never revealed in the product jacket of the recorded materials.

The following are several outfits and organizations that have been identified as the main distributors of these recordings today. As indicated, all products shown in Table 3 are materials that were considered to undergo evaluation based on the formulated scheme, prior to sound preservation.

Table 3 List of products taken as specimens from various outfits and organisations

No	Product	Outfits and Organisation
1	Commercial	Malls CD Stores / Cultural Centers
2	National Museum	Archives
3	Recording Studio	University Putra Malaysia
4	Live Performance	Concert recorded live
5	Amateur	Using a portable recorder

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EVALUATION PROCESS USING THE RESEARCH INSTRUMENT

The process of reviewing the recording quality of local string instruments from the perspective of sound preservation was based on the research scheme (Table 6) designed earlier. Figure 7 represents a walk-through of how each recording will undergo the evaluation. Prior to the evaluation, seven important cases will be discussed.

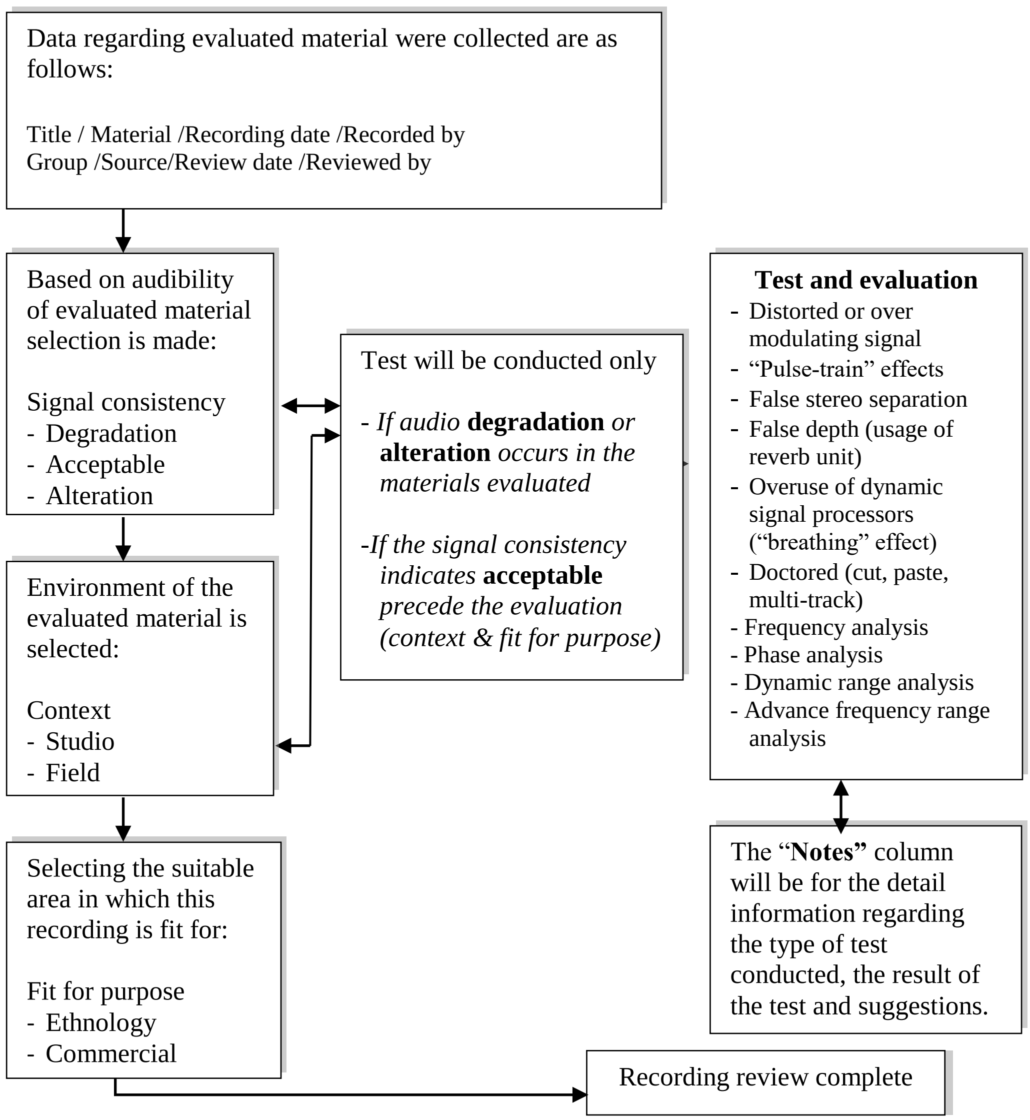

Figure 7 In reviewing the recording quality of local string instruments (sape) from the perspective of sound preservation, all five samples of recording materials will undergo the process of evaluation using the design research instrument.
(prepared by Ahmad Faudzi Musib 2013)

Example 1: Distorted or Demodulation Signal Sape

Product: Commercial Productions (Music Store)

The first specimen was selected randomly from the shelf of a music store. The selected recording is ‘Sape Lansan’, track number 5 from the Secret Sound: Traditional Music of the Sarawak Ethnic Group (CD2006-114). Since there was a degradation of audio signal specifically to a ‘distort sounding signal’, a test was carried out to determine the actual cause of distorted sound as suggested in the research instrument shown in Figure 7. The entire musical piece was uploaded to a computer for analysis and the region was identified. The region was selected on the waveform that reaches its maximum amplitude. Audibly, the signal is heard as a distorted sounding signal. The test result of Item 3 of Table 4 clearly shows that the signal is interpreted as -3.53dB on the left and -3.54dB on the right channel. The measurement of left and right channels of the recording measuring at a number of samples that could exceed 0 dB relative to full scale, did not show any value of possible ‘clip’ or ‘distorted signal’ as shown in Item 4 in Table 4. Based on the test result of the analysis, the occurrence of ‘distorted sounding signal’ was due to poor signal extraction from the original carrier, hence reducing the quality of the recording of the local string instrument from the perspective of sound preservation.

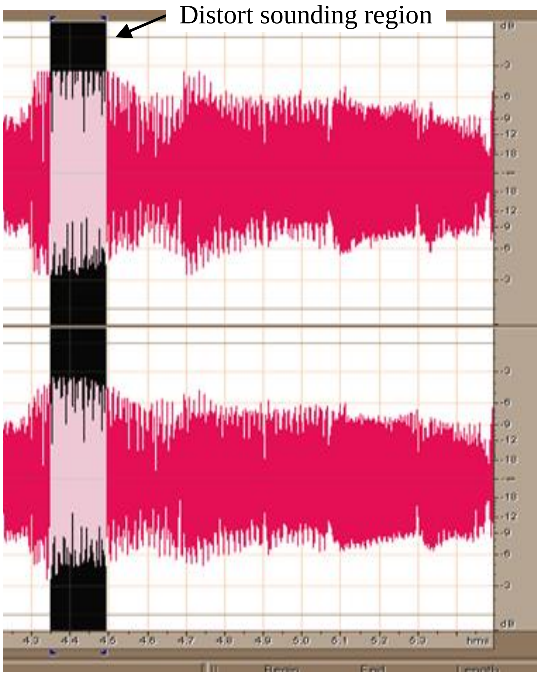

Figure 8 Distorted or demodulation signal sample taken from Track 5 entitled ‘Sape Lansan’ from the Secret Sound: Traditional Music of Sarawak Ethnic Group, CD2006-114. (analysis by Ahmad Faudzi Musib 2012)

Table 4 Waveform statistic measured the output value of ‘0’ for clip or distort signal, but the actual fact is that the sound of the sape is distorted. (analysis prepared by Ahmad Faudzi Musib 2013)

No.	Measurement	Left	Right
1	Minimum Sample value of the lowest amplitude	-21813	-20567
2	Maximum Sample value of the highest amplitude	21812	21812
3	**Peak Amplitude with the highest amplitude in decibel form.**	**-3.53 dB**	**-3.54 dB**
4	**Possibly Clipped based on 0 dBFS (decibel relative to full scale).**	**0**	**0**
5	DC Offset measure in percentage. Positive values are above the center line (zero volts), and negative values are below it.	-.158	.17
6	Minimum RMS Power	996.99 dB	996.99 dB
7	Maximum RMS Power	-inf dB	-inf dB
8	Average RMS Power- reflects perceived loudness.	-3.01 dB	-3.01 dB
9	Total RMS Power- the total power of the entire selection	-8.31 dB	-9.4dB
10	Actual Bit Depth	16-bits	16-bits

Example 2: A Signal Processed Sape with a Heavy Synthesized Music as a Backline

Product: Commercial Productions (Music Store)

Specimen two was taken from Jerry Kamit’s solo albums, Akai Nyamai, Sape: Volume 1 and Trance Sape and Sape Easy Listening: Volume 1. Based on the research instrument design in reviewing the quality recording of sape as a local string instrument from a sound preservation perspective, this recording indicated some form of sound enhancement as a whole. Audible enhancement was made to the sape particularly the ‘spatial depth’. A test was carried out, as suggested in the research instrument shown earlier in Figure 7, to determine the actual cause of ‘spatial depth’[8]. The entire musical piece was transferred to the computer for audio analysis. Since the music composition and musical arrangement are prone to trance music, it was impossible to extract a single note struck as the solo sape was heavily drowned out in synthesized music utilized as backline accompaniment. Visible changes in amplitude as well as long decay time suggested that the sape underwent some kind of effect processor. Audibly, the signal is heard as a ‘reverb sounding’ sape signal shown in Figure 9a. To prove the hypothesis a simulation was conducted on an acoustic sape. A single note struck followed by a damping of the thumb on the vibrating string is used as a sample. Since reverb effect can be easily understood as an effect on a single sound, what one hears from a sape player in a large hall or a small room is the ‘reflection time’[9]. Within a large hall, the reflection time is longer than in a small room. Large spaces such as a hall or auditorium would give a longer decay time. The damping of the string was done on purpose. As the damping took place, the remaining sound or the ‘residue’[10] was used to measure how long it took for the amplitude to fade out (Figure 9b).

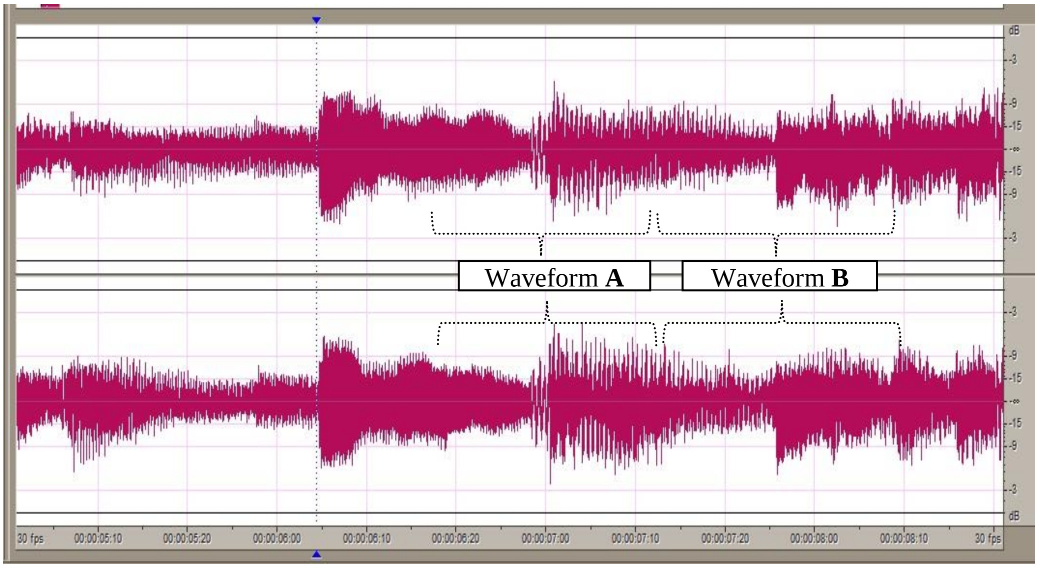

Figure 9a Enhancement of the acoustic sape sound with reverb found in 'Leleng' from Jerry Kamit's Sape Easy Listening Vol.1. Both amplitudes of Waveform A and Waveform B represent a longer decay time hence indicating a usage of effect processors – suggesting the sape was played in a large auditorium (analysis by Ahmad Faudzi Musib. Location 00.00.06.04 and Waveform B begins at 00.00.06.28)

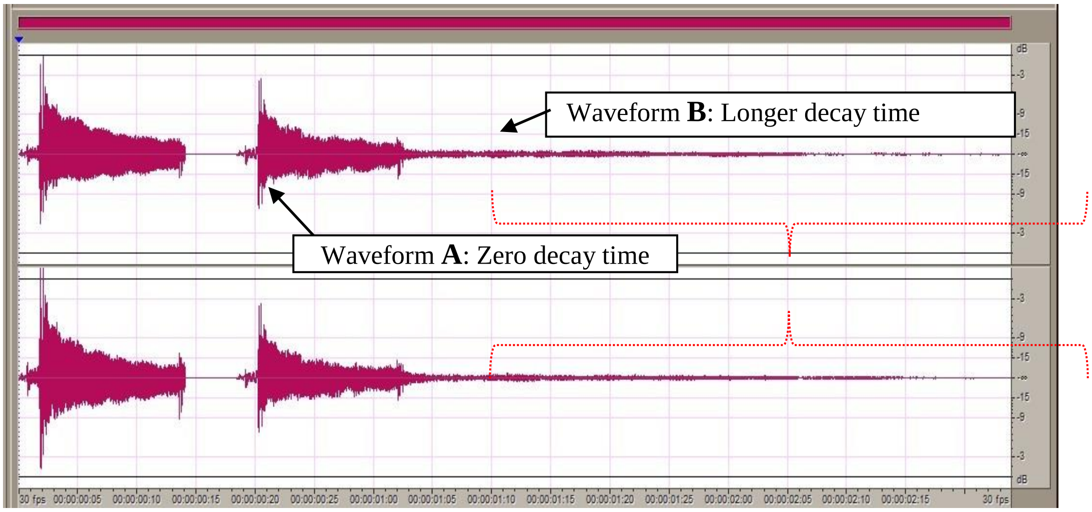

Figure 9b Simulation of a single note on *sape* with no reverb shows zero decay time. The second waveform (with reverb simulation) shows a longer decay time. (Source: Ahmad Faudzi Musib. ARCPA No:2042–2045 location 00.00.01.26)

The waveform statistic shows differences in all measurement values between Waveform A (without reverb) and Waveform B (with reverb) shown in Table 5.

Table 5 The waveform statistic shows differences in all measurement values between Waveform A (left) without reverb and Waveform B (right) with reverb (analysis by Ahmad Faudzi Musib. ARCPA No:2042-5 Location 00.00.01.26).

Without "reverb" effects (Waveform Statistic)			With "reverb" effects (Waveform Statistic)		
	Left	Right		Left	Right
Min. Sample Value	-20427	-26723	Min. Sample Value	-16138	-15870
Max. Sample Value	29082	32767	Max. Sample Value	22410	22033
Peak Amplitude	-1.04 dB	0 dB	Peak Amplitude	-3.30 dB	-3.45 dB
Possibly Clipped	0	8	Possibly Clipped	0	0
DC Offset	.008	.007	DC Offset	.001	.001
Min. RMS Power	-30.49 dB	-26.47 dB	Min. RMS Power	-51.95 dB	-53.66 dB
Max. RMS Power	-10.07 dB	-8.35 dB	Max. RMS Power	-12.04 dB	-12.18 dB
Average RMS Power	-15.44 dB	-15.03 dB	Average RMS Power	-29.20 dB	-29.57 dB
Total RMS Power	-15.38 dB	-14.66 dB	Total RMS Power	-24.32 dB	-24.75 dB
Actual Bit Depth	16 Bits	16 Bits	Actual Bit Depth	16 Bits	16 Bits

Due to the alteration of sape sound using the processor effects, the chances of it being an ethnographic recording of sape are nil. Although the recording is not suitable for ethnographic display from the perspective of sound preservation, Jerry Kamit has nevertheless successfully demonstrated creative musical ideas in composition and arrangement.

Example 3: Isolated Signals and Purposely Creating Stereo Separation of the Left and Right Sound Sources

Product: Commercial Productions (Cultural Centre)

The third sample was 'Dat Diat', taken from Sarawak Sape Music: From Kayan Ethnic Group. Tabun Budah and Usak Utong of Ume Kahei performed the recording in Long Makero, Belaga, with the recording produced by The Sarawak Craft Council. It was audibly obvious that the music was recorded and engineered using stereo separation. To visualize the separation of the left and right channels, the music was analysed using the research instrument design earlier mentioned. As shown in Figure 10, the amplitudes representing the left and right channels are not similar. This indicates two different musical patterns suggesting perhaps a melody and counter melody. The techniques demonstrated here utilise two-dimensional sounding instruments. The music begins with one sape from the left followed by the other sape that appeared from the right based on the amplitude patterns. It was an interesting approach in sound recording, but is not suitable for ethnographic recording particularly from the perspective of sound preservation. In sound preservation no alteration should be made to the sound source. This includes the sound of the instrument as well as localisation. In creating a stereo sound environment the re-positioning of two separate sources altered the sound of the sape, hence defeating the purpose of searching and reviewing sape as a local string instrument sounding of the native Orang Ulu from the perspective of sound preservation.

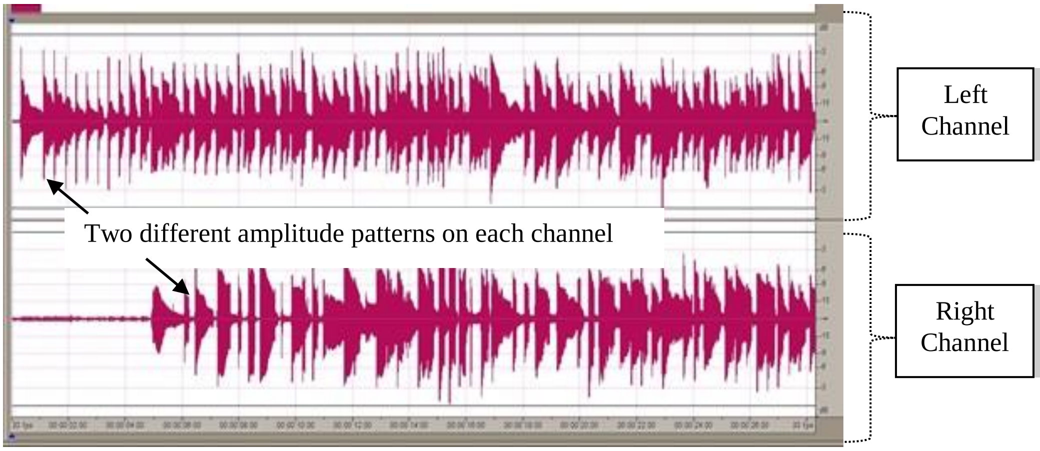

Figure 10 Isolated signals and purposely created stereo separation of the left and right sound sources. This sample is Track 2 entitled 'Dat Diat', taken from Sarawak Sape Music: From Kayan Ethnic Group, SCC-2006-1. (Source: Ahmad Faudzi Musib 2012)

Example 4: Field Recording

Product: Ethnology Department, Sarawak Museum

In evaluating the recording quality of recorded materials obtained from the Ethnology Department, Sarawak Museum, what was audibly heard is an open air context (Figure 11), and the environment suggests that the sape was recorded in the late evening probably around midnight. A test was conducted using spectrogram analysis of the amplitude trend. What is visible are amplitude consistencies in faded darker image, with lesser color intensity representing the sound of a rooster captured with the sape playing. Based on the research scheme used earlier, the signal consistency shows that the sape (athrophony11) along with a rooster (biophony12) were in the same environment. The result of the review material clarified that there was no alteration or degradation occurring in this recording. The side sound and the sape as sources were kept balanced with no recreation or false depth nor localization of sound (that can be doctored using a multi-track recorder). The quality, authenticity and the originality of the recording can be recommended as an ethnology recording suitable for sound preservation as local string instrument sounding, sape of the native Orang Ulu. The inclusion of side sounds may open up the opportunity for other fields of research. The scope of required information is much larger not limited only to musicology but to other social sciences such anthropology among other fields.

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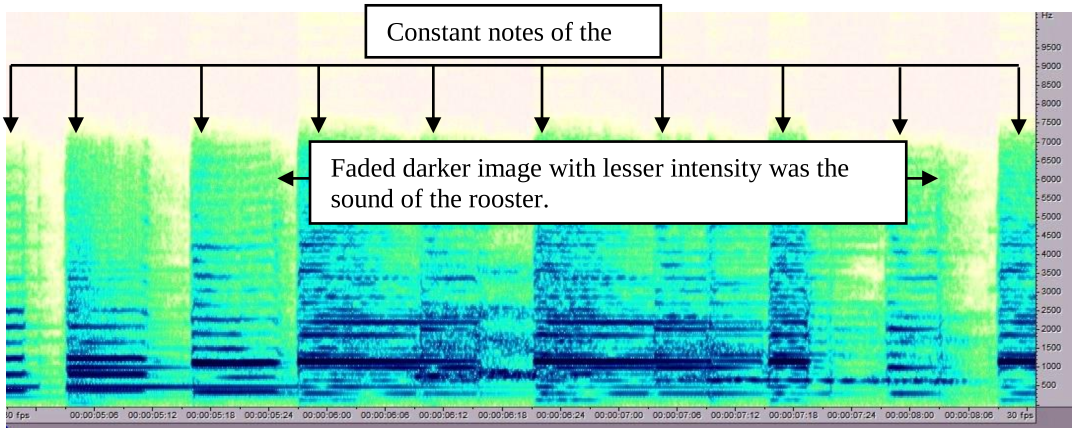

Figure 11 Analysis of the spectrogram shows the visible amplitude consistency of the *sape* along with a rooster, suggesting that both the *sape* and the rooster were in the same environment. (Source: Gorlinksi, 1993)

Example 5: Studio Recording

Product: Universiti Putra Malaysia (Archives)

Various aspects of sound were captured through multi-sourcing sound produced by the instrument through ubiquitous recording. The focus is the instrument; hence only the source is captured limiting the original context within the rural environs of the long house in Sarawak where the sape is played along with other instruments. Most of the time, the studio recording environment is the best environment to record audio signal without any interruption of the so-called 'noise'. This could be the approach for conventional recordings. Although the technological equipment in a recording studio is state of the art, one should remember that the content of the recoding is not only limited to the clarity of the sound but other acoustic properties such as sape in its context. In a recording studio, sounds were isolated, captured and treated before the recording took place (Figure 12).

Figure 12 On the left is an acoustic *sape*. A small capsule condenser microphone is placed at the back of the instrument to capture the sound produced from the back of the sape. On the right is electric *sape* (on the floor) with a pick-up installed in the body cavity. (ARCPA 2044-9 and 2044-12)

With an electric sape, noise gate devices were used to ‘stop’ the continuous electrical buzzing sound appearing in the recording. This is normally due to faulty wiring of the pickup that is attached to the sape.

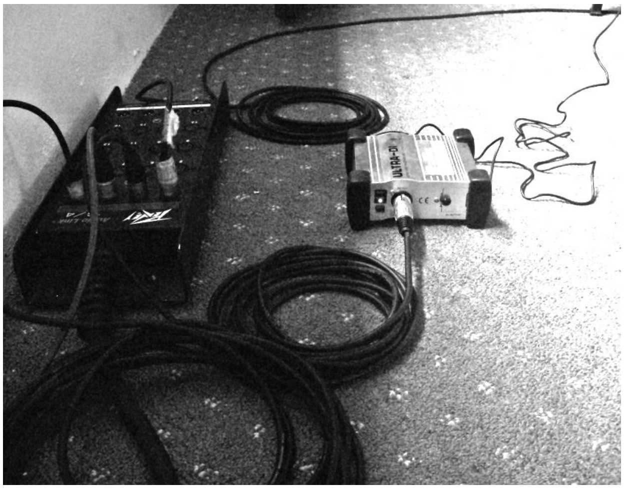

Figure 13 Usage of D.I., an abbreviation for direct injection box, only picking up the vibration of the string through the magnetic pickup installed on the sape. (photo by Ahmad Faudzi Musib)

There were times when electric grounding was not done properly during the installation of the sape so that the faulty wiring of the magnetic pick-up introduced an electrical buzzing noise. The sound engineer had no choice but to apply equalization to remove the unwanted frequencies that alter the sound of the sape. In a worst-case scenario, engineers had to use a ‘gate device’ (Figure 14) to stop the buzzing sound from continuously leaking into the recording.

Figure 14 Usage of gate device to stop continuous, unwanted sound from leaking through the recorded track. (photo by Ahmad Faudzi Musib 2012)

The detachment happens as the native sape which is normally played in the long house of the Orang Ulu is now performed in a concert hall along with sound reinforcement systems for a large audience. Similar circumstances occur in a recording studio. The sound of the native sape was isolated and recorded in a sound proof booth. Other visible transformations such as adding frets, adopting more strings and using a built-in pick-up embedded onto the cavity of the instrument changes sound quality and the repertoire of the traditional sape. The evolution from playing in long house to concert hall, concert hall to studios and from acoustic to electric, has increased the sound experience for the performer in evaluating quality sound.

CURRENT ISSUES OF SAPE PLAYING: AN OBSERVATION

In the early usages of sape, rattan strings were used as the source before the bicycle brake wires became available in the island of Borneo (Chan & Musib, 2010). Later bicycle brake wires were replaced by the metal strings of an acoustic guitar due to a particular gauge or size that became available and have remained as the tonal characteristic of metal guitar strings until the present day. In the aspect of string settings, makers have substituted the wooden tuning pegs to guitar machine heads. Based on an interview with informant Matthew Ngau Jau (2010), using the guitar machine heads allows for precision tuning and provides a convenient way for string replacement. Indeed machine heads and guitar strings complimented each other in creating a desired sound.

Obviously the introduced materials open up sound potentials for sape players. The nickel composition contained in the metal strings along with a magnetic pickup installed in the body cavity of the sape, translate the vibration of the strings into sound at the amplifier as the string is plucked. The result is a clearer high overtone produced through the fluctuation of the string in the magnetic field of the pickup. This phenomenon can be explained through the pickup placement. Placing the pickup close to the bridge13 (Figure 18) produces a brighter string sound. A test conducted on a Gibson Les Paul Standard guitar showed that the reason for different readings of two different outputs of the pickup, was due to the positioning of the pickup on the body of an electric guitar cavity. The higher output pickup placed at the bridge led to a less pronounced vibration produced by the strings at the bridge. By positioning the high output pickup on the less pronounced vibrations of strings at the bridge with another pickup with less output due to placement at the neck position creating greater vibration of the strings compensates for the output hence keeping a balance of overall sounding of the guitar. As for the sape the humbucking[14] and the single coil[15] were the two common pickups installed in the traditional sape that introduced an unbalance and less pronounced output. The body construction and mechanism of an electric guitar are not similar to a sape. What must be noted is that one of the significant features creating drawbacks is that the sape is actually a zither and not a lute. Modifications have been made to the sape making it more like an electric guitar, resulting in an altered timbre.

Figure 15 Sape with wooden tuning pegs, guitar machine heads to substitute the wooden pegs. The transformation makes for easier string replacement and precision of tuning. (photo by Ahmad Faudzi Musib 2012)

Figure 16 Sape with single coil pickup installed (photo by Chan Cheong Jan, 2010).

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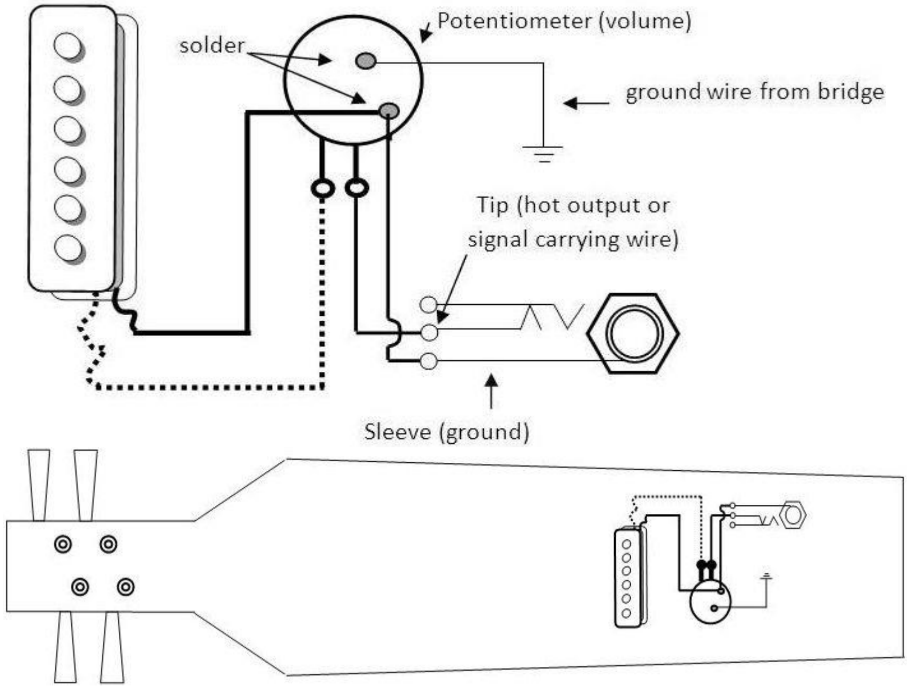

Figure 17 Matthew Ngau Jau, *sape* with single coil wiring installation (top); location of the pickup inside the *sape* cavity (bottom). (Source: Ahmad Faudzi Musib, 2010)

Figure 18 On the left is shown the Gibson Burst Bucker model made specifically for the neck and bridge position (ARCPA No 2031-15) while the photo on the right is a type of humbucking pickup installed inside the *sape* cavity acting as a bridge pickup, hence producing an unpronounced sound. (photo by Ahmad Faudzi Musib, 2012)

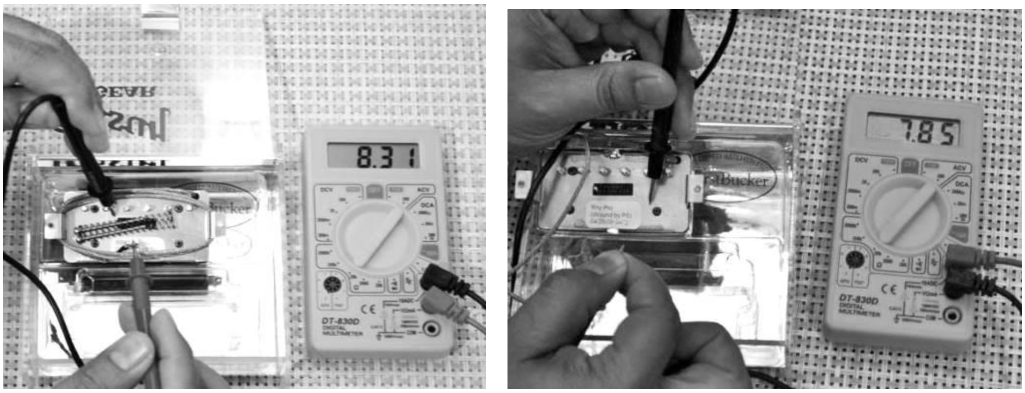

Figure 19 Shown on the multi meter is the Gibson Burst Bucker Pro (lead or bridge pickup) with an output signal at 8.31ohm on the top, and on the bottom the Gibson Burst Bucker Pro (rhythm or neck pickup) with an output signal at 7.85 ohm (ARCPA No. 2031–2050 & 2031–2076) (photo by Ahmad Faudzi Musib, 2012).

The rapid growth of audio enhancement tools such as amplification and the use of pick-ups have become difficult to resist. The adaptation of electronics into native sape instruments is considered sound enhancement for some players. The traditional native sape that used to be a soft-sounding instrument now stands side by side on the stage with other electronic instruments with the aid of amplification – so that sape players are not aware that their instruments are slowly becoming detached from their natural environment.

CONCLUSION

In this paper, we moved from a single view of ideal sape sound towards acknowledgement of different contexts in which sound is produced. The sound of sape, would have a different set of perceived ideal sounds according to the position of the user whether as player, sound engineer, sound archivist and others involved with recording. With this plurality of ideals of sound for one instrument, we can produce an evaluation that is meaningful for all based on the 'actual sound' produced acoustically by the instrument. However, this 'actual sound' is problematic whereby a philosophical question remains unanswered. The outcome of review of the five examples remain open-ended, but not without some insights. The Example 5 recording carried out in the studio by the researchers with specific awareness of the inherent acoustic qualities of sape, is an example that closely reflects the actual sound of the instrument. At the same time, what is also indicated is that any recorded sound profile is made through creative solutions in the selection of microphone and placements made to maximise the capturing of signals of the particular instrument that in and of itself is a unique instrument. The field recording in Example 4 is what we as listeners hear when sape is played in a natural and social environment. Field recordings seldom cross paths with artistically produced recordings. However, increasingly advanced audio settings continue to present questions related to contextual sounds as perhaps an important part

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of the identity of the instrument. Example 2 presents some of the most available, commercial as well as artistic productions of sape recordings. It is our view that the artistic recordings using sape today has room for improvements in order to fulfil a more refined demand for sape sound profiles. Putting together Examples 1, 2 and 3, it is easy to observe that what is available in today's sape recordings may not give an apt impression of the sonic capability of the acoustic instrument. This is an indication that recording preservation has not done enough, either for sape or other ethnic instruments. At the same time, what is lacking are recordings that could reflect the actual sound, or the raw sound of the instrument that is 'as heard' by players and listeners in ordinary life settings. Projecting forward, we envision that artistic preservation of sape must be not only produced as a variant of electric guitar sound, but as a unique contribution to modern compositions capturing delicate sound profiles of the sape instrument.

ENDNOTES

1 Nagra: An open-reel tape recorder invented by Stefan Kudelski. Nagra was used since 1950 as audio recorders that were used by the radio journalist. The device first product launch in 1951 as Nagra 1 to present Nagra PICO in 2012, digital handy recorder that use by field recordists.

2 In 1951, Elmo Edward Crump of the Kay Electric Co. produced the first commercially available machine for audio spectrographic analysis, which they marketed under the trademark "Sona-Graph." The graphs produced by a Sona-Graph came to be called "Sonagrams." For decades, all spectrograms were Sonagrams. (Source: http://earbirding.com/blog/archives/1229)

3 ALC: Automatic Loudness Control: is a function that built-into a stereo audio digital recorder which enables the source input signal undergoes a processing known as audio compression. With ALC set to "on" mode, the audio compressors will attenuate any loud signal from over modulating of signal or distorted. Unfortunately, most ALC process is done automatic.

4 AGC: Automatic Gain Control: is a built in device that serves as "hands on the knob" function, keeping the correct as well as ideal signal level.

5 NOS: An abbreviation for *Nederlandse Omroep Stichting*. NOS is a stereo microphone techniques founded by Holland Radio that uses two microphones of a same model position with an axle angle of $\alpha = \pm 45° = 90°$ degrees space, and place at distance of 30cm between the two microphones mentioned.

6 ORFT: Initiated by Office de Radiodiffusion Télévision Française or the Radio of France. The ORTF is a stereo microphone techniques is set the angle between the microphone axes at 110° with the distance between two similar pickup angle of microphones at a = 17 cm and this will give a captured angle of 96° space.

7 Blumlien Pair was introduced by Alan Blumlein for the creation of stereo recordings based on stereo microphone techniques. The pair consists of two microphones of the same made at a pickup angle of bi-directional (Figure 8) pickup pattern, with both positioned and forming 90° angle.

8 Spatial depth: Sound perception based on three dimensional perspective through ear as a receptive sensors

9 Reflection time: Referred to as time taken for sound reflected against a hard surface causes a persistence of sound in an acoustic environment after the actual sound triggered.

10 Residue: Referred to persistence of sound in an acoustic environment after the actual sound triggered. The persistence or after triggered effect sound usually are simulation to simulate of

reflected sound against a hard surface causes a continuance of sound in an acoustic environment after the actual sound triggered.

[11] Anthrophony: Referred to sound produce by the human such as talking, singing, movement, usage of machine and other mean of manmade sound.

[12] Biophony: Referred to sound produce by the large, small animals, insects and other of its kind.

[13] Pickup placement: There are two main pickup designs for an electric guitar, the neck and the bridge pick-up, with each comes with different resistance reading, hence outputting different sound of the bridge or the neck.

[14] Humbucking is made of Alnico (mixture of aluminium, nickel, cobalt) magnets. Each humbucking comprises of two single-coil pickup, with each magnets wounded together in one unit. This pick-up can be seen installed in most of Gibson Les Paul model of an electric guitar.

[15] Single coil is made of Alnico (mixture of aluminium, nickel, cobalt) magnets. Each single coil comprise of wounded magnet as a single unit. This pick-up can be seen installed in most of Fender Stratocaster model of an electric guitar.

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BIOGRAPHY

Ahmad Faudzi Musib is senior lecturer at the Universiti Putra Malaysia, Music Department since 2009. Born in 1966, he studied Music Synthesis at Berklee College of Music, Boston Massachusetts, U.S.A. in 1990 with Prof. Dr Richard Boulanger, completed his Master of Music (Electronic /Computer Music Emphasis) with Prof. Dr Donald Wilson at University of Miami, Coral Gables, Florida, U.S.A. in 1993, and in 2015 he completed his PhD in Music with a thesis under the supervision of Prof. Dr Gisa Jähnichen at the Universiti Putra Malaysia. He was teaching in different functions at the Ocean Institute of Audio Technology, Universiti Teknologi MARA, Universiti Telekom (Unitel). In 2015, Muṣīb was commissioned as Industry experts by the Department of Skill Development, Ministry of Human Resources in the field of Information and Communication Technology. He has written chapters in books published in University Putra Malaysia book series on music research, and University of Malaya book series on research in musicology since 2011 until present. Musib has also worked as sound synthesis, guitarist, as well as an audio engineer in several local album productions.
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