MUDRA
E-ISSN 2541-0407

MUDRA Jurnal Seni Budaya Volume 37 No. 2, Mei 2022
P119-125

Subjective Evaluation of Stereo Recording Techniques on Javanese Kendang

Jack Arthur Simanjuntak[1*], Gelar Pandu Raharjo[2]

[1,2] Program Studi Musik – *Sound Design and Music Production*,
Fakultas Ilmu Seni ,Universitas Pelita Harapan
Jln. M.H. Thamrin Boulevard 1100, Lippo Village, Karawaci, Tangerang 15811
Indonesia

simanjuntak.jack@gmail.com

Kendang Jawa is a traditional Javanese musical instrument which is used in a Javanese gamelan ensemble, often played for traditional events. Kendang Jawa has three separate parts dependant on its size, namely *bem* (largest), *batangan* (medium) and *ketipung* (small). Through advances in recording technology, the development and preservation of Nusantara's musical arts can continue to be encouraged. The quality of the recording is predominantly determined by the placement of the microphone in use. The lack of studies on the importance of microphone layouts and distancing in kendang Jawa recording is a problem that requires attention. The purpose of this study is to evaluate the participants' subjective assessment of stereo recording techniques on kendang Jawa. Qualitative methods were used to analyze the preferences of expert and non-expert participants. Recording of 16 audio samples were performed using four stereo recording techniques, namely XY 90º, AB, ORTF and Mid-Side with four variable distances at Studio Lokananta, Surakarta. The recording sample was tested subjectively on 40 participants. This study reveals that the preference of expert and non-expert participants is the XY 90º technique. As many as 73% of expert participants enjoyed the recording of kendang Jawa through the XY 90º technique at a distance of 1 meter. High sound clarity and balanced stereo images are several crucial factors in this technique. The result of this study contributes to the understanding that the aspect of the impression of space and time of low reverberation is one of the essential criteria in determining the sound quality of kendang Jawa recordings.

Evaluasi Subjektif Teknik Perekaman Stereo Pada Kendang Jawa

Kendang Jawa merupakan alat musik tradisional Jawa dalam kesatuan ensambel gamelan Jawa, yang biasanya dimainkan untuk acara tradisi. Kendang Jawa memiliki tiga bagian berdasarkan ukurannya yaitu *bem* (besar), *batangan* (sedang) dan *ketipung* (kecil). Melalui kemajuan teknologi perekaman, pengembangan dan pelestarian kesenian musik Nusantara dapat terus digiatkan. Kualitas perekaman sangat ditentukan oleh penempatan mikrofon yang digunakan. Sedikitnya kajian terhadap pentingnya tata letak mikrofon dan jarak dalam perekaman kendang Jawa menjadi masalah yang memerlukan perhatian. Tujuan penelitian ini adalah mengevaluasi penilaian subjektif naracoba terhadap teknik perekaman stereo pada kendang Jawa. Metode kualitatif digunakan untuk menganalisis preferensi naracoba ahli dan non-ahli. Perekaman 16 sampel audio dilakukan menggunakan empat teknik perekaman stereo yaitu XY 90º, AB, ORTF dan Mid-side dengan empat variabel jarak di Studio Lokananta, Surakarta. Sampel perekaman diujikan secara subjektif terhadap 40 naracoba. Studi ini mengungkapkan bahwa preferensi naracoba ahli dan non ahli adalah teknik XY 90º. Sebanyak 73% naracoba ahli menyukai perekaman kendang Jawa dengan teknik XY 90º pada jarak 1 meter. Kejelasan bunyi yang tinggidan citra stereo seimbang merupakan faktor krusial pada teknik ini. Hasil penelitian ini berkontribusi pada pemahaman bahwa aspek impresi ruang dan waktu dengung yang rendah menjadi salah satu kriteria dalam menentukan kualitas bunyi perekaman kendang Jawa.

**Corresponding author*
Received: February 24, 2021; Accepted April 14, 2022; Published April 19, 2022
https://doi.org/10.31091/mudra.v37i2.1911

INTRODUCTION

Javanese kendang is a musical instrument found in Javanese gamelan in which the main functionality is as the rhythm regulator. The Javanese kendang is played by hitting the face using the musicians' bare hands and no use of other tools. Javanese kendang are classified depending on their size, namely *bem* (largest), *batangan* (medium), and *ketipung* (smallest) (Setyawan et al., 2017). With these size classifications, the Javanese kendang are played as a single unit in a Javanese gamelan ensemble during live performances or at the time of recording.

The recording method in principle consists of a multi-microphone method as well as a close microphone method, each method having different sound impression characteristics. The close-range microphone method, commonly used in popular music genres result in a more artificial recording. On the other hand, the multi-microphone recording method is widely used in classical music genres, big band, orchestra, and traditional music, which results in recordings that has greater natural impressions of reality (Izhaki, 2012; Roblom et al., 2013).

In general, the recording of Javanese kendang is carried out using a close-range microphone technique, this results in a more intimate recording and minimizes the effect of sound reflections in the place of recording. This causes the spatial illusion that the stereo image, stereo localization of the sound source, and the distance/depth of the sound source to the listener cannot be formed (Moylan, 2007).

Simanjuntak & Hansen, (2021) analyzed the preference for recording stereo techniques on Javanese drum instruments in the context of jazz music. A subjective test was carried out using 16 samples of kendang recording through stereo techniques XY90º, XY120º, ORTF, and AB. The results identified that the aspects of equilibrium, timbre, and clarity are necessary in determining the quality of the recording.

The investigation of the application of stereo techniques in gender, bonang, and peking gamelan was conducted by Sebastian & Simanjuntak (2020). Stereo techniques XY90º, NOS, AB, and ORTF were used to record 24 samples that were tested subjectively. This study found that the NOS technique was highly favored. Reverberation, separation, and stereo image are fundamental factors for determining recording quality. An interesting finding from the angklung toel research conducted by Susanto (2020) revealed that the XY90º stereo technique was preferred by the majority of participants. The natural sound of bamboo is the main criterion in determining the recording quality.

The purpose of the study is to evaluate the participant's subjective assessment of stereo recording techniques on traditional Javanese kendang musical instruments. Experimental methods, preference tests, and interviews were used to perceptually test the sample against expert participants to investigate the criteria used in selecting sample preferences.

This study explores the subjective investigation that determines the recording quality of Javanese kendang in the context of stereo recording.

METHODOLOGY

Sample Recording and Setup

Javanese kendang were recorded at the Lokananta studio, Surakarta. The intent was to produce a sample recording of Javanese kendang which will then be tested subjectively. The components of the Javanese kendang that are played in this recording include each component of the Javanese kendang, namely *bem* (largest size), *batangan* (medium size), and *ketipung* (smallest size). Each of these components were played to adequately provide an overall interpretation of the Javanese kendang sound to the listener. Javanese kendang musicians, who already have at least 10 years of experience playing Javanese kendang, were asked to play the Javanese kendang in a fast rhythmic pattern for 60 seconds.

The stereo microphone techniques used in the recording were XY90º, AB, ORTF, and Mid-Side. These techniques are some of the common stereo techniques used in recording natural characteristics. Four different distance variables, namely 0.5 meters, 1 meter, 1.5 meters, and 2 meters, were applied to this sample recording to obtain differences in sound perception between direct sound and reflected sound (Figure 1). The total recording samples produced were 16 units.

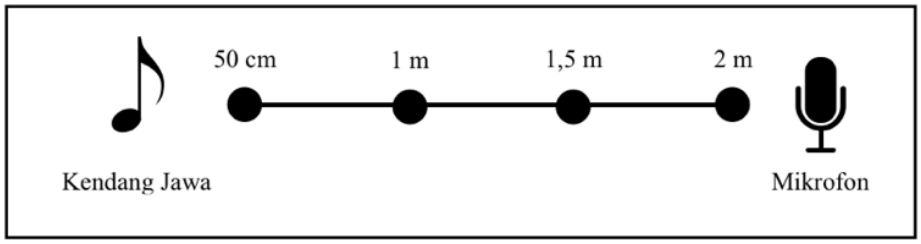

Figure 1. Four Variables Distance of Javanese Kendang to Microphone.
(Source: author, 2020)

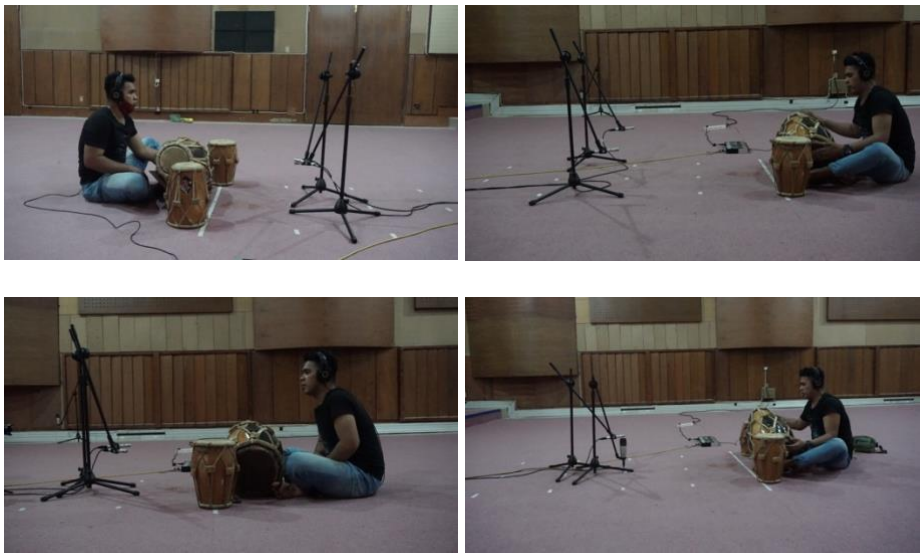

Figure 2. The layout of the microphone against the Javanese drum in sample recording.
(Source: author, 2020)

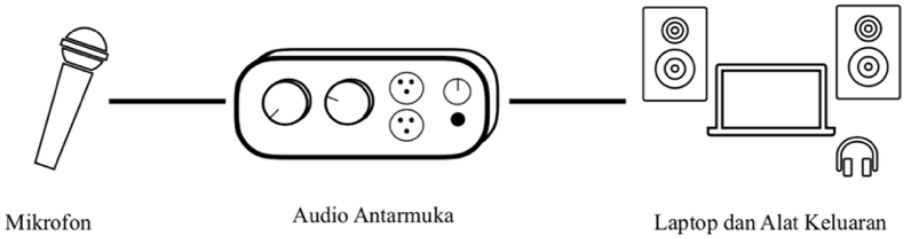

Figure 3. Diagram of the Javanese drum sample recording system.
(Source: author, 2020)

Players play a set of Javanese kendang in a cross-legged sitting position. The three kendang in sequence from the player's left, namely the *ketipung*, the *bem*, and the *batangan* are in front of the player. The *bem* is placed horizontally, while the *ketipung* and *batangan* are placed vertically to the left and right of the bem, respectively (Figure 2).

Two kinds of microphones were used in this sample recording. The cardioid polar condenser microphone which has a frequency range of 50 Hz-20,000 Hz, a frequency response with a flat curve in the 200 Hz-400- Hz range and has attenuation below 100 Hz as well as amplification at a frequency of around 8000 Hz, as shown in Figure 4.

A condenser microphone with a bidirectional polar pattern is used in the application of the Mid-Side technique. This microphone has a frequency range of 40 Hz-18,000 Hz with a frequency response curve as shown in Figure 5.

Subjective Test

The audio samples from the recordings that have been given names will then be subjectively tested on 40 participants. Participants were asked to give

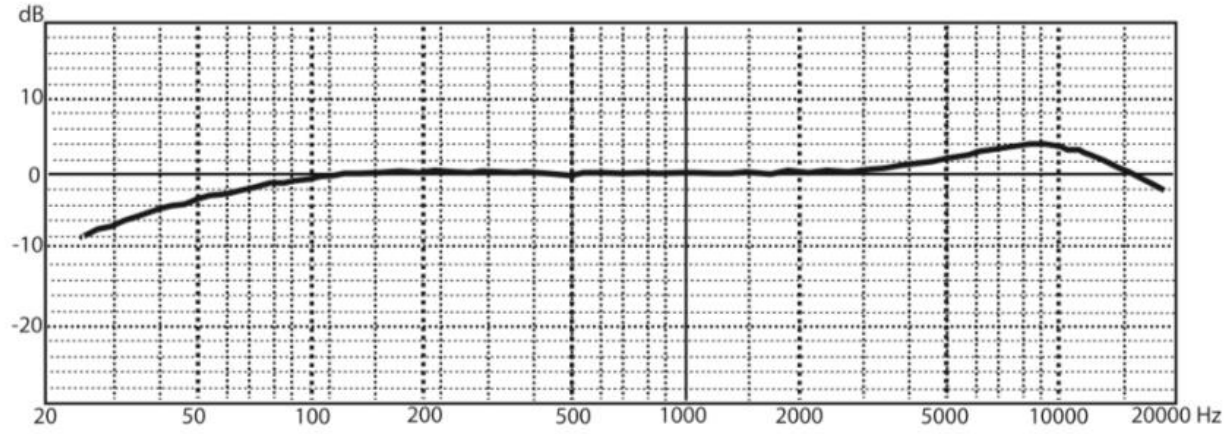

Figure 4. Frequency Response of Cardioid Polar Pattern Condenser Microphone.
(Source: https://www.ageofaudio.com/en/four-entry-level-comparison-microphones, 2020)

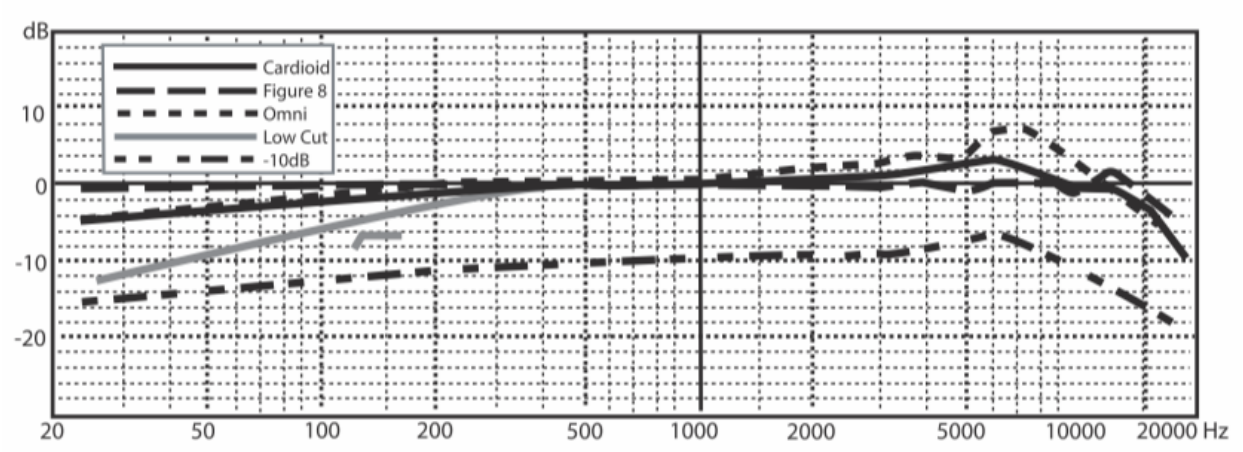

Figure 5. Frequency Response of Bidirectional Polar Pattern Condenser Microphone.
(Source: https://www.audiomentor.com/reviews/samson-co3-review-budget-recording-studio-microphone/, 2020)

an assessment using a scale of 1-5, ranging from Very Poor to Very Good. Furthermore, expert participants were then interviewed to examine the parameters used in determining the assessment of the sample of Javanese drum recordings being tested.

Participants

Participants were divided into two categories, namely experts and non-experts. The criteria for expert participants are traditional musicians who have 10 years of career experience, as well as experts in the field of sound with a minimum education of a bachelor's in the field of sound. The criteria for non-expert participants is someone who has played a Javanese drum instrument for less than 10 years, is not a traditional musician, and is not a graduate of art in the field of music.

Test Procedure

At the testing stage for participants, testing was carried out independently in consideration of the research conditions that occurred during the time, specifically, the COVID-19 pandemic. The audio sample data was to be downloaded independently by the participants from the Google Drive online storage page. Furthermore, the sample will then be listened to with headphones or monitors from each participant. Participants were also asked to fill out a questionnaire form that aims to identify the listening duration, listening device, as well as the price range of listening devices. The aim is to determine the competence of the participants, and the quality of the listening device used in this subjective test, which also affects the hearing perception of the participants.

This subjective test is carried out by filling out a questionnaire online through the Google Form page that has been provided. The questionnaire given contains a sample assessment column using the Likert scale with five ratings and a brief reason for the assessment column. Uniquely for expert participants, online interviews were conducted using the Zoom software. This interview was conducted to obtain reasoning and insights in more depth regarding the discussion of the subjective tests conducted on expert participants. After the interview is conducted, the interview will be automatically recorded from the Zoom software and a transcript of the interview will be carried out.

Furthermore, the probability value of a sample that has been tested is calculated using the following equation:

$$P(S) = \frac{X}{n}.100\%$$

where P is the probability of a score category S, X is the number of voters for a score, n is the total number of participants.

DATA ANALYSIS AND INTERPRETATION

The intention of the subjective test was to identify the preferences of the two groups of participants on the recording of Javanese kendang using four different stereo microphone techniques.

The results of the questionnaire revealed that 67.5% of participants had more than 10 years of experience, and 32.5% of participants had less than 10 years of experience. Regarding the price of listening devices, 40% of participants use devices with a price range of Rp. 1,000,000-Rp. 2,000,000, and 32.5% of participants use devices with a price above Rp. 2,000,000.

In subjective testing, the listening device used also determines the audio quality of the Javanese drum recording samples which can influence the participants' decisions. The findings above show that the equipment used is in the semi-professional category with medium audio quality.

Expert Participants Preference Analysis

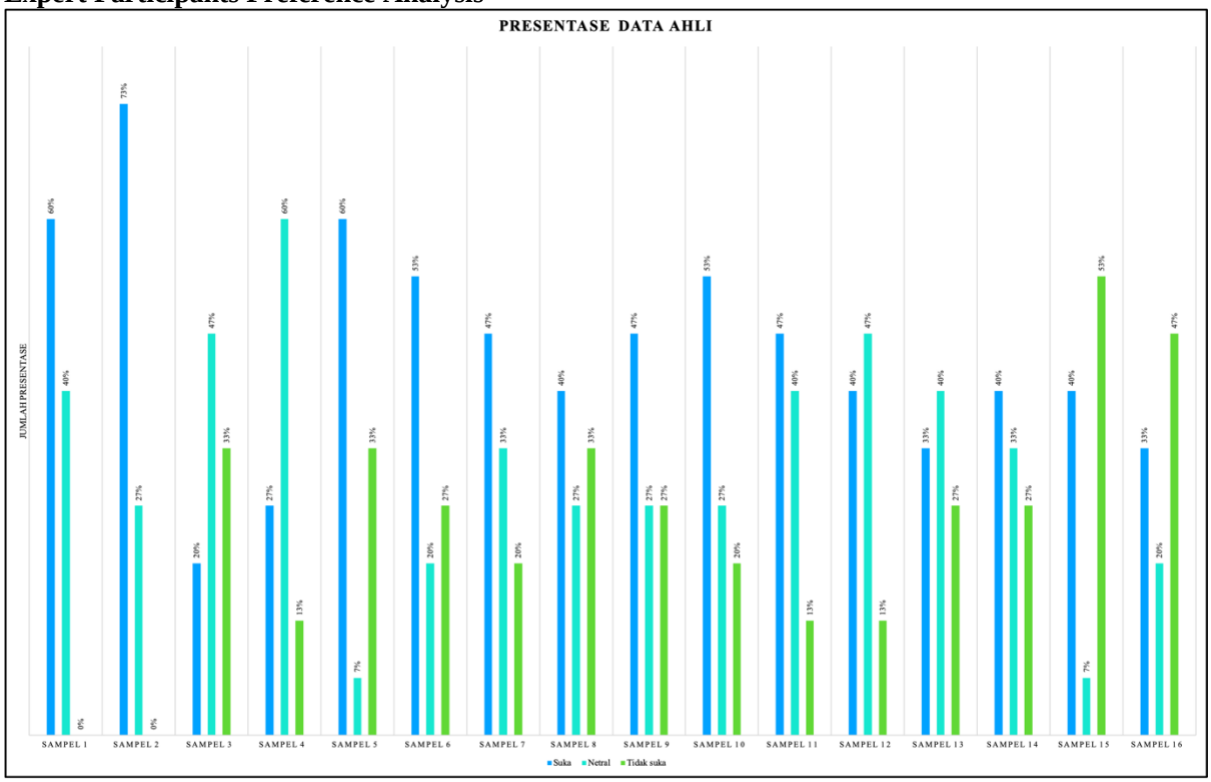

Figure 6. Frequency Distribution Diagram of Expert Group Sample Preferences.
(Source: author, 2020)

Figure 6 shows the preference frequency distribution of an audio sample in the group of expert subjects. Looking at this table, it appears that Sample 2, which is the sample using the XY90º microphone technique with a distance of 1 meter is a highly preferred sample by 73% of participants in the expert group. What's interesting about this finding is that no expert participants stated that they did not enjoy Sample 2. Only 27% of the participants stated that they were neutral. The interviewee explained that the perceived direct sound was more dominant than the reflection. This finding is consistent with the assertion that the technical characteristics of the XY90º microphone do not produce substantial spatial significance (The Ultimate Guide, n.d.). This justifies that one of the essential criteria for a good Javanese drum recording quality is the ratio of direct sound larger than reflection. This means that low reverberation time can provide great sound clarity in Javanese drum recordings. On the other hand, a long reverberation time produces sound reflections that can diminish the clarity of the sound source.

This study supports the findings of Simanjuntak & Hansen (2021) regarding drum stereo recording preferences in jazz ensembles. It was concluded that the XY90º stereo microphone technique was the technique most favored by the expert participants. Aspects of the stereo image, namely the balance between the instruments on the left and right illustrates a clear picture of the kendang, and the perception of low frequencies is a necessary criterion in the selection of this technique. On the other hand, there is a distinction in the investigation of gamelan ensemble stereo recording technique preferences (Sebastian & Simanjuntak, 2020). This study revealed that for gamelan ensemble recording, the XY90º technique was the least preferred. There are several justifications that can explain this, particularly, the need for higher ensemble sound unity, higher reverberation time, clarity, and balance of stereo images.

In contrast, it was found that the Mid-Side microphone technique with a recording distance of 2 meters for Javanese drum instruments was not a worthwhile preference by expert participants, this is indicated by the selection of Sample 16 by merely 47%. The interviewee explained that the perceived frequency content was only in the high-frequency range, there was no clarity in the middle and low-frequencies. Based on this explanation, the implication that emerges is that the Javanese kendang sound *bem* (the largest size) and its low frequency characteristics, are an essential sound in the characteristic of Javanese kendang, which cannot be produced when recorded using the Mid-side microphone technique.

The mid-side microphone technique provides spatial characteristics and flexible stereo spread to obtain a greater low-frequency response; it is necessary to use a polar pattern that is sensitive to the direction of the sound source from all directions (*omnidirectional*), whereas the middle microphone generally uses a polar pattern that is sensitive to the direction of the sound source, approaching from the same direction (*cardioid*) (Mid/Side (Mid/Side). MS) Mic Recording Basics | Universal Audio, n.d.).

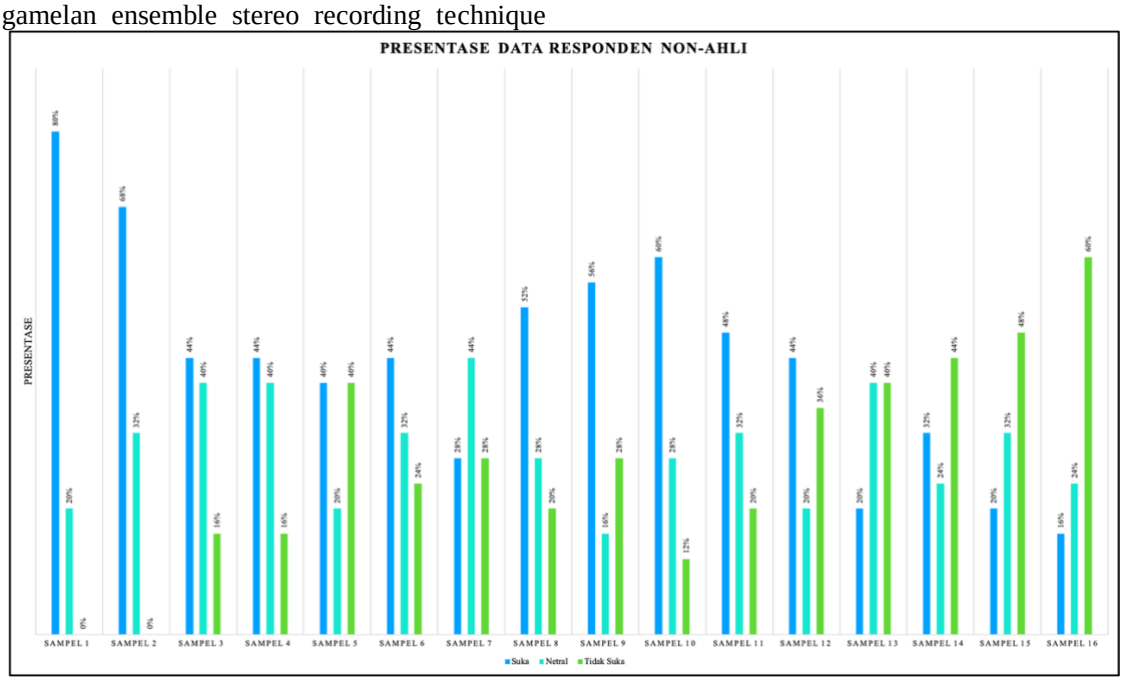

Figure 7. Frequency Distribution Diagram of Non-Expert Group Sample Preferences.
(Source: author, 2020)

Non-Expert Participants Preference Analysis

It was established that 80% of non-experts preferred Sample 1, which is the XY90º stereo microphone technique with a distance of 50 centimeters (Figure 7). This indicates that the clarity of sound, panorama, and transient is very important. Furthermore, it was also revealed that low space reflection is a significant criterion for the percussive sound of Javanese kendang to be perceived with high clarity.

An interesting finding from the image below was that the recording technique that was unpreferable for most participants is the Mid-Side stereo microphone technique with a distance of 2 meters. It was revealed that the low stereo spread, large distance perception, and low tonal balance, especially in high frequencies are more dominant in Javanese drumming, these are some justifications of why the Mid-Side technique is not favored.

CONCLUSION

The purpose of this study is to evaluate the participant's subjective assessment of stereo recording technique on traditional Javanese kendang musical instruments. The most obvious finding that surfaced from this study was that the two groups of participants, both experts and non-experts, chose the XY90º microphone technique as their preference albeit the different distance variables. This study found that clarity, low reverberation time, and left & right stereo image balance are the three significant sound quality attributes in Javanese drum recordings.

Some suggestions for further research are recording in studios aside from Lokananta by paying attention to the reverberation time of the room used, along with further investigation of several other stereo microphone techniques that have not yet been explored in this study. It is also important to pay attention to the deepening of the subjective criteria of artists, experts, and gamelan musicians in determining the quality of the recording and its relevance to acoustic parameters.

REFERENCES

Izhaki, R. (2012). Mixing audio: Concepts, practices and tools (2. ed). Elsevier, Focal Press.Mid/Side (MS) Mic Recording Basics | Universal Audio. (n.d.). Retrieved September 24, 2021, from https://www.uaudio.com/blog/mid-side-mic-recording/

Moylan, William. (2007). Understanding and crafting the mix: The art of recording (2.ed). Elsevier/Focal Press; /z-wcorg/.

Romblom, D., King, R., & Guastavino, C. (2013). A Perceptual Evaluation of Recording, Rendering, and Reproduction Techniques for Multichannel Spatial Audio. *Audio Engineering Society Convention 135*. http://www.aes.org/e-lib/browse.cfm?conv=135&papernum=9004

Sebastian, N., & Simanjuntak, J.A.,(2020). Study of Preference for Stereo Recording Techniques of a Pelog-based of Gamelan Gender, Bonang, and Peking Ensemble. *Proceedings of the 1st International Conference on Interdisciplinary Arts and Humanities* (*ICONARTIES 2019*), 540–546.

Setyawan, D., Arief, A., & Almasjid, A. (2017). Analisis Instrumen Kendang Dalam Karawitan Jawa Ditinjau Dari Nilai Luhur Tamansiswa. *Jurnal JPSD Prodi PGSD UAD*.

Simanjuntak, J.A., & Hansen, A. (2021). Study of Preference of Stereo Recording Techniques on Kendang Instruments in Jazz Ensambles. Proceedings of the 2nd International Conference on Interdisciplinary Arts & Humanities (ICONARTIES) 2020. http://dx.doi.org/10.2139/ssrn.3800572

Susanto, C. (2020). Analisis Preferensi Responden Terhadap Teknik Perekaman Stereo Pada Angklung Toel. S1 Thesis. Universitas Pelita Harapan.

The Ultimate Guide: Stereo Recording Techniques & Setup. (n.d.). DPA. Retrieved September 24, 2021, from https://www.dpamicrophones.com/mic-university/stereo-recording-techniques-and-setups