Experimental Study on Comparison Sound Quality Measurement of Thai fiddle Resonator

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***Abstract*—This work is a scientific experiment report. study how to measure and compare the sound quality of musical instruments. Especially the The Sx dwng or Thai fiddle This is an interesting process for development in term of multiciliary study of art and sciene and also expand Thai 's cultural capital in order to present a sustainable couture to be view on the world stage. This experiment hypothesized the finding of relations between the surface tension values of the python skin that tight-fitting on the resonator and the fundamental frequency values . This will be qualitative indicator in the production of The Sx dwng or Thai fiddle, that is economic and easy to use for the existing musical instrument maker.**

***Keywords*—Musical acoustic, Sound quality, Thai Musical instruments, Sx d̂wng,**

I. Introduction

The Sx dwng is a Thai fiddle that has evolved from an animal catching device called the " Dwng ". It is a cylinder shaped to put prey and lure small animals to eat. Sx dwng is a kind Thai musical instrument. there are 2 strings that resonate with a Treble tone . The Sx dwng has an important component: the Resonator must be made of rosewood or ivory, with a slight bulge in the center. Make it hollow with phyton skin tight-fitting on, punch holes in 2 holes to match the spear. The face is raised with a python skin because it will get a beautiful clear sound. The counterpart is approximately 72 centimeters long, made of rosewood or ivory, which has many components such as the tuning pegs are intended to stretch 2 strings made from tendons or silk, connects the rod and the barrel, which is equipped with the bow made from wood witch horsetail hair stretched between the two string.[4] [6]

The process of creating Sx dwng to have good sound quality depends on the skill of a musical instrument maker in the woodworking and many related craftsmanship, musical instrument maker has the ability to play the musical instrument, it will make the quality of the Sx dwng even better. Before the mechanic could produce the Sx dwng the production process has many steps, in each step consists of different techniques that are unique According to the wisdom of musical instrument maker work gained from teachers and experiences that have been developed and developed by themselves. [2] [5] [6]

Now a day, the raw materials used in the production of Sx dwng are very limited due to the new environmental laws such as The Convention on International Trade in Endangered Species of Wild Fauna and Flora, which makes it harder to find the materials for making Sx dwng. If we be able to develop cultural capital for commercial development,

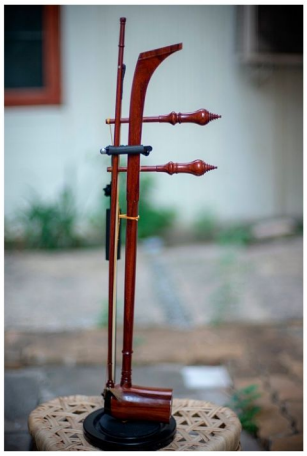

Fig. 1. Thai fiddle (Sx d̂wng)

and also to study, record, and inherit knowledge, concepts of sustainable heritage, therefore, having an idea to use scientific and technological processes to synthesize knowledge in the science of musical instrument construction Especially the Sx dwng to lead to the above goals

II. Background of Study

From the literature review, it has been found that musicologists have been studied in order to record the process of the production of Sx dwng of famous Thai musical instrument makers, in which the research is conducted in ethnomusicology. Record the background of learning how to create musical instruments, how the mechanic was transferred at the time of the research. That musical instrument maker How is the production process. How to use production tools And with evaluation methods How to classify the sound quality of the musical instrument Many reports shown that methods for evaluating the quality of musical instrument makers will use the method of listening to check the standard of the tension of phyton skin by tapping and listening to the sound, each mechanic will have different methods and expertise according to their own aptitude [5] [6]

Regarding research related to science and technology, it is found that the study of the acoustic testing of musical instruments, whether in orchestral instruments That has studied the direction of broadcasting Of that musical instrument What is the direction? The work of Thai music shows that there are attempts to study the process of measuring the shirt to identify the quality of the instrument's sound, whether

978-1-7281-9978-8/20/$31.00 ©2020 IEEE

the measurement methodology to characterize acoustic parameters of Thai fiddle (Sx ̂dwng) ,The Collecting Process of Xylophone's Sound by P. Thinnakorn na ayuthaya The Experimental Study on Sound Characteristics of Ja-Khay Strings by T. Wangwiwattana et al [1] [2] [3] [9] [10]

According to research, it can be summarized as follows: First, the study of the characteristics of the sound of the musical instruments are all have to work in the noise control room, requires measuring tools such as a microphone which has frequency response widely and precisely. As well as using a spectrum analyzer to be able to read the acoustical value of the instrument. Secondly, components that make the identity of the instrument is difference by each musical instrument, whether strings, xylophone bar or a resonator, which the dimension and physical characteristics of the musical instruments. It is important to consider the design of instruments, procedures or systems that will be used in the measurement. For this reason, the researcher has seen the issue that measurement method the research as mentioned above is complicated, inconveniently used for those craftsman or musical instrument maker to use in a factory. [1] [2]

The researcher hypothesized that if the relationship between the fundamental frequency of sound and the tension of the material can be determined, in this case, the tension of the python skin that is tight-fitting resonator, therefore conducted an experiment finding the relationship, if the above assumptions are true, then the instrument for measuring the tension of the material can be made to the musical instrument maker to check the properties of the resonator to make sure that the instrument manufacturers meet. this is an objective method that can be used by general manufacturers of various musical instruments easily.No need to have knowledge of music acoustic audio engineering.

III. Methdology

This experiment wants to investigate the relationship between the fundamental frequency of acoustical property and the tension of the phyton skin. The researcher asked the musical instrument maker, who has 20 years of experience, to make resonators which is made from the same kind of wood from the same origin. The resonators have similar size, with a difference of not more than 1 centimeter That has similar meanings through the production process then use the test method tension of phyton skin, according to the musical instrument maker 's method Inherited, that is, listening from the sound using the ears and judged by the musical instrument maker's experience The musical instrument maker confirmed that The 5 resonators. have the same sound quality is in according the satisfaction of the musical instrument maker, These 5 resonators will be used as an example throughout the experiment.

The experiment process is divided into three parts the first part is to record the audio sample each resonator. used the high quality audio measurement microphone which has frequency respond range of 9Hz – 30kHz omnidirectional polar pattern with sensitivity: 8mV/Pa. connect to professional audio interface and recorded in a digital work station software with 16 bit resolution 44.1 kHz sampling rate. This system is properly calibrated. The recorded audio sample is

Fig. 2. The resonator of Sx ̂dwng

TABLE I
Readable frequency of resonator

Item	1	2	3	4	5
1	750	730	750	730	750
2	730	740	740	720	740
3	750	730	745	720	745
4	750	740	740	720	740
5	730	740	745	730	740
6	750	740	750	740	740
7	725	745	750	745	750
8	735	740	740	750	740
9	750	730	750	740	750
10	750	730	750	740	750
Average	742	736.5	746	735.5	744.5

viewed on audio analyzer software to see the fundamental frequency. Each resonator was excited by a signal generator (pink noise). with the same level of amplitude for ten sample, then calculated for the average value, unit in Hertz

The second part is a test for the tension of the python skin using continuous dial indicators for measuring the tension of the material. This method of measurement of the tension dial indicator is because of the spring used in a dial indicator to push the needle out of the dial housing. The spring has enough strength to push against the pressure of the surface, enough for the needle to move the surface away from the surface of the aluminum base. It doesn't have enough strength to push a hard material like glass or metal away from the base. The dial scale is indicating is the distance of the python skin from the surface of the aluminum base which mean increasing the tension of in this case python skin decreases the amount of pressure countering the needle spring, the distance decreases and is reflected in the reading on the dial scale. Due to the cross-sectional size of ours said the screen is small, only 6 centimeters in diameter, so only one test point was chosen Is the center of the phyton skin the researcher test 10 times per sample. readable data can be seen in Table 2.

From the above data, it can be seen that the measured values for all 10 times of each resonator has the same value without any deviation This data indicate that using the continuous dial indicators to test the tension of the python skin is accurate. Nevertheless, they have to wait for the results from the analysis the relationship between the python skin tension value and the fundamental frequency

Fig. 2. Continuous dial indicators

TABLE II
READABLE FREQUENCY OF RESONATOR

Item	1	2	3	4	5
1	85	85	88	83	86
2	85	85	88	83	86
3	85	85	88	83	86
4	85	85	88	83	86
5	85	85	88	83	86
6	85	85	88	83	86
7	85	85	88	83	86
8	85	85	88	83	86
9	85	85	88	83	86
10	85	85	88	83	86

Fig. 3. tension testing with a resonator

value, which measures how the relationship will be.

In the third step, the researcher will use the information obtained from the experiment to find the fundamental frequency using the measurement process, of the first step, and put that on the chart for comparison. with the second set of data obtained from the experimental results, that use the continuous dial Indicators to find the surface tension of the python skin that is tight-fitting on the resonator as used in the experiment. As shown in Chart 1

IV. DISCUSSION

From the chart data showing the comparison between the fundamental frequency and the measurement of the tension of the python skin with Continuous Dial Indicators, it can be seen that there is a significant connection. However, further studies with the larger sample group should be done more. In

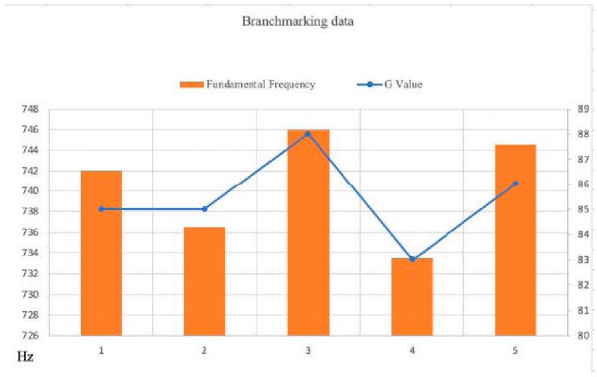

Chart 1. Comparison data set

order to know the deviation of the calibration Even though, the process of measuring tension using continuous dial indicators is not a advance technology, but it is worthwhile tool that efficient and can be used in a music factory easily and economically. During studies, the researcher found that there is a gap in the process with to be cover That is to study of the density of python skin, which may affect the relationship between the fundamental frequency and the python skin tension as measured by continuous dial indicators.

One thing that is pondering is the classification or benchmarking of musical instruments in terms of quality. Idealistic sound quality of the Thai traditional music society There are many minor details that different from each school. In which each school has its own unique identity Using scientific measurements In order to explain the beautiful properties of the sound of Thai musical instruments that should be a way to lead classification or level determination In this regard, social science research may be conducted along as qualitative research in order to find a suitable methodology that is unharmful to. Thai traditions and good beliefs of the Thai music society.

V. CONCLUSIONS

From data analysis concluded that using the Continuous Dial Indicators to find the relationship, between the fundamental frequency of a sound and tendency is works. Although there are some deviations there is a relationship shown quite obvious the researchers plan to expand this concept to experiment with more samples. In order to find the deviation by experimenting at a musical instrument production plant to record the data of more samples. While doing the research, the researchers also saw an issue that could be used to measure continuous dial Indicators to test the correlation in the process of getting the wet skin back, to measure the tension of the skin while drying in order to reduce the loss of python skin is being developed.

REFERENCES

[1] Ayuthaya, P. T. N., Morkonr, A., & Punkubutra, S. (2018). The Collecting Process of Xylophones Sound d (Ranād xek) from Art to Numerical Data. 2018 International Conference on Engineering, Applied Sciences, and Technology (ICEAST).

[2] Ayuthaya, P. T. N., & Sakorntanant, S. (2019). Measurement methodology to characterize acoustic parameters of Thai fiddle (Sx dwng) 2019 5th International Conference on Engineering, Applied Sciences and Technology (ICEAST).

[3] Bucur, V. (2019). Methods for Measuring the Acoustic Properties of Wind Instruments. Handbook of Materials for Wind Musical Instruments, 443– 472.
[4] Eupho, D. (1987). Thai Musical Instruments. Bangkok: fine Art Department
[5] Kongudomsin, W. (2017). Methods Of Making Saw-Duang by Prasit Tasanakorn. Chulalongkorn University.
[6] Pätynen, J., & Lokki, T. (2010). Directivities of Symphony Orchestra Instruments. Acta Acustica United with Acustica, 96(1), 138–167.
[7] Sowadt, B. (1999). The Sound Frequency of Notes Used in the Thai Musical Scale. Bangkok: Reurnkaew Karnphim
[8] Teerapong, K. (2017). Methods Of Making Saw-Duang By Master Manoch Pudpong. Bangkok: Chulalongkorn University.
[9] Wang, L. M., & Burroughs, C. B. (2001). Acoustic radiation from bowed violins. The Journal of the Acoustical Society of America, 110(1), 543–555.
[10] Wangwiwattana, T., Saguanrum, S., Kittimathaveenan, K.,& Pinsopon, U. (2019). Experimental Study on Sound Characteristics of Ja-Khay Strings. 2019 5th International Conference on Engineering, Applied Sciences and Technology (ICEAST).