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Binaural Audio and 360 Video: Immersive Method of Preserving Banten's Culture and History

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Abstract

Visual media is an easy-to-use medium for documenting events, discoveries, and even the culture of a particular country. It's different with audio media, where audio media is very difficult to describe something like a culture without someone having had experiences related to that culture. Binaural audio is an audio system where the system allows a person to record audio that can represent the auditory results of the ear organs. If a person is presented with a binaural audio of a cultural performance, then the audio can simulate a person's perception as if he is at that cultural performance. Over time, the preservation of culture and history is needed so that Indonesian culture and history remain known in this increasingly modern era. The combination of visual media such as 360 Video with binaural audio media is expected to attract people to be more curious about Indonesian culture and history and appreciate it more as well as open the possibility for people with disability to experience the historical location through 360 video or Virtual Reality. This research is a means to documenting and preserve the Chinese Indonesian shrine across Indonesia's island starting from Banten province.

***Keywords**: ambisonics, 360, preservation, acculturation*

Binaural Audio dan Video 360: Metode Imersif Melestarikan Budaya dan Sejarah Banten

Abstrak

Media visual adalah media yang mudah digunakan untuk mendokumentasikan peristiwa, penemuan, dan bahkan budaya suatu negara tertentu. Berbeda dengan media audio, di mana media audio sangat sulit untuk menggambarkan sesuatu seperti budaya tanpa seseorang memiliki pengalaman yang berkaitan dengan budaya tersebut. Audio binaural adalah sistem audio di mana sistem tersebut memungkinkan seseorang untuk merekam audio yang dapat mewakili hasil pendengaran organ telinga. Jika seseorang disajikan dengan audio binaural dari pertunjukan budaya, maka audio tersebut dapat mensimulasikan persepsi seseorang seolah-olah dia berada di pertunjukan budaya itu. Seiring berjalannya waktu, pelestarian budaya dan sejarah sangat dibutuhkan agar budaya dan sejarah Indonesia tetap dikenal di era yang semakin modern ini. Kombinasi media visual seperti 360 Video dengan media audio binaural diharapkan dapat menarik minat masyarakat untuk lebih penasaran dengan budaya dan sejarah Indonesia dan lebih mengapresiasinya serta membuka kemungkinan bagi penyandang disabilitas untuk merasakan lokasi bersejarah tersebut melalui video 360 atau Virtual Reality. Penelitian ini adalah sarana untuk mendokumentasikan dan melestarikan kuil Cina Indonesia di seluruh pulau Indonesia mulai dari provinsi Banten.

***Kata kunci:**. ambisonik, 360, pelestarian, akulturasi*

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INTRODUCTION

Indonesia's local culture and history are rapidly lost due to the era of globalization that is increasingly widespread. The development of technology has also made Indonesia's local culture to disappear mainly because people are more focused on things which make their lives easier. The ethics and local culture of an area in Indonesia are increasingly lost due to the culture of other countries that enter Indonesia. For example, Indonesian classical dances such as Jayengrana Dance from Sumedang have a diminishing interest due to the assumption that classical dance movements are very rigid and strict compared to modern dances that are more concerned with self-expression. Therefore, it is necessary to have documentation media from these various local cultures so that they can be preserved. Visual media is a medium that is very often used to document an event and even a certain culture. This is because through visual media, a person can easily imitate an activity or an object.

A soundscape is the elements of sound which occur at a time in a particular location. A soundscape is the totality of the sound environment with an emphasis on the way the soundscape is received and understood by the person listening to it. The soundscape of a location can be said to be the identity of the location. Each soundscape in a particular location has unique sound elements compared to other places. For example, the Chinatown area in Jakarta is very synonymous with the sound and sound of the Chinatown market and the sound of Chinese songs. These sounds are one of the characteristics of a location. An event which occurs in a specific location can also be obtained audio through a recording process to become documentation of the event. This research is designed to be a means of archiving various historical locations in Indonesia with binaural audio and 360 video as a method of recording audio-visual archives of the location.

Alison introduced the term binaural in 1861 as an explanation that there are two ears involved in human hearing. The term binaural was still used until 1970 where the term was used for a technique with the reproduction of two signals intended for two ears. There is a term where a system that produces a sound with two channels is called stereophonic and binaural. The two terms were first combined by Bell, when he wrote about the "stereophonic phenomena of binaural audition" (Long, 2006).

Binaural has the potential as a very useful and interesting medium (Cook, 1953). When hearing music with both ears in a concert hall, one will hear a basic proportion of musical vocals that reverberate all the way to the musical vocals directly depending on the position they are sitting in. This gives the idea that the dimensions and acoustic character of the hall are continuous with visual impressions (Cook, 1953). When sound is recorded binaurally, events that occur

next to or behind our heads will be clearly localized. The source of the sound located in front sounds like it is coming from inside our heads, overhead, or even behind (Long, 2006).

Virtual Reality (or 360) video content has recently become very popular in the media industry as it allows viewers to experience the content in an immersive and interactive way. A 360° professional video camera captures the entire viewing sphere and makes stitched video output typically in stereoscopic 4K, 8K and stereoscopic 6K equirectangular formats (Takacs et al., 2019). For the younger generation, immersive VR is more effective than mobile smartphones in inducing positive emotions. VR will probably soon be as popular as TVs and smartphones today in people's daily lives (Liu et al., 2020).

The history of the growth and development of the city can be a reference for starting an effort to preserve and conserve activities for some historical old city areas. By studying the history of the development of a city or area, it will be possible to see historical old city areas which have the potential to be developed and improved activities (Pawitro, 2015). The older the age of an old city area, the more developed the history of the region will be (Pawitro, 2015).

Chinese Indonesian Shrine History

Boen Tek Bio Shrine is in Tangerang City, Banten Province. The shrine has an address at Jalan Bhakti No, 14, Sukasari Village, Tangerang District, Tangerang City, Banten Province. Boen Tek Bio Shrine was established around 1684 which was founded by the residents of Kampung Petak Sembilan. At first, the temple building still used semi-permanent materials, but when in the early 17th century the trade routes around the Cisadane river area began to become crowded, the temple buildings underwent changes (kebudayaan.kemdikbud, 2022).

The name "Boen Tek Bio" has a literal meaning, namely Boen (fortress), Tek (Virtue), and Bio (house of worship). Overall it means a place or container for literati who have wisdom. There are two other shrines located in the Tangerang area, including the Boen San Bio Shrine and the Boen Hay Bio Shrine. When associated with the two shrines, they have a philosophical one, namely virtue as high as a mountain and as vast as the ocean (kebudayaan.kemdikbud, 2022). Boen Tek Bio Shrine is the oldest shrine in Chinatown, Tangerang City. Its presence cannot be separated from the arrival of the Chinese people who eventually became known as the "Citadel Chinese" (indonesiakaya, 2022).

Boen Hay Bio Shrine was founded in 1694 and is the oldest shrine in Serpong, South Tangerang. When passing through the gate of Boen Hay Bio Temple, visitors can see an ornament in the form of a giant crab. The shrine is dominated by red and this building also has various other ornaments such as dragon carvings, large dragon statues, and hong birds which have meaning on each of these

carvings. The shrine is one of the cultural heritages in Tangerang, Banten (direktoripariwisata, 2022).

Boen San Bio is a shrine located on Jalan K.S. Tubun No. 43 Pasar Baru Village, Tangerang City. The shrine has a short distance from the Boen Tek Bio shrine (kebudayaan.kemdikbud, 2022). The Boen San Bio Shrine was built in 1689 by Lim Tau Koen, a Chinese merchant. The purpose of the construction of this shrine is as a location to place a statue of Kim Sin Khongco Hok Tek Tjeng Sin originating from Banten (kebudayaan.kemdikbud, 2022). Boen San Bio Shrine originally used bamboo matting for walls and rumbia leaves with wooden support poles for the roof, five years before Lim Tau Koen built it using sturdier building materials (indonesiakaya, 2022). At first the visitors to this shrine mostly came from Chinese merchants who lived around Pasar Baru. About 10 years later, the Boen San Bio society was founded which was the forerunner of the establishment of Nimmala Vihara (kebudayaan.kemdikbud, 2022).

MATERIALS AND METHOD

Cultural and Historical Preservation Site Selection Stage

The selection stage of cultural and historical preservation sites for the Tangerang and South Tangerang areas will be carried out based on several criteria:

1. The location is a traditional market or shrine which has historical and cultural elements in the Banten area (Tangerang or South Tangerang)
2. The location can be easily accessed.
3. The stronger the historical and cultural stories bound by the location; the location becomes a top priority with a maximum limit of years of establishment before 1942.

Each of these criteria will be applied to each location obtained through literature studies or through field research. Each location will be documented from a single point which is used as a position for recording binaural audio and 360 video.

Binaural Audio and Video 360 Recording Stage Planning

At this stage, Binaural audio and 360 video recording will be done using a Gopro Max 360-camera. The recording stage of the audio and visual will be divided into three times, namely morning, afternoon, and night with the following time division:

1. Morning: 8:00 – 9:00
2. Noon: 11:00 – 12:00
3. Evening: 19:00 – 20:00

This time division is determined based on the level of activities that occur at the location where morning is the time with low activity towards high and the evening is the time with low activity where people start to rest. The recording hours are selected based on the hour each activity starts (8:00 in the morning when most of the public starts working) Recording will be done for 30 – 45 minutes at each location point. Everything that happens during the recording process will still be recorded as is without any editing (the recording will be conducted on another day if the current day is raining).

After the audio and visual recording process at each location is successfully carried out, the results will be processed using software. The audio produced by the binaural microphone will be combined with the visuals that have been recorded with a single point on the part in the video as the key point of binaural audio. The results of the binaural audio will be processed through software such as Adobe Premiere Pro so that all sounds and sounds can be processed into Ambisonic audio.

RESULTS

Binaural Audio and Video Recording 360 Boen Tek Bio Shrine

Boen Tek Bio Shrine is a shrine with open space and has a large courtyard so that the position of the 360-camera can be placed in the middle of the courtyard. At the location of the Boen Tek Bio Shrine, the recording process will be carried out in two ways as an experiment in the recording method.

Figure 1. Camera placement position 360 at Boen Tek Bio
Source: Author (21/09/2022)

Recording is done using Gopro Max which will capture audio and visuals in 360 degrees as well as Binaural audio recording using Zoom H4N and Roland CS10-EM placed on a pair of OpenBinaural artificial ears designed by CarlosGS and made using a 3D Printer.

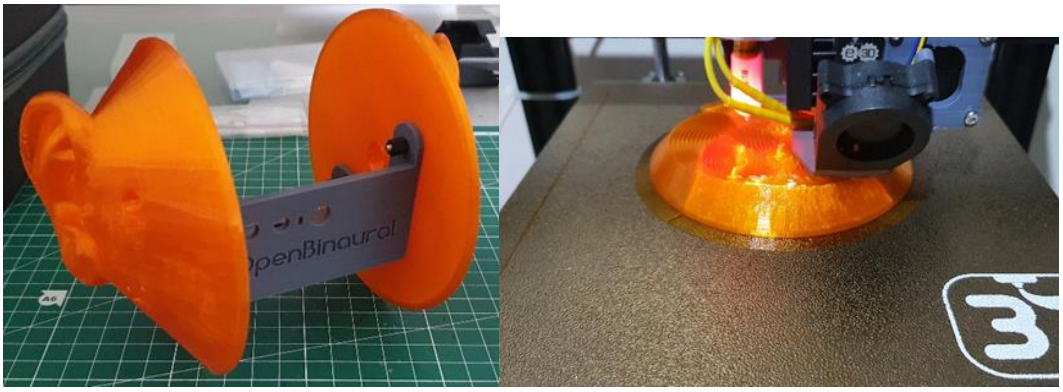

Figure 2. Artificial Ears on 3D Printer Creality Ender 5 Pro
Source: Author (07/09/2022)

The recording process is carried out at 9:00 am with a duration of 30 minutes without any changes during the recording process. The Gopro Max and Zoom H4N and artificial ears are attached to a camera stand and then placed in the middle of the grounds of the Boen Tek Bio Shrine (Figure 1).
Recording is also carried out at 11:30 noon and at 19:00 at night by placing the camera stand as well as the Gopro Max and the artificial ears in the same position as the recording position in the morning.

Figure 3. 360-camera placement position at Boen Tek Bio daytime
Source: Author (27/09/2022)

At night, Boen Tek Bio Shrine experienced an increase in visitors because people could visit the shrine to perform worship after work.

Figure 4. 360-camera placement position at Boen Tek Bio nighttime
Source: Author (27/09/2022)

When the evaluation of the recording results from the Boen Tek Bio Shrine was carried out, it was found that the recording results using the H4N Zoom with the Roland CS10-EM and artificial ears did not have good quality for use with the visuals of the Gopro Max. The recording result of the Zoom H4N has a high level of noise generated by the tool itself which then it was decided that for the next location, the recording process will only use Gopro Max to get 360 audio and visual data.

The recording process at the Boen Tek Bio shrine experienced several obstacles, including:

1. Recording is done in the rainy season so that the weather during the daytime recording process looks like the afternoon.
2. The location of the shrine which does not have a roof for the grounds makes the 360-camera easy to heat up because it is exposed to direct sunlight, causing the camera to automatically turn off the system.
3. The constraints on point two caused the recording session to be carried out another day because the predetermined time was passed.

Binaural Audio and Video Recording of 360 Boen Hay Bio Shrine

Boen Hay Bio Shrine is a shrine located in a small alley with a parking lot and a school on the left side of the shrine. Boen Hay Bio Shrine has a small gate and a location that is not too spacious. The entire area of the shrine is covered by a roof so that the location is quite safe from rainy weather. In this shrine, the recording position will be carried out under the main gate of the shrine. This is also because it is an effort to appreciate the shrine and the devotees who want to do worship so that the recording position does not cross the outer boundary of the prayer room.

Figure 5. Boen Hay Bio 360-camera placement position
Source: Author (07/12/2022)

The recording process is carried out at 8:05 am with a duration of 30 minutes without any changes during the recording process.

Figure 6. Boen Hay Bio's 360-camera placement position under the gate
Source: Author (07/12/2022)

The afternoon session for recording at the Boen Hay Bio shrine was conducted at 11:00. The recording process did not run smoothly due to technical problems with the camera so that the recording duration could not be done for 30 minutes.

Figure 7. 360-camera placement position at Boen Hay Bio nighttime
Source: Author (07/12/2022)

The recording process at night was carried out at 19:35 because the rain was still occurring until 19:25. Wednesday, December 7, 2022, is the night of Cap Go, so many Chinese people who adhere to the Confucian religion come to the shrine to worship.

The recording process at the Boen Hay Bio Shrine experienced several obstacles, including:

1. The recording process experienced some technical difficulties. The 360-camera suddenly stopped the recording process repeatedly which caused the recording needs to be repeated. Due to the technical difficulties, the morning session time was slightly missed.
2. Battery changes due to the battery running out and full SD Card capacity causing the recording to be slightly hampered which means the recording data must be sorted out to be able to record again,

Binaural Audio and Video Recording of 360 Boen San Bio Shrine

Boen San Bio Shrine has a location not far from the Boen Tek Bio shrine. Boen San Bio Shrine has a large courtyard covered with a roof in the position where the incense barrel urn is placed.

Figure 8. Boen San Bio shrine grounds
Source: Author (08/12/2022)

Figure 9. Boen San Bio 360-camera placement position
Source: Author (08/12/2022)

The recording process is carried out at 9:00 am with a duration of 35 minutes without any changes during the recording process. The camera is positioned in the center of the court at a distance about 2–3-meters from the position of the incense barrel urn. Recording was also made at 12:05 noon.

Figure 10. The position of the main road to the Boen San Bio shrine
Source: Author (08/12/2022)

The recording process at the Boen San Bio shrine went quite smoothly, only experiencing several obstacles, such as:

1. The recording result was a little noisy because the position of the Boen San Bio shrine was on the side of the main road as shown in figure 10.
2. The recording schedule has repeatedly changed due to the rainy weather that does not allow for audio or visual recording.

Binaural Audio and Video Recording 360 Old market Tangerang Banten

Tangerang old market is a market where the location consists of a large street with shops on the left and right sides of the road. Once upon a time, Tangerang old market started from a large gate at the end of the street with the words "old market culinary area", but the gate was removed and replaced with a small stage with the words “Old market area” on the left side of the gate. The recording process will be carried out at a location point in front of a store called Tehe Bistro.

Figure 11. Tangerang Old Market 360-camera placement position
Source: Author (08/12/2022)

The recording process is carried out at 8:00 am with a duration of 35 minutes without any changes during the recording process. The camera is positioned on a sidewalk in front of the Tehe Bistro store.

Figure 12. 360-camera placement position at Tangerang Old Market daytime
Source: Author (08/12/2022)

Recording is also carried out at 11:30 noon by placing the camera stand and camera 360 in the same position as the recording position in the morning. The recording situation at 19:00 at night experienced a significant change because at night, the location of the old Tangerang Market became a culinary tourism location where along the market street was filled with market snacks and street vendors. This caused the placement position of the 360-camera to change from the placement next to the sidewalk to above the pavement (Figure 13).

Figure 13. 360-camera placement position at Tangerang Old Market nighttime
Source: Author (08/12/2022)

The recording process in the old Tangerang Market took place quite quickly, only experiencing several obstacles, including:

1. Recording is done in the rainy season so that the weather during the daytime recording process looks like it is being done in the afternoon.
2. Recording at night must undergo a 360-camera position adjustment (exceeding the normal height of the standing position) because many street vendors fill the streets of Tangerang old Market (Figure 13).

Binaural Audio and Video 360 Post Processing Stages

The post processing of 360 audio and video can be started when the recording data has been obtained from the shrine recorded using the 360-camera. The form of data obtained is 360 data. Any data that has been obtained must first be processed using the Gopro App so that it can be converted into MP4 data format. After all the data is converted into MP4 format, the data can be edited and processed using Adobe Premiere Pro software. The first step when opening Adobe Premiere Pro is to create a new project and select the data from the recording results on location.

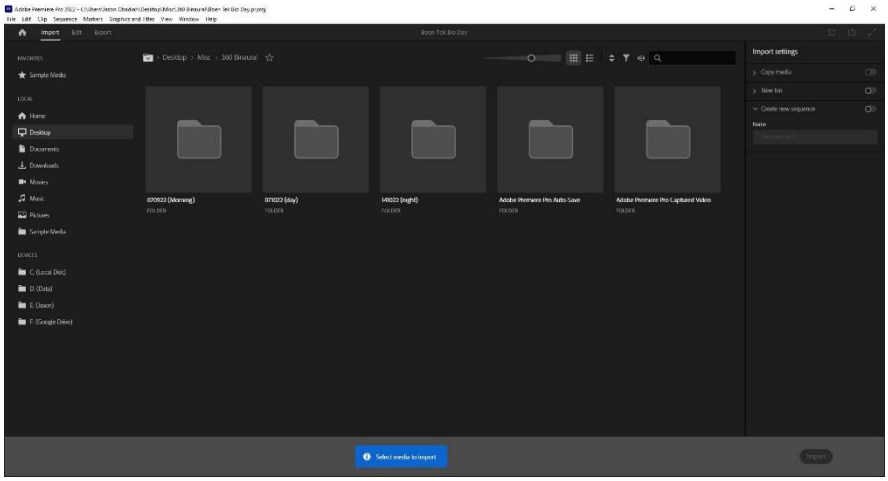

Figure 14. Adobe Premiere Pro project creation
Source: Author (18/12/2022)

After the creation of a new project is complete, it can be continued with the creation of a new sequence intended for 360 and VR by selecting the Sequence menu in the Tab at the top then New Sequence. When the new menu window is visible, the next step is to select *VR* in the *Sequence Presets* section, which can then be selected *stereoscopic 29.97* and then *4096 x 4096 – Ambisonics* options. If the *4096 x 4096 – Ambisonics* option is not available, it can be replaced with another one if the option has the term Ambisonics.

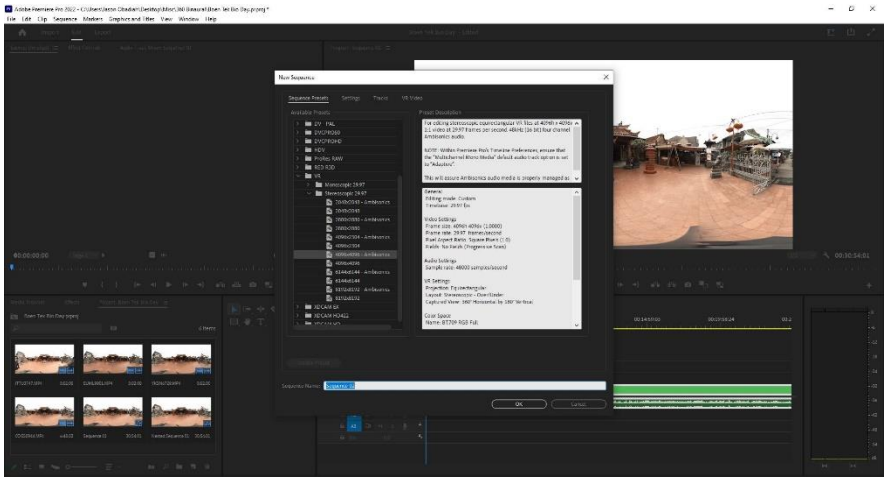

Figure 15. New Sequence for VR creation
Source: Author (18/12/2022)

When the Sequence for VR has been created, it can be continued by entering video data into the Sequence. When video data is entered into a Sequence, there are times when a warning arises stating that the Sequence settings are different from the settings in the video data. If this happens, the *Change Sequence Settings* option can be selected (Figure 16).

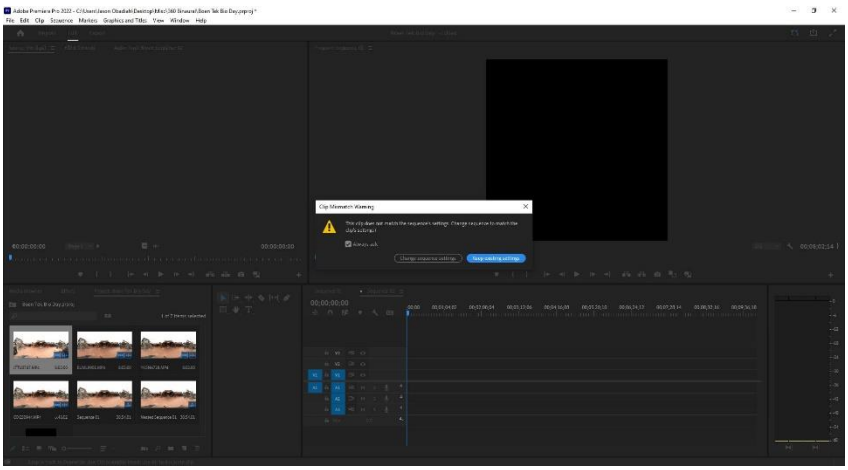

Figure 16. Change Sequence Settings warning
Source: Author (18/12/2022)

Before proceeding to the next stage, one of the settings of the software must be ensured that the software can carry out the editing process for Ambisonics type audio. The menu can be accessed in the *Edit* menu, *Preferences* then *Timeline*. In the *Timeline* menu section, the *Multichannel Mono Media* section must be ensured that the *Adaptive* option is selected.

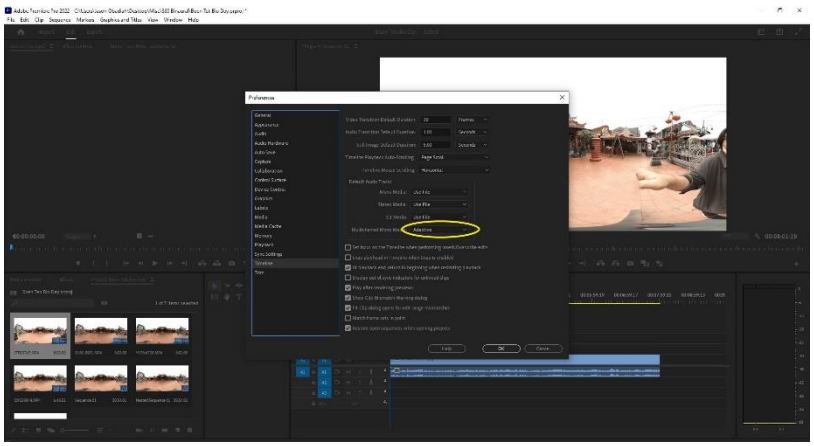

Figure 17. Multichannel Mono Media configuration
Source: Author (18/12/2022)

After all the above settings are completed, the editing process of the video data that has been obtained from the 360-camera can be started. Since the 360 GoPro Max camera will automatically cut every duration of the recording data carried out into a maximum of eight minutes, it must be combined into one data according to the order in which the video data was obtained.

The next stage is to export the data so that the edits that have been made can be played as 360 or VR data. In the software, select the *File* menu then *Export* and then *Media*. When a new menu arises, open the *Video* section and click on the more section. After the section is clicked, an additional menu will appear and the *Video is VR* checkbox should be selected (Figure 18).

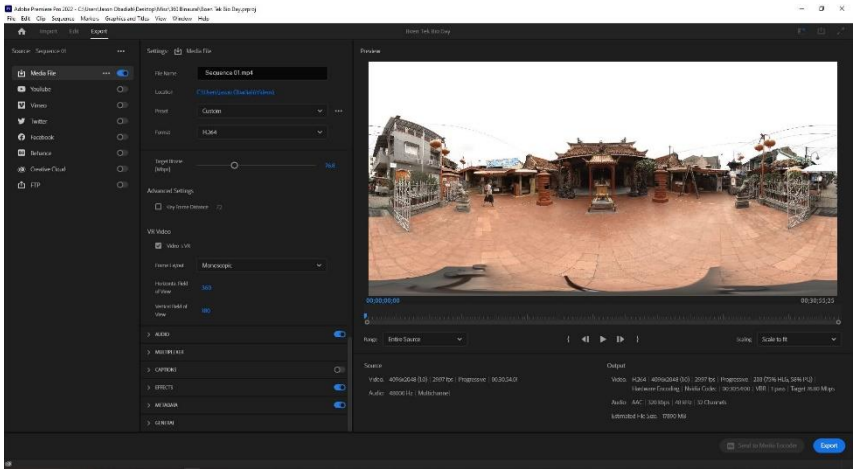

Figure 18. Video is VR configuration
Source: Author (18/12/2022)

For the Audio menu section, the settings which must be done are in the *Channels* section where the settings must be changed to *4.0* and in the more section

where after the section is clicked, the *Audio is Ambisonics* checkbox must be selected.

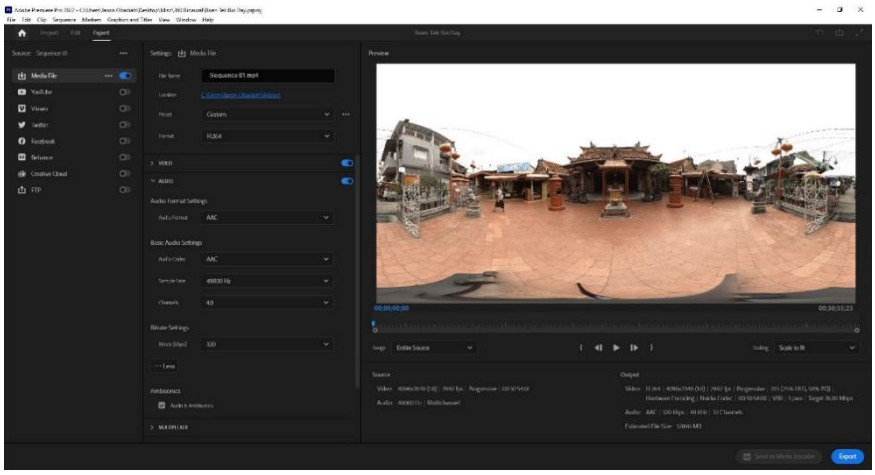

Figure 19. Audio is Ambisonics configuration
Source: Author (18/12/2022)

If the *Audio is Ambisonics* checkbox is not seen when setting up the Audio menu section, then the data format needs to be changed to *Quicktime* and then change the *Audio Channel Configuration* to *4 Channels* (Figure 20).

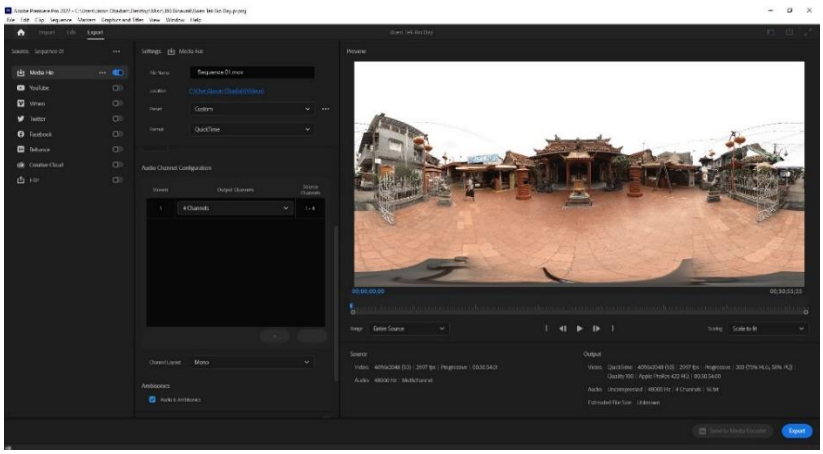

Figure 20. Audio is Ambisonics alternative configuration.
Source: Author (18/12/2022)

DISCUSSION

The usage of 360 camera to capture the moment in real time have few difficulties. While the atmosphere and the ambience of the temple can be captured, the immersive feel of the video cannot be captured perfectly due to the quality of the video and audio played through the conventional screen. For immersive

experiences, a person must use a VR headset which raise another problem. The price of a VR headset is still expensive and not easily accessible to everyone.

CONCLUSION

The use of binaural audio with 360 video is still very rare in Indonesia while the potential in the use of such systems is significantly diverse. Using the immersive 360 video to documented and preserved historical sites and culture, this research has the hypothesis that people can have more appreciation for Indonesian culture with the use of the latest technology to introduce various Indonesian cultures nationally and internationally. These 360 videos and Ambisonics audio data can be converted into VR format. By using the VR headset, these historical and cultural sites can be immersive experienced by the people with disability, especially the people who can no longer have the means to travel.

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