

Optimisation of Live Streaming Process in the Post Covid-19 World

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Abstract: This study documents a relative improvement on sound quality by selected power-users to stream a music performance through a live streaming platform using an improved method. To gather necessary information, a survey was circulated, inquiring users' perceptions and experiences regarding the common steps and methods, the use of third-party programme and difficulties of creating the live stream setup for live performance. Results of the survey determined which aspects of live streaming principles were emphasised in the control test, making any potential improvements upon streaming method of interest to those who took the survey. A control test was formulated, emphasizing the common live streaming methods and technical difficulties encountered by the participants. The control test was taken by five power-users from Malaysia which include a producer, a sound engineer, two freelance musicians and an educator. The resulting data was used as a new basis for improvement in the live streaming processes. Once the control test data was obtained, the next step was to analyse the processes in use and devise more efficient methods of executing them. As the aim of the research is to determine whether an increase in audio or sound quality could be made, a more detailed analysis of a small control group provided the information required to base improvements upon. For a qualitative study of this scope, survey and control testing were identified as being suitable collection methods.

Keywords: Performance, live stream, audio quality, methods, optimization

Introduction

The Covid-19 pandemic has affected and changed the economic landscape globally. In Malaysia, several companies and business premises were shut down, which has caused many people losing their jobs. This is the implication when industries and key sectors that contribute to the Malaysia's economic growth were interrupted and temporarily immobilised for almost three months due to the implementation of the Movement Control Order (MCO) by the government. To be specific, one of the affected sectors identified is the entertainment and live music industry. This is because all the concerts, performances and live events scheduled early March until now were and are being postponed or cancelled to ensure the safety of the public. Since we are in the information age, local industry players should make full use of the existing technology in ensuring the continuity and sustainability of live music industry in Malaysia especially during this Coronavirus outbreak.

Nowadays, it seems that the live streaming technology is developing constantly; we have various media such as YouTube Live, Facebook Live, Twitch and just to name a few. The demand is increasing as more and more people are using it for broadcasting, business, Esports, gaming videos and as an essential marketing tools to earn money. Recently, one of the top K-Pop superstars, BTS has hosted a virtual concert and managed to attract about 756,600 viewers from 107 different regions. It is known that the single virtual concert has generated almost \$20 million in ticket sales (Stassen, 2020). Another example is Devin Townsend, heavy metal composer and performer from USA who gained \$45000 and \$81000 in his first and second quarantine concerts respectively (Grech, 2020). What is striking is that it was a one-man show and the performances were done in his house and live streamed through YouTube Live and using several third-party programmes.

Problem Statement

In Malaysia, the livestream concert did not fully realise its potentialities in keeping the live music alive, especially during the lockdown. Besides, this helps to generate income and diversify revenue of the live music industry. However, as an audience, this does not mean that livestream concert can replace the feel and satisfaction of watching a live concert or performance. One of the main issues in streaming a live concert is the poor quality of audio produced. This is due to the absence of proper process, tools and third-party programmes for sound editing and mixing.

Live stream has become one of the important online platforms in broadcasting any sort of event, reaching thousands of people with the use of only mobile phone or computer. However, there is a relative difference in the process and outcome between streaming a live musical performance and other live events. Concert live streaming deals with aspects of producing audio and sound which realise the objective of having the normal live musical concert—to perform music in front of a live audience. Therefore, the main purpose of having the live concert livestreamed is to ensure that the concert can still be organised via online platform which audiences can stream the concert anywhere at their convenience and at the same time a decent quality of audio and performance can be produced, same quality as the recorded performance. Moreover, in this digital age, online platform is seeming to be more accessible to the public and community, and widely reach more audience compared to the normal live concert. But one may ask: “Why not do a recorded concert instead?” The online streaming medium allows artistes and musicians to live-stream shows and interact (two-way communication) with their audience in real time—which is something that cannot be achieved from any recorded or archival performance. Thus, it offers the audience or viewer the feel of a real concert experience. It can be said that the audience is integrated and engaged into the performance through this medium.

However, without applying proper methods or processes, the sound produced during the live streaming generally will be unclear, unbalanced and lacking clarity. This is the result when the sound input is picked up directly using only the built-in microphone in the laptop or smartphone and there is no other external device involved in the process. Hence, a poor quality of sound output is likely what audiences will hear from their speakers or headphones. When this happens, it will create bad impression and perception towards live stream concert and in terms of public acceptance it will certainly be less favourable compared to the normal live music.

While the area of interface optimisation is vast, this study focuses on two main points of interest related to the streaming process. First, identifying and asserting the optimised methods required to stream a musical performance. Second, determining if the use of OBS Studio to stream a live music affects the audio quality produced.

Objectives of the Research

The primary aim of this research is to determine whether a significant improvement in the audio quality to stream a musical performance through YouTube can be made by using an optimised method. The secondary aim is to find out if the utilisation of OBS Studio in the live streaming process affects the audio quality.

Literature Review

There exists a substantial body of work with regards to the diverse perspectives in live streaming or real time internet broadcast. However, there is not much concentration on the audio quality aspect of live stream. The body of work in this area is continually growing, as new streaming platforms are invented, and new broadcasting software comes into production.

One of the essential publications related to this study is Wes Simpson's *Video Over IP* (2008). This book details a comprehensive foundation in the aspect of transporting your video over internet networks and sheds light on basic technologies, applications, methods for video transport and different forms of video and audio compression involved in video and audio streaming. Simpson emphasises about the importance of making sure that audio performance is comparable to the level of video performance. According to him, studies have shown that people perceive video quality to increase when audio quality is increased. He also discusses some rules regarding the audio quality in the streaming business. For instance, it is crucial to use audio signals and sources that match the application as closely as possible. This is because what might be right for streaming normal conversations may not work well for a musical performance (Simpson, 2008, p.132). Some of the issues stated in the book have been solved by the latest applications and technologies.

Uti and Fox (2012) concentrate on the challenges and benefits of live video streaming originating from cameras and microphones of mobile devices across existing cell phone networks. In their article, Uti and Fox identify various problems that are specific to the compression and streaming of real-time video from mobile devices over cell phone networks.

Another notable book that focuses on the features of live stream capabilities is T. L. Taylor's *Watch Me Play: Twitch and the Rise of Game Live Streaming* (2018). As the title suggests, it gives an insight into the emerging role of live game-streaming, consolidating video game and broadcast cultures. Taylor focuses on the use of a new live-streaming platform; Twitch. She outlines in-depth some ideas on how private game playing can be transformed into public entertainment by using live-streaming methods. Taylor started the discussion of live game-streaming in a historical context explaining how the phenomenon is not new, rather, its existence derived from a logical extension and development of previous broadcast media such as television, radio or game consoles. In fact, there are more historical information of broadcast media than of gaming in the context of live streaming. Additionally, the book also analyses some issues related to the broadcast and participatory culture, which include online harassment on the Twitch platform to the legal challenges that several streamers face.

Erika Pursiainen's *Co-creating an engaging live-streamed concert with potential viewers* (2016) focuses on providing essential aspects and practical tools for musicians and producers to co-create engaging live-streamed concert experiences with the viewers. Based on this study, an engaging live-streamed concert experience can be considered as interplay between different people and audiovisual aspects involved in a live music production that together co-create memorable experiences (Pursiainen, 2016, p.91). Thus, in order to achieve that, one needs to have a proper live-streamed concert production. This production team plays an important role, which will require them to plan strategically and holistically in creating fascinating experiences with the viewers. Findings from this study also suggest that this memorable experience can be formed through the integration of innovative technology like virtual reality into the live-streamed process or production.

The rise of streaming technology has given a new shape to the live music industry as described in an article by Naveed, Watanabe, and Neittaanmäki (2017): "Co-evolution between streaming and live music leads a way to the sustainable growth of the music industry — Lessons from the US experiences". This article explains that the significant adaptation of technology and ICT into the live music industry has contributed in maintaining and enhancing its growth and development. "The advancement of digital innovation such as artificial intelligence, machine learning, fintech, virtual reality, and big data has enabled the sustainability and activation of this co-evolution while leading the live music industry to transform into a "live-concert-streaming music industry" (LCSMI) that enables participative creativity for all stakeholders" (Naveed, Watanabe, & Neittaanmäki, 2017, p.14). It also states that the co-evolution between live music and the increasing popularity of live streaming services could effectively save the music industry in terms of diversifying the income generation activities.

In Ian Paul's *OBS Studio Review: The most powerful screen capture tool money can't buy*; he points out the utilisation of this software with platform like Twitch or YouTube Live to broadcast game streams and capture

gameplay videos. He also reveals how this application was useful to advanced users to help them optimize their setup for streaming or recording video when they first fire up the program. However, such reviews give little to no mention of audio or sound quality of the live stream, be it through Twitch, YouTube Live or Facebook Live platform.

Another review regarding the OBS Studio is Mark Wycislik-Wilson's OBS Studio Review: Everything you need to live stream and record video using multiple sources. The author indicates that OBS Studio is a two-in-one software that is able to do the mixing and editing of multiple screen or video sources. Its features allow you to live stream and mix at the same time (Wycislik-Wilson, 2020).

Summary

Overall, the literature that demonstrate the concepts, core elements, functions, features, benefits and drawbacks of live streaming are currently available. Granted, there are positive aspects. But there are concerning gaps in the literature: sound or audio quality and methods in improving live stream audio quality are not thoroughly discussed.

Research Methodology

There will be two types of data collection methods employed through this research; firstly, a survey and secondly, a control test. The survey will be taken by five power-users who have the experience in live streaming a musical performance through YouTube Live or Facebook Live or any other platform. This survey enquired about a user's perception and experience regarding the common steps and methods, the use of third-party hardware and software, and difficulty of creating live stream for a musical performance. Results of the survey determined which aspects of live streaming principles were emphasised in the control test, making any potential improvements upon streaming method of particular interest to those who took the survey. Participants of the survey were "power-users," defined in this study as users who have the experience and ability to operate the live streaming. The inclusion of power-users was important for credibility of specific methods, and whether or not they were worth comparison. Participants included: a producer, a sound engineer, two freelance musicians and an educator from Malaysia.

Preparatory research involved identifying methods that could provide adequate results to answer the research question. A qualitative study is appropriate for this context, as the results for this research come from computer commands recorded by humans. Due to the time allocated for the completion of this study, it was appropriate to seek qualitative results that were also applicable in a practical context. Using results which give more explicit information about individual processes used by each user will be beneficial in comparison to using a large sample size with less information. Information that will be gathered using the earlier example could be studied in more depth and allowed for a more suitable time frame and adequate results to definitively address the research question. As the aim of the research is to determine whether an increase in audio quality could be made, a more detailed analysis of a small control group provided the information required to base improvements upon. For a qualitative study of this scope, survey and testing were identified as being suitable collection methods.

There were a number of limitations that influenced this project and caused changes to the current iteration of the research question. The original intention of this study was to optimise live streaming methods in broadcasting a music concert as thoroughly and inclusively as possible. These concepts included, amongst others: the use of third-party hardware and software; reduction of production cost in general; and creating new methods of sustaining productivity. As many of these areas require a longer research period to measure, they were either included in a cursory manner or disregarded from this study altogether.

The Survey

The purpose of the survey was to observe the most common difficulties or issues encountered and which techniques were commonly employed by the five participants in making a live broadcast. A limitation of this type of survey was that not all live stream features and methods could be covered, and some were omitted as the focus of this study is specifically on audio or sound quality. Opinion may differ significantly from one user to another as they may struggle with different techniques, whilst being well acquainted with others that they have practised. The survey provided all the required information to justify the content of the control test and outlined the research question. It is also possible to see correlations between the perceived difficulty of live streaming and the gear that the user opts to use. The key advantage of using a survey for this purpose was that it could produce a large amount of data in a short time, which is important for a paper of this scale.

The Control Test

On the other hand, the purpose of the control test was to emphasise particularly the common technical difficulties in live streaming and gauge their method of solutions as proposed by current power-users. Each of the subjects utilised in the control test addressed the main streaming processes, noted in the survey. Once the survey data was obtained, the next step was to run and record a private live-stream broadcast of a band performance on YouTube Live using the newly devised methods. This control test was set up in a recording studio, equipped with a reliable internet connection. The instrumentation is vocal, electric guitar, bass guitar, and drums. The band was required to play the same 2 minutes of music consecutively for four times, and I utilised each highlighted method from the survey results in the streaming method.

The method needed to consider the following: firstly, the use of a laptop with its built-in microphone; secondly, the use of a laptop with its built-in microphone and OBS Studio; thirdly, the use of a laptop, OBS Studio, an audio interface and a microphone, and; finally the use of a laptop, OBS Studio, an audio interface and four microphones. Whilst the test was being conducted and streamed through YouTube Live, audio and video of the live stream were recorded by OBS Studio, a third-party broadcasting program. Below is a table of gear used for the control test.

Table 1 The Gear Used for the Control Test

No.	Method	Gear
1	Use of one laptop with built-in microphone	a) MacBook Pro
2	Use of one laptop with built-in microphone and OBS Studio	a) MacBook Pro b) OBS Studio program
3	Use of one laptop, OBS Studio, an external microphone and audio interface	a) MacBook Pro b) OBS Studio c) Shure SM57 and SM58 microphones d) Focusrite Scarlett 18i8 3rd Gen USB Audio Interface
4	Use of one laptop, OBS Studio, four external microphones and one audio interface	a) MacBook Pro b) OBS Studio c) Shure SM57 and SM58 microphones d) Focusrite Scarlett 18i8 3rd Gen USB Audio Interface

Once I completed the tests using these four methods and analysed the recordings, the complete findings were presented in a small table. Complete results were presented adjacent to one another to see if there was a

significant improvement among any of the four methods being used. A small commentary was provided concerning significant issues or relevant observations with regards to the outcome of each method I used in the control test.

Any implications for further research on this topic are discussed after the presentation of the findings. These methods have been chosen as they can effectively gather the required information to satisfy the research question.

Results and Discussion

Once the information was filtered in this manner, the objective results of the survey was provided, emphasising the main audio problems faced by the participants and their proposed methods in improving the audio quality of the live stream.

The most common difficulties that have been identified related to audio quality while live streaming a musical performance (in order from the most mentioned to the least mentioned):

- Unbalanced sound;
- Vocal or music instrument sounds muffled and lacking clarity;
- No or low audio;
- Buzzing or audio noise;
- Very loud and distorted audio.

Other issues:

- Muddy or unintelligible mix;
- Latency issues;
- Audio that cuts in and out.

Focusing on the audio aspect, the most common techniques used to make potential improvements upon sound quality, cited in the survey were:

1. Invest in proper audio equipment to capture the sound of the performance. Avoid using laptop's built-in microphone;
2. Use a streaming software or video switcher to control audio and video feeds;
3. Compress the final mix;
4. Soundcheck and rehearse the live broadcast;
5. Monitor the streaming process from an audience perspective;
6. Watch the video from variety of devices-mobile phone, tablet and laptop;
7. Microphone placement.

This resulting data was used as a basis for improvement. After the data analysis was complete, a small table was provided about the optimised methods used to complete the control test. See below for the processes mentioned earlier:

1. The use of one laptop with built-in microphone;
2. The use of one laptop with built-in microphone and OBS Studio;
3. The use of one laptop, OBS Studio, an external microphone and audio interface;
4. The use of one laptop, OBS Studio, four external microphones and one audio interface.

Table 2 The Control Test Results

No.	Method	Result
1	Use of one laptop with built-in microphone	Audio was less clear. Unbalanced levels from all instruments (voice, guitar, bass, and drums); one was quite soft while the other was loud in volume. Background noise is evident since the internal microphone tended to pick up room noise. There was a lack of sound clarity: vocal and each instrument was not clearly heard because the laptop's internal microphone was not good in capturing sound from multiple audio sources, in this case, a band performance.
2	Use of one laptop with built-in microphone and OBS Studio	Audio quality was still not of the standard expected. Anyhow, this method is slightly better than method 1 in terms of sound balancing as I was able to use the OBS Studio's intuitive audio mixer for a quick mixing and filtering based on current audio sources.
3	Use of one laptop, OBS Studio, an external microphone and audio interface	Audio is clearer and any background noise is quite minimal in comparison to methods 1 and 2. This external microphone improved the quality of sound over the computer's internal mic. There was a substantial improvement in the sound clarity if compared to the previous methods.
4	Use of one laptop, OBS Studio, four external microphones and one audio interface	Audio is the clearest and most articulate among all the methods used. This method allowed me to do a basic mixing and editing on the voice and each separate instrument track, producing a more detailed and balanced sound. With the use of audio filtering features in OBS studio, I managed to compress the final mix and sending it to the live-streaming host—YouTube Live.

After the author done the test using the four devised methods and analysed the results, it is clear that there is a substantial improvement in audio quality by employing the third and fourth methods in comparison to the first and second methods. This control test has taken into consideration various aspects which includes ensuring that its preparation or production cost is minimal and affordable and can accommodate those who are in a tight budget. The most important is to acquire entry-level microphones that can result in great sounds and an audio interface that are capable of producing decent sound quality for live streaming. In this case, I used the Shure SM57 and Shure SM58 dynamic microphones and Focusrite Scarlett 18i8 (3rd Gen) USB Audio Interface.

Conclusion

Audio is the core element of every live streaming session, especially when dealing with the broadcast of a musical performance or concert. There is high possibility that people may turn off the concert live stream if its audio is poor regardless of how good the video is (Wasem, 2019). In live broadcasts, this is a crucial aspect for any musician or producer to deliver a decent audio output through any live streaming platform. In addition, audio forms the audience's perception of the quality of our live streaming and having clear audio quality will help to enhance their streaming experience.

This paper asks if a significant improvement in the sound quality to stream a musical performance through YouTube Live can be made using an optimised method. In order to gather the necessary information, a personal survey interview was conducted for five selected power-users, enquiring on which practices or methods they found more efficient in improving the audio of their streaming broadcasts. A control test was then created to emphasise these issues and solutions.

The survey revealed that the most common problems encountered by the five power-users in making live broadcasts were, in decreasing order: unbalanced sound, vocal or music instrument sounds muffled and lacking clarity, no or low audio, buzzing or audio noise, and very loud and distorted sound. All these elements were made into integral features of the control test. Four aspects were measured in the control test: firstly, the use of laptop's internal microphone; secondly, the use of laptop's internal microphone with OBS Studio, thirdly, the

use of a laptop, OBS Studio, an audio interface and an external microphone, and finally, the use of a laptop, OBS Studio, an audio interface and four external microphones.

The control test results showed a relative improvement in the sound quality attributed to the gradual increase of external tools used in the first method to the fourth method. It is obvious that the fourth method that I used managed to solve some of the drawbacks when live streaming. This is because with the use of four external microphones, I was able to mix and edit each audio source individually and through the distinguishing features in OBS Studio software, I could apply the compression and filtration to the final mix.

It is clear that a substantial improvements can be made upon currently used streaming methods, but there is more to be explored. The control test that was issued was also limited in the fact that it only revealed suggested methods exploited by the five power-users. These users may not have provided an accurate example of the most popular techniques employed by the majority of power-users. This would mean that any improvement upon test results could only be concluded as being relative, and not claimed as an absolute improvement upon every livestreaming method in use.

Findings from this study hopefully can be used as guidelines and principles in broadcasting a live stream performance. This study can also act as a survival kit for the local music industry players to sustain the production flow and growth of live music concerts in Malaysia should another Movement Control Order happens in the future.

The necessity for this project is obvious to performing artistes, musicians and other creative practitioners who are impacted by this world's pandemic. They need to engage with new ways of performing and also new media to interact with their fans or target audiences. For them, it is a prerequisite to be able to produce an optimal audio quality through the live streaming of their performances. This also is in line with the emergence of Internet of Things (IoT) concept where it helps to contribute in the sense of expanding revenue sources for live music and entertainment realms in Malaysia. Since we are in the information age, local industry players should make full use of existing technology in ensuring the continuity and sustainability of live music industry in Malaysia especially during this Coronavirus outbreak.

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