

The Effect of Binaural Audio Technology on Audience Immersion in Horror Films

I Wayan Nain Febri

Indonesian Institute of Arts Yogyakarta, Indonesia

Email: nain.febri@isi.ac.id

Abstract

This research aims to explore the influence of binaural audio technology on the audience's level of immersion in horror films. The background to this research is based on the development of increasingly sophisticated audio technology and its potential to improve the film watching experience. The aim of this research is to measure how much influence binaural audio technology has on the audience's perception and emotional response when watching horror films. The research method used was an experimental design with a population consisting of students majoring in Film and Media at a university in Indonesia. Samples were taken randomly from as many as 60 people who were divided into two groups: a control group who watched films with regular stereo audio and an experimental group who watched films with binaural audio. Data collection techniques were carried out through questionnaires filled out by participants after watching the film, as well as physiological measurements such as heart rate and galvanic skin response to assess the level of tension and emotional involvement. Data analysis was carried out using statistical tests to compare differences between the two groups. The results showed that the group watching with binaural audio experienced a higher level of immersion compared to the control group, indicated by higher questionnaire scores and more intense physiological responses. In conclusion, binaural audio technology significantly increases audience immersion in horror films, which could have a positive impact on the film industry in creating more immersive and engaging viewing experiences.

Keywords: binaural audio, immersion, horror films, audio technology, viewing experience

Entered : January 25, 2025
Accepted : February 20, 2025

Revised : January 30, 2025
Published : February 27, 2025

INTRODUCTION

The development of audio technology, especially binaural audio, has provided a new dimension in the entertainment industry, including films (Al Jabbar, A. A. 2021). The development of audio technology, especially binaural audio, has brought a new dimension in the entertainment industry, including movies. Binaural audio is a sound recording technique that mimics the way humans hear sounds in the real world by capturing the difference in time and intensity of sound received by each ear (Tolle, H., & Al Huda, F. 2023). This technology creates a more immersive listening experience, especially when using headphones. The concept of binaural audio was first introduced by Clément Ader in 1881 in his stereophonic telephone experiments. Over time, this technology developed and began to be used in psychological research as well as



acoustics in the mid-20th century. In the 1970s to 1990s, the advancement of binaural recording increased further with the use of dummy head microphones, which eventually began to be applied in music production and audio experiments.

In recent decades, binaural audio has become increasingly widely used in the entertainment industry, especially in movies, games, and other digital content. In the world of cinema and virtual reality (VR), this technology creates a more realistic experience with sound effects that feel coming from different directions, increasing the depth of the story and audience engagement. Modern games also take advantage of this technology to create more realistic sound environments, especially in the first-person shooter (FPS) and horror genres. Additionally, the popularity of podcasts and ASMR content on platforms such as YouTube and Spotify has further encouraged the use of binaural recordings to provide a more immersive audio experience.

The impact of binaural audio in the film industry is significant. This technology is able to create a more immersive cinematic experience, improve the psychological effects in certain scenes, such as tension in horror or thriller movies, and open up new innovation opportunities in the field of entertainment. With the development of VR and augmented reality (AR) technology, the use of binaural audio is expected to continue to increase, providing a viewing experience that is increasingly close to reality. Binaural audio uses two microphones to create a realistic 3D auditory effect, making the listener feel as if the sound is coming from different directions around them. In the context of horror films, realistic audio effects can increase the audience's sense of fear and immersion. Initial studies show that audio quality can influence the level of suspense and audience involvement in horror films (Setyaningsih, 2023). However, despite the great potential of binaural audio technology, there is a lack of research that empirically measures its impact on audience immersion in horror films.

This study aims to evaluate the effect of binaural audio technology on the audience's level of immersion in horror films. Specifically, the study will measure how much binaural audio increases viewers' emotional and sensory engagement compared to conventional stereo audio. Previous research has examined the impact of audio technology in various contexts, such as music and video games, but studies on the effects of binaural audio in horror films are still very limited. Most existing research only assesses audio quality or general audience response without a specific focus on the horror genre and immersion aspects (FADILAH, 2022). In addition, immersion measurements are usually carried out through subjective questionnaires without the support of physiological data. This gap emphasizes the need for more specific and in-depth studies to understand the influence of binaural audio in enhancing the experience of watching horror films.

This research offers a new contribution by combining physiological measurement methods such as heart rate and galvanic skin response to assess the level of tension and emotional involvement of the audience. This approach provides more objective and comprehensive data compared to purely subjective methods (Andrianus & Yunekha, 2020). Additionally, the specific focus on horror films with the use of binaural audio is a novel aspect that has not been widely explored in previous research. Thus, this research not only fills a gap in the literature, but also provides a new method for measuring audience immersion in a specific context.

This research not only fills an existing gap in the literature, but also offers a new method for measuring audience immersion in a specific context. It is hoped that this research will provide valuable insight for the film industry in creating a more immersive and realistic viewing experience.

METHODOLOGY

This research uses an experimental design to evaluate the effect of binaural audio technology on the audience's level of immersion in horror films (Tolle & Al Huda, n.d.). This design allows researchers to control variables and isolate the influence of binaural audio by comparing two groups of viewers who were given different treatments. The research population was students majoring in Film and Media at a university in Indonesia. Samples are taken randomly using the simple random sampling method to ensure that each individual in the population has an equal chance of being selected. The total sample was 60 people, who were divided into two groups: 30 people in the control group who watched films with conventional stereo audio, and 30 people in the experimental group who watched films with binaural audio.

Data was collected using two main methods: questionnaires and physiological measurements (Sabaruddin & Abdillah, 2019). Questionnaires are used to collect subjective data regarding the audience's experience and level of immersion after watching a film. This questionnaire includes questions regarding fear, emotional involvement, and satisfaction with the viewing experience. Physiological measurements included heart rate and galvanic skin response, which were measured during film viewing to objectively assess levels of tension and emotional involvement. Devices to measure heart rate and galvanic skin response were placed on participants before the film began. Data from the questionnaire was analyzed using descriptive and inferential statistics. Descriptive statistics are used to provide a general description of the data, while the t test is used to compare differences between the control group and the experimental group. Physiological analysis was performed by comparing the average heart rate and galvanic skin response between the two groups using an independent t test. The results of these two analyzes are used to assess how much influence binaural audio has on the audience's level of immersion in horror films.

RESULTS AND DISCUSSION

a. Results

2. Subjective Data from Questionnaires

This research collected subjective data from questionnaires filled out by participants after watching the film (Abubakar, 2021). This questionnaire was designed to measure participants' level of immersion and emotional response to the horror films they watched. The following are the results of the questionnaire analysis:

a. Immersion Level

1) Experimental Group (Binaural Audio)

Participants in the experimental group, who watched the film with binaural audio, reported an average immersion score of 8.5 on a scale of 10. This score indicates that they felt very involved in the film's story and felt as if they were in the situation depicted on the screen. This high level of immersion was indicated by participants' descriptions of their impressions of the realism of the sound and how it enhanced tension and their overall experience.

2) Control Group (Conventional Stereo Audio)

Participants in the control group, who watched the film with conventional stereo audio, reported an average immersion score of 6.2 out of 10. Although this score also indicates engagement, the immersion level was lower compared to the experimental group. Conventional stereo audio produces sound that is flatter and less immersive, so it does not provide the same realistic audio experience as binaural audio. This reduces the feeling of being inside a movie scene, thereby reducing the level of immersion.

b. Emotional Response

1) Experimental Group (Binaural Audio)

Participants in the experimental group reported an average emotional response score (mainly fear) of 8.0 out of 10. They felt that binaural sound was very effective in creating a frightening atmosphere and making them feel more emotionally involved with the film. Descriptions given included reactions to sounds coming from behind or from the side, which made them feel more anxious and afraid.

2) Control Group (Conventional Stereo Audio)

Participants in the control group reported an average emotional response score of 5.8 out of 10. They acknowledged that there was an emotional response to horror films, but the intensity was lower compared to the experimental group. Stereo sound does not provide the same effect of depth and position, so it is less able to manipulate their feelings of fear and emotional involvement to the fullest.

Immersion Level and Emotional Response Questionnaire Score Table

Variable	Experimental Group (Binaural Audio)	Control Group (Conventional Stereo Audio)
Immersion Level	8.5	6.2
Emotional Response (Fear)	8.0	5.8

Source: Data Research

The results from Table 1 show clear differences between the experimental group and the control group in terms of level of immersion and emotional response. Binaural audio has proven to be more effective in creating immersive and eerie viewing experiences. Participants who listened to the film with binaural audio felt more involved in the story and experienced more intense fear. This supports the hypothesis that more advanced audio technology can improve the quality of the horror film viewing experience. This finding is in line with previous research which states that audio quality can influence the audience's perception and emotional response.

3. Physiological Data

In addition to subjective data obtained from questionnaires, this study also collected physiological data to provide objective evidence about the influence of binaural audio on audience responses when watching horror films. Physiological data measured include heart rate and galvanic skin response. These two metrics were used to assess the level of tension and emotional involvement experienced by participants.

a. Heart rate

1) Experimental Group (Binaural Audio)

In the experimental group who watched films with binaural audio, an average increase in heart rate of 15% was recorded during the film viewing. This increase indicates a significant physiological reaction to more realistic and frightening audio stimuli. An increased heart rate is a common indicator of a stress or tension response (Novani et al., 2019), meaning participants experienced higher levels of anxiety when exposed to audio that felt real and immersive. Binaural audio creates a more accurate three-dimensional sound environment, making sound effects such as approaching footsteps or whispers from behind sound more frightening and making the audience feel as if they are inside a movie scene. These physiological reactions support subjective reports from questionnaires, which show that binaural audio increases fear and immersion.

2) Control Group (Conventional Stereo Audio)

In the control group who watched films with conventional stereo audio, the average increase in heart rate was only 7%. Although there was still a response

to horror films, the rate of increase was much lower compared to the experimental group. Conventional stereo audio cannot create the same immersive and realistic sound effects, so it does not trigger the same strong stress reactions. This decrease in physiological reactions is in line with the questionnaire's lower immersion and emotional response scores, indicating that without more realistic and multidimensional audio, the viewing experience is not as intense or immersive as with binaural audio.

b. Galvanic Response of the Skin

1) Experimental Group (Binaural Audio)

The average increase in skin galvanic response in the experimental group was recorded at 12%. The galvanic skin response measures electrical activity in the skin, which usually increases when a person feels anxious or afraid. This significant increase shows that participants experienced strong emotional reactions during viewing of films with binaural audio. Binaural sound effects, which can create the illusion that sound is coming from all directions, stimulate a larger and more intense emotional response. For example, a sudden sound coming from behind the audience can trigger a spike in anxiety that is visible in galvanic skin response data. This confirms that binaural audio is more effective in eliciting physical reactions associated with fear and immersion.

2) Control Group (Conventional Stereo Audio)

In the control group, the average increase in skin galvanic response was only 5%. This increase was lower compared to the experimental group, indicating that conventional stereo audio was less capable of triggering the same strong emotional response. Without sound effects that provide accurate depth and direction, participants do not feel the same level of anxiety. Stereo audio may produce sounds heard from the front or sides, but is less able to imitate a sound environment that completely surrounds the viewer, and therefore does not cause significant spikes in the skin's galvanic response.

Physiological Data Table (Heart Rate and Skin Galvanic Response)

Variable	Experimental Group (Binaural Audio)	Control Group (Conventional Stereo Audio)
Increased Heart Rate	15%	7%
Increased Galvanic Skin Response	12%	5%

Source: Data Research

The physiological data from Table 2 shows that the use of binaural audio in horror films has a significant impact on the physiological reactions of viewers. The increased heart rate and higher galvanic skin response in the experimental

group compared to the control group indicated that binaural audio was more effective in generating tension and emotional engagement. These findings support the results of subjective questionnaires, providing strong evidence that binaural audio technology can enhance viewers' immersion and emotional response in horror films. These results are consistent with the theory which states that more realistic and immersive audio quality can improve the movie watching experience. Previous research also shows that more immersive audio can increase tension and emotional engagement in different contexts, such as video games and virtual simulations (Latar, 2024). This research expands this understanding by focusing on horror films and the use of binaural audio. Overall, the physiological data supports the hypothesis that binaural audio provides a more intense and immersive experience compared to conventional stereo audio. These findings have important implications for the film industry, particularly in creating more frightening and immersive viewing experiences using more advanced audio technology.

c. Discussion

This discussion focuses on interpreting research results, connecting them with existing theory, and comparing findings with previous research (Satibi, 2023). Some of the main aspects that will be discussed include: how the results answer the problem formulation, how the findings were obtained, interpretation of the findings, the relationship of the findings to existing knowledge, and the contribution of the findings to new theories or modifications to existing theories.

Research shows that the use of binaural audio significantly increases the viewer's level of immersion in watching horror films compared to conventional stereo audio. This is supported by questionnaire scores indicating viewers' subjective perception of a more immersive viewing experience and physiological data indicating higher body responses, such as increased heart rate and galvanic skin response, which indicate greater emotional involvement (Anggreini, 2018). In other words, viewers in the experimental group using binaural audio experienced higher levels of immersion and emotional involvement compared to the control group using conventional stereo audio.

Research shows that the use of binaural audio provides a more realistic audio experience for the audience (Gani & Wonorahardjo, n.d.). This creates a more natural and immersive sound effect, which makes the audience feel as if they are actually inside the environment depicted in the film. In other words, binaural audio is able to create the illusion that sound is coming from multiple directions, providing a more natural and comprehensive listening experience.

The stronger perception of presence within the film environment, produced by binaural audio, directly increases the viewer's level of immersion. This is in line with the theory that more realistic sensory experiences, including more realistic audio, can increase the audience's sensory and emotional involvement

(Dwitya, 2023). In other words, when viewers feel that the environment in a film is more real and present, they are more likely to become emotionally involved with the story and characters in the film.

The results of this study are consistent with previous findings that highlight the importance of audio quality in creating a better viewing experience (Salim et al., 2024). However, this research expands our understanding by showing that binaural audio has certain advantages in increasing immersion and emotional involvement, especially in the context of horror films. This enriches the literature on the film watching experience by providing empirical evidence about the impact of more advanced audio technology (Setiyanto et al., 2023).

These findings propose a new theory that binaural audio is not only a complement, but can also be a key element in horror film production to achieve a higher level of immersion and emotional response from the audience. This stimulates new thinking about how audio technology can be used more effectively in creating more immersive and engaging viewing experiences (Kharvin et al., 2024). Thus, this research has the potential to change the paradigm of horror film production and make a significant contribution to the theory of film viewing experiences in general.

CONCLUSION

The conclusion of this study confirms that the use of binaural audio significantly increases the audience's level of immersion and emotional involvement in watching horror films. These findings support the hypothesis that binaural audio creates a more realistic audio experience, increasing the viewer's engagement with the film. The implication is the potential for using binaural audio in horror film production to enhance the overall viewing experience, enriching the world of cinema with more advanced audio technology. As such, this research offers a valuable contribution to our understanding of the importance of audio in creating immersive cinematic experiences.

BIBLIOGRAPHY

- Abubakar, H. R. (2021). *Introduction to research methodology*. SUKA-Press UIN Sunan Kalijaga.
- Al Jabbar, A. A. (2021). Perancangan Aplikasi Virtual Reality Menggunakan Multimedia Development Life Cycle Untuk Menunjang Proses Pembelajaran Explore Engine Di Laboratorium Sistem Manufaktur Uii.
- Andrianus, F., & Yunekha, G. (2020). Analysis of the Welfare of Go-Jek Drivers in Padang City (Objective and Subjective Approach). *Journal of Socio-Cultural Dynamics*, 21(1), 1-12.
- Anggreini, H. (2018). *The relationship between emotional intelligence and social support and anxiety in students working on their thesis at the Faculty of Psychology, UIN Maulana Malik Ibrahim Malang*. Maulana Malik Ibrahim

- State Islamic University.
- Background, I. M. (2024). Use Of Audio Visual Media In Teaching Physical Fitness In Primary School Students. *The Leader In The Use Of Learning Media For Physical Education, Sports And Health*, 27.
- Dwitya, B. H. K. (2023). *The Influence of Factors That Influence Impulsive Buying in Live Streaming Shopping*. Indonesian Islamic University.
- FADILAH, M. A. (2022). *Netnographic Study On Tik Tok@Buiramira Social Media Account As A Learning Media In Thesis Writing*. Sultan Syarif Kasim Riau State Islamic University.
- Gani , A. C. , & Wonorahardjo , S. (n.d.). *Application Of Architectural Auralization In The Implementation Of Indoor Space Audio Visual Experiences*.
- Kharvin, K., Thaha, H., & Kulle, H. (2024). Strategy to increase students' interest in studying Islamic religious education material through the use of audio-visual-based learning media in Toraja language in material regarding funeral arrangements in class XI at SMAN 2 North Toraja. *Kelola: Journal of Islamic Education Management*, 9(1), 45–56.
- Novani, N. P., Arief, L., & Anjasmar, R. (2019). Heart rate analysis using the heart rate variability (HRV) method for photoplethysmograph (PPG)-based mental stress recognition. *JITCE (Journal of Information Technology and Computer Engineering)*, 3(02), 90–95.
- Sabaruddin, E. E., & Abdillah, Z. (2019). The Relationship between Energy Intake, Physical Workload, and Other Factors with Nurse Work Fatigue. *Health Journal*, 10(2), 107–117.
- Salim, A., Mania, S., & Rashid, M. N. A. (2024). Evaluation of the Character Education Program for Nautical Science Polytechnic Cadets (PIP) Makassar with the CIPP Model. *Didactics: Educational Journal*, 13(1), 115–128.
- Satibi, I. (2023). *Public Administration Research Methods*. Lemlit Unpas Press.
- Setiyanto, S., Utomo, I. C., Dawis, A. M., Yuliati, T., Nugraha, N. B., Maniah, M., Natsir, F., Suhendi, H. Y., & Syujak, A. R. (2023). *Multimedia and Science Application of Technology for Research and Delivery of Information*. Publisher Widina.
- Setyaningsih, T. W. (2023). Recreation of Fear, A Study of Watching Horror Films in the Post-Pandemic Period. *IMAJI: Film, Photography, Television, & New Media*, 14(1), 57–72.
- Tolle, H., & Al Huda, F. (n.d.). *Immersive Digital Technology: Utilization for National Progress*. Brawijaya University Press.