Post-print of Research on Film and Television Sound Recording Technology and Art

Authors: Li Wenshen

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Abstract

Film sound recording constitutes a critical component in film post-production and editing planning. This paper adopts film sound recording technology as its research perspective, exploring the intrinsic connotations of its technical applications and analyzing the applied techniques for artistic sublimation. Through technical means such as timbral brightness contrast and rhythmic tonality in dimensions including shot space and scene distribution, it achieves synergy between sound and cinematic imagery, thereby enabling viewers to comprehend filmic content from an auditory perspective.

Full Text

Preamble

Film and Television Recording Technology and Art Research
(School of Theater, Film and Television, Communication University of China, Nanjing, Jiangsu 211172)

Abstract: Film and television recording constitutes a critical component in post-production and editorial planning. This paper examines recording technology from a technical perspective, exploring its applied connotations and analyzing techniques for elevating its artistic expression. Through timbral shading, rhythmic pitch, and other technical means applied to shot space and scene distribution, the technology achieves synergy between sound and visual imagery, enabling viewers to comprehend film content from an auditory dimension.

Keywords: Film acoustics; Film and television recording; Recording technology; Artistic expression; Cocktail party effect

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1.2 Sound Conceptual Design Technology

With scientific and technological advancement, media forms such as digital and mobile platforms have experienced rapid growth, thereby endowing film and television recording technology with artistic expression capabilities. Under conditions of technological development and increasing demands for production quality, recording technology has gained significant attention in film production. Film and television recording technology can provide audiences with enhanced aesthetic experiences from an auditory perspective, demonstrating its applied value through production techniques and acoustic principles. Moreover, during the application of recording technology, artistic expression is enhanced, elevating the acoustic interpretation effects of films.

1.1 Technical Overview

As a branch of recording arts, film and television recording technology possesses both technical sophistication and artistic expressiveness, representing a critical factor in film creation. When auditory and visual technologies are integrated, they create entirely new artistic forms for film audiences, fully demonstrating the application skills of recording technology. From the perspective of auditory technology application, resonance with audience emotions is achieved, enabling viewers to form three-dimensional perceptions of film works.

In the design and application of film and television recording technology, post-production Foley can be employed to enhance production effects and strengthen the synergy between sound and image. However, recording technology is not limited to simply capturing sounds; in post-production sound design, it must also accomplish sound-image matching. Accomplished sound engineers place greater emphasis on the artistic expression of image quality and cinematography, achieving highly authentic sound effects that restore the film's artistic expression during sound integration. Furthermore, with the assistance of various tools, the effectiveness of recording technology is enhanced to obtain unique sound effects that meet audience demands, thereby increasing the infectiousness of the work.

Since human hearing exhibits differential responses to pitch, sound characteristics, and intensity, excellent film works should prioritize authenticity when employing sound technology, while fully utilizing recording technology in both spatial and hierarchical dimensions of sound. Consequently, the production of both auditory and visual aspects in film works is particularly crucial. Audio-visual creation forms a multi-dimensional space that enables simultaneous pro-

duction, dividing the visual and auditory elements of the work and advancing the narrative through synergistic progression and independent existence. Therefore, acoustic application is of considerable importance in film works.

High-quality recording technology can enhance the overall artistic expression of films. Through the dual effects of image and sound, films form continuous and comparable visual imagery, thereby demonstrating the artistry of production. Films contain multiple compositional methods, and sound is processed within spatiotemporal structures, including combinations between sounds and overlapping treatments of image and sound.

In sound conceptual design, comprehensive planning is conducted for sound levels, sound-image matching, and sound spacing. The planning protocol is as follows:

1. **Production Materials:** The sound engineer prepares relevant film materials, categorizes them, and determines the film' s broadcast unit and production cycle.
2. **Performer Conditions:** Based on the performer' s role requirements, determine the direction for timbre and pitch processing.
3. **Clarify Artistic Effects:** Define the film' s artistic effects to establish the direction for recording treatment.
4. **Structure Analysis:** Organize the film' s structure and design recording treatment methods for different segments of time, space, and hierarchy.

1.3 Acoustic Fundamentals

Sound Speed: During sound propagation, the relationship is: solid propagation > liquid propagation > air propagation. This demonstrates that as the density of the sound propagation medium increases, sound speed correspondingly increases.

Wavelength: The distance formed after a vibrating particle completes a full vibration cycle is called wavelength. Typically, the distance between two wave peaks or two wave troughs is measured.

Frequency: Frequency is calculated as: frequency = sound speed / wavelength.

Amplitude: Using the initial value as a baseline, calculate the result of peak/trough value minus initial value, and take the maximum value.

Phase: This represents the angular measurement result of waveform fluctuation. Generally, the angular measurement for one vibration cycle is 360 degrees.

Recording technicians should strengthen their study of acoustic fundamentals to enhance operational proficiency and infuse film sound effects with acoustic principles.

1.4 Musical Sound

Pitch: This element depends on frequency. When frequency is fixed, it corresponds to a specific pitch value. Currently, the international standard pitch frequency is 440 Hz.

Volume: Volume includes two elements: intensity and loudness. Volume intensity, as a physical quantity, is measured in watts per square meter. Volume loudness considers the audio receiver, as each individual's perception of loudness differs. Generally, when sound wave intensity is high, the perceived loudness is greater.

Timbre: Timbre represents the characteristic quality of a performer' s voice. For instance, if a role requires a loyal and honest timbre but the performer' s voice is relatively sharp, appropriate processing should be applied to ensure timbre suitability for the plot while preserving the performer' s original voice. Typically, if a performer' s timbre is unsuitable, a dubbing performer may be employed to reduce the difficulty of recording technology application.

1.5 Microphones

Microphone categories are numerous: dynamic and piezoelectric types can directly convert sound signals into electrical signals with low power consumption; condenser microphones use batteries or rectifiers as power supplies to regulate sound wave vibrations. Proper microphone usage ensures effective sound collection and forms the foundation of recording technology application.

1.6 Binaural Effect

When humans receive sound signals, time reception differences and phase differences occur, collectively termed the binaural effect. Taking timbral difference as an example, audio energy from various frequency bands produces certain differences when received by both ears. Film production can utilize the binaural effect to complete recording treatment and enhance film artistry.

1.7 Cocktail Party Effect

When people are in environments with complex sound signals, such as cocktail parties or gatherings, the phenomenon of distinguishing sounds in the environment is called the cocktail party effect. This occurs because the live environment enhances auditory attention or because information is obtained from facial expressions and lip movements during conversation. Therefore, when applying recording technology in film, the cocktail party effect should be avoided as much as possible, since audiences cannot physically attend the film' s "cocktail party." Appropriate background music should be added to eliminate such audio complexity.

Methods for Eliminating the Cocktail Party Effect:

1. During full-shot sound collection, the cocktail party effect may be encountered. To emphasize key sounds, have principal performers deliver lines while other performers mime conversation.
2. In close-up recording treatment, record the principal performer while others remain silent.
3. During shot transitions, record other performers' lines to match lip movements with the image.

1.8 Masking Effect

When two audio signals exist simultaneously, listeners will mask the quieter sound and perceive the louder sound. Influencing factors of the masking effect include volume level and frequency. This recording treatment method shares similarities with the cocktail party effect. When matching images after recording other actors, control the audio of other performers while increasing the audio of principal performers, thereby utilizing the masking effect to enhance audience reception of primary information and mask conversations of other performers. The masking effect can eliminate cocktail party effect issues during application. Therefore, when establishing masking audio signals, design should be completed from both volume and frequency perspectives to ensure effective recording technology application.

2.1.1 Microphone Usage Techniques

As a key element in recording technology, dialogue requires various microphone specifications selected according to shooting scenarios. Commonly used microphone types in film and television recording include miniature wireless and short shotgun types. When using miniature wireless microphones, omnidirectional types should be avoided in favor of cardioid pattern types. Generally, in recording technology application, highly directional microphones should be used for medium shots, close-ups, and 特写 shots to achieve targeted sound collection.

Highly directional microphones, primarily short shotgun types, should be fixed on microphone stands during sound collection. After fixing the microphone, use a boom microphone suspended directly in front of the performer, aimed at an appropriate position near the actor' s lips to minimize microphone visibility. During microphone placement, orientation should follow the performer' s sound source to reduce sound collection failures.

For full-scene shooting where diverse objects surround the performer, facilitating microphone concealment, wireless lavalier microphones can be used to achieve accurate sound collection. Simultaneously, recording personnel should maintain effective communication with cinematography personnel. During filming, recording personnel should follow camera movements and performer actions to enhance spatial sense in sound collection and elevate the artistry of sound expression.

2.1.2 Control of Recording Levels

During synchronous film recording, frequency consistency should be maintained between the mixing console and video recorder, with attention to both mixing console output frequency and recorder audio input frequency. After connecting the mixing console and recorder for audio matching, promptly use the mixing console standard to transmit a 1kHz signal to the recorder audio while calibrating level values. Generally, recording engineers use headphones to monitor sound quality and ensure effective volume control. If sudden high-intensity sounds occur in the audio, compression limiting may be applied, though this may compromise sound quality, requiring preservation of sound authenticity. In long-shot filming scenarios, sound collection should ensure microphone-image matching, with timely adjustment of recording level values to preserve the sense of distance in synchronous recording effects, winning the artistry of film sound production through authentic sound.

2.1.3 Avoiding Noise Issues

During synchronous recording technology application, noise issues should be addressed effectively. Common noise types include car horns, clothing friction, and building renovation sounds. If such noises are mixed into film works, they will compromise the artistic expression of the plot. Therefore, noise treatment should be strengthened in synchronous recording technology. For indoor filming, synchronous recording should close doors and windows and place highly directional microphones to complete sound collection. For outdoor filming, time-shift shooting methods should be employed, conducting shooting activities during noise-free periods to eliminate noise pollution. When shooting dynamic shots, miniature microphones should be fixed to reduce clothing friction noise. When encountering strong winds during shooting, microphones should be positioned downwind or covered with multiple layers of nylon cloth to reduce noise.

2.2.1 Recording Equalization Technology

Equalizer: Due to differences in frequency curves formed by microphone sound collection and performer timbre, appropriate treatment is typically applied based on audio recording effects. For instance, some performers have sharp timbres lacking in pleasantness; some have heavy nasal tones; some have unclear articulation. These issues all represent auditory differences manifested through sound intensity variations. Equalization technology can be applied to process signals across various frequency bands and improve recording quality.

Exciter: This recording equalization treatment technology, also called a harmonic generator, can add dynamically changing harmonics to specific frequency bands. Appropriate harmonic addition can enhance sound beautification effects. The difference between exciters and equalizers lies in that equalizers can adjust signal intensity in partial frequency bands, while exciters can add harmonics to all frequency bands. Inappropriate excitation methods can damage the original

sound, resulting in poor auditory effects. Therefore, equalization treatment is more widely accepted.

Compressor: This recording treatment technology effectively adjusts the range of recording levels. Typically, this technology automatically processes various audio signals on the time axis. When sound is quiet, volume increase operations are performed according to preset parameters. When recording intensity is high or exceeds limits, volume reduction control is performed according to predetermined parameter standards. The result of this recording treatment technology is adjusting the frequency variation range of the original sound trajectory, modifying the maximum and minimum values of recording volume, and narrowing the gap between maximum and minimum volume levels. Compressors are typically used to reduce volume variation cycles. During volume control, they can enhance the fullness of recording perception, ensure clarity of quiet sounds, and mitigate harshness in loud sounds.

Reverberator: This recording technology can enhance sound beautification effects, create spatial auditory impressions for sound, and deliver smooth, transparent listening experiences.

2.2.2 Recording Noise Reduction Technology

1. **Limiting Method:** Set threshold values to control recording levels, filtering audio signals below the threshold and processing signals above the limit. Signal level specifically represents the total level value of audio signals and noise electrical levels. This noise reduction technology can accurately process noise with high signal-to-noise ratios. For example, the RVOX plugin used in WAVE has noise processing effects, with optimal parameter values in the [-50, -40] dB range. In reality, background audio noise in films has varying noise levels. More accurate level control ranges can effectively filter noise while preserving the integrity of sound collection.

2. **Sampling Noise Reduction Method:** This noise treatment technology is highly efficient for eliminating background noise. The basic approach involves collecting noise waveform samples, then analyzing the timbre characteristics and audio waveforms of entire material segments based on these samples to enhance automated noise removal. The advantage of this method lies in its ability to improve noise removal completeness. However, this noise reduction method also causes certain damage to original sound collection; when the signal-to-noise ratio is low, greater damage to original sound occurs. After noise removal, the recording effect exhibits strong metallic characteristics. Generally, this noise reduction method is not suitable for human voice recording treatment but can be used for scene reviews and background music addition. During application, attention should be paid to signal-to-noise ratio settings to minimize damage to original sound.

2.2.3 Spectrum Processing

Human voice spectrum characteristics exhibit particularity. Based on human voice production mechanisms, there are three frequency spectrum regions:

1. **Vocal Fold Vibration:** Musical sounds formed by vocal fold vibration have flexible volume in this range, creating significant spectral variations across different pitches and production methods.
2. **Nasal Cavity Resonance:** Harmonics formed by nasal cavity resonance are primarily low-frequency. Frequency equalizers can effectively capture such spectra. The regulation frequency for nasal harmonics should not exceed 500 Hz, with core frequency values for equalization treatment in the [80, 150] Hz range. At this point, equalization bandwidth manifests as four times the frequency range. For example, in 100 Hz audio, select the frequency equalization core point. The gradual transition range of the equalization curve is [100, 400] Hz, with equalization gain decibel range of [-6, +10] dB. Notably, when applying gain decibels, monitor speakers should not be set to low audio levels to avoid amplification of nasal sounds.
3. **Fricative Effects:** The spectrum formed by human voice fricative effects is greater than 4 kHz. Since this frequency band contains musical audio spectrum resources, the regulation range for fricative effect spectrum is [6, 16] kHz. At this point, equalization bandwidth manifests as three times the frequency range, while the core frequency shows one or two times the frequency range. When performing equalization treatment on mid-frequency, the treatment frequency is 6800 Hz, and its equalization gain can be reduced to -10 dB. This demonstrates that when processing human voice frequency, certain frequency-sensation bands should be effectively increased and adjusted using wide frequency bands with small curve variations. This audio processing method can enhance equalization continuity between human voice, musical sound, and fricatives, ensuring clear and natural sound quality.

When narrow-band equalization increases at one or two times the frequency range, excessive processing of human voice alters original sound timbre. Therefore, during recording technology application, while maintaining sound effect artistry, naturalness of sound sensation should be preserved, with the starting point of treatment being non-damaging to human voice, with appropriate special effects added. Audio equalization treatment can be performed using a 0.2 times frequency range.

Conclusion

In summary, film and television recording technology encompasses various technical application theories and acoustic artistic expressions. When applying film and television recording technology, the goal is to enhance audiences' dual artistic experiences of vision and hearing, present virtual spaces three-dimensionally, and maximize the functional application of digital film and television technology.

In the expressive application of film and television recording technology, greater reliance is placed on the essential characteristics of acoustics, including irregular variation patterns and diverse forms, which establish the technical foundation for recording technology development and application. In the future, film and television recording technology will elevate film and television artistic expression and enhance audience auditory experiences from more advanced technical perspectives and more artistic expressive forms.

References

[1] Sun Hongwu. Application of Digital Technology in Film and Television Recording Education [J]. JinGu Creative Literature, 2020(17): 79-80.
[2] Geng Yiyang. Analysis of Film and Television Recording Technology and Art [J]. Home of Drama, 2020(2).
[3] Zhao Jun. The Moderate Reverse Effect of Workflow and Teaching Process on Vocational Education Teaching Outcomes—Taking Higher Vocational Recording Technology and Art Major as an Example [J]. Journal of Sichuan University of Arts and Science, 2019(6): 145-151.
[4] Wang Haijing, Xu Jun. Let Sound Fly with Dreams—Record of 2018 CSMPTE Film and Television Recording Application Technology Exchange Seminar [J]. Modern Television Technology, 2018(6): 50-51.
[5] Rebiya · Abudurehefu, Tong Xin. Broadcasting and Film Language Sound Recording Technology and Artistic Treatment—Taking Xinjiang Broadcasting and Film Translation Center as an Example [J]. Film and Television Production, 2017(07): 60-64.
[6] Tao Sha. Analysis of Short Video Development Prospects from Network Perspective [J]. China Media Technology, 2020(10): 38-40.

Author Information: Li Wenshen (2000-), female, from Laiyang, Shandong, majoring in Recording Arts at the School of Theater, Film and Television, Communication University of China, Nanjing. Research interests: sound design, recording arts.
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Note: Figure translations are in progress. See original paper for figures.