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FEATURES OF SOUND RECORDING IN OPEN SPACE

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Abstract

The purpose of the research is to analyze the features of sound recording in open space from a technological point of view. To do this, the following tasks should be performed: establish the role of open space when it performs the function of the dominant environment during speech or sound recording; prove the importance of obtaining intelligible speech from the microphone when recording sound in an open space, taking into account the influence of extraneous sounds. **Research methodology.** The following methods have been applied: analytical for the study of the scientific basis for the considered issues; theoretical for generalizations of theoretical provisions and practical observations and generalization of the obtained theoretical base and practical results, structural and functional for highlighting the components of successful sound recording in open space conditions and determining their functions in the process. **Scientific novelty.** For the first time, information on the use of specialized equipment that will help to hide the shortcomings of sound is summarized. The importance of further sound processing by technical devices is also highlighted. The article outlines the specifics of open space in the context of sound recording; the main sources of sound in open space are identified and the features of working with them are analyzed. **Conclusions.** The article has analyzed the peculiarities of sound recording in open space and has established the role of specific factors that can affect the work in terms of the peculiarities of the sound engineer's work. The role of using special microphones to hide flaws is established by analyzing the literature. The factors affecting the sound recording quality in open spaces have been generalized.

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Problem statement

One of the modern sound design challenges is the quality of the sound recording in open space. Filmmakers are trying to expand their vision to attract new audiences and offer new unexpected locations, and sound engineers have to accept all the challenges and find high-quality and professional methods of recording sound anywhere. According to Volodymyr Diachenko:

«Today there are many different views on the aesthetic and artistic nature of sound. But, to define, create and measure sounds, a person uses the laws of physics and musical acoustics. For example, sound engineering as a creative profession uses technical terminology regarding the nature of sound, because in it the artist's goals are achieved with the help of technical means». (Diachenko, 2008, p.6)

So, in our study, we will consider what are the features of sound recording in an open space.

It is worth noting that an open space includes: streets and squares, sports grounds and stadiums, open platforms and sorting stations, green theaters and summer stages, parks and areas of festivities and recreation, outdoor exhibitions and shows and advertising, etc. In addition, open spaces include warning and information areas in the open air, for example for civil defense purposes.

The specificity of open space is its dependence on climatic factors and atmospheric conditions, as well as the need to take into account the attenuation in the air, as the length of the sound zones reaches several hundred meters and even kilometers. When creating a wide variety of video content, quality audio recording is just as important as the visible

range. So, for example, the microphones built into various types of cameras are far from perfect and have certain shortcomings that most likely do not allow recording the sound accompaniment of the video in the proper quality when the group is in an open space.

These disadvantages of built-in microphones include the presence of sound interference when touching the recorder during video recording, limited range, omnidirectional sensitivity diagram (hence the inability to eliminate extraneous noise), narrow frequency audio range, and inability to record loud sounds without distortion.

An indisputable solution to these problems is the use of external microphones with cameras or mobile devices. But there is another, less obvious, difficulty. The fact is that there are no microphones that can record sound equally well in different conditions and scenes. For each creative task and situation, it is necessary to select models with the most suitable characteristics.

The question now is why it is difficult to get a legible speech from a microphone when recording sound in an open space. It is logical to conclude that extraneous sounds interfere because the automatic signal level control system cannot always correct the situation completely.

If there is a loud noise in the background of the language, the system will lower the level and the language will not be heard at all. If the system speed is low, the first phrase will be truncated at the beginning of the conversation. You can use a digital control system instead of an analog automatic level control system. In the latter, the speed of operation is faster.

In this regard, it should be noted that human speech is in a very narrow fre-

quency range. The lowest voice, bass, is about 80 Hz. Based on this, if you want to record human speech in an open space, you need to “reject” all frequencies outside the range of human voice. To do this, there are special high and low-frequency filters that are built into the microphone amplifier. The range passed by these filters is called the transmission band bandpass.

There is an opinion among industry professionals that it is better to use specialized microphones for recording outside, in particular in an open space, the transmission band bandpass of which is narrowed to 100–4000 Hz. You should also pay attention to microphones with adjustable filters. In some situations, such a fine-tuning capability can be quite useful.

Recent research and publications analysis

This issue is considered in the works of V. Diachenko, V. Didkovskiy, and S. Lunova, who work not only as researchers in the field but also produce educational literature (methodological recommendations, training manuals, etc.).

The purpose of the article is the analysis of sound recording features in open space, namely sound sources in open space; devices needed to record sound on the spot; means of sound and voice reduction; features of voice recording, and voice recording on the button microphone.

Main research material

Large open areas, such as parks, squares, playgrounds, gardens, and adjacent areas that need sound recording have a whole range of conditions and nuances

in creating such a project. A sound engineer, like an artist, must create his own, fundamentally new sound panorama based on a model (music performance). The phonogram differs from the original image in terms of size, three-dimensional structure, and balance of sounds. The main reason for the difference in perception between “live” and “reproduced” sound lies in the peculiarities of human localization of sound sources.

The task is a bit complicated by the fact, that the open area is more difficult to voice, because it is wider, which requires laying several hundred meters of wire to connect the speakers, the speakers themselves must be specialized, and the sound in the finished system is nowhere to be seen. Accordingly, the power of such a system must be very significant.

It is necessary to determine the main sources of sound in an open space, namely, it is advisable to start with the main – speakers, as the central system will be securely hidden in the room. But the speakers must meet all the necessary requirements, such as moisture-resistant and frost-resistant housing, which is not afraid of the wind, direct sunlight, rain, or snow.

You should also pay attention to the nuances of the environment because all-weather speakers are not a panacea. Of course, they can help in sounding in an open area, but it is better to install them not far from the premises, and for larger tasks, you should think about suitable technical support.

For louder sound, which can be perfectly audible in large open spaces, several types of special acoustics are used, one of which is the speakers. They are able to propagate sound directed over long distances without much distortion, they are

convenient to mount on walls or poles, and playback of sounds, music and voice will be at a high level. As written in an article by the educational company Nas, "When approaching sound design, it's good to remember the three parts of sound in film: human voices, music, and sound effects. These are the three elements that audiences expect a video or movie to have" (The Importance of Sound Design, 2022).

The second option for sound recording of open spaces is landscape acoustics. It differs in that when a site or part of it needs sound recording without attracting attention, the speakers of landscape acoustics can be made in the form of a stone or a small lantern to illuminate the area.

If the main task of the sound recording of a large open area is the transmission of voice and voice messages, you should use horn acoustics. It is the loudspeakers that clearly transmit speech messages in a certain direction, such speakers can be easily fixed at a high enough height on poles, fences, or decorative elements. However, there are also loudspeakers designed to play music.

It is also necessary to determine the features of the sound recording of open areas. Namely, in addition to special speakers designed for sound recording in wide open spaces, there are several nuances of sound. Thus, to ensure the efficiency of the system will need a large number of wires.

There are three ways to record sound: mechanical, optical, and magnetic. In modern devices, the sound is recorded using electrical energy. Direct audio reproduction is only possible with mechanical recording. The optical and magnetic recording must be amplified, corrected, and converted on special electro-

acoustic devices, which are called reproducing equipment. The optical method of the sound recording is used in sound cinematography and, in addition, in some studies.

It is advisable to determine what devices are needed to record sound on the spot, namely: in this regard, it should be said that almost anyone can record in the studio, but professionals are much more appreciated for their ability to quickly and efficiently solve non-standard problems. Creative thinking has always been valued. When we say "recording", we mean the recording of sound from a living source. The most popular sound recording is voice recording.

Many organizations have to prepare musical material, for example for a sketch, and in this case, it is not about studio quality, but about the possibility of recording directly in the workplace.

It is believed that the studio is characterized by the presence of a special room, and a large amount of equipment for recording and sound processing. In addition, there is a large number of additional devices which make the process easier. We should not forget about the role of the environment itself. The training manual for acoustic equipment states:

"To create optimal acoustic conditions in acoustically defined rooms, sound-absorbing materials and structures are used, as well as sound-dispersing elements and structures that cover and decorate the surfaces of the room. At the same time, the main acoustic parameter of the room is considered to be the standard reverberation time. Without the use of sound-absorbing materials, the reverberation time in the room exceeds the necessary optimal value". (Didkovskiy and Lunova, 2001, p. 8)

But all this is not possible if there is no mobile studio based on a spacious car. For this reason, sound engineers should have only the essentials.

If the sound is tracked from the source to the recorder, you can use the following simple scheme: microphone – mixer – sound card – laptop. You will also need headphones to control the recording process. Another important detail is the microphone stand. The main requirements for recording equipment outside the studio are small size, lightweight, and autonomy.

Using a laptop is more convenient and easier. This is because it is easy to take along. In addition, you can quickly and accurately record and edit material. Another plus of using a laptop is the huge amount of time it takes to record. The laptop allows you to connect various modules and use any convenient software. We can say that almost any laptop can be configured to work with sound.

If the task of a laptop is only recording, it's easiest to set up, as this process requires minimal resources. If an autonomous operation is envisaged, special attention should be paid to the battery. Also, do not forget that to digitize the received sound you will need a sound card with analog stereo input and stereo output.

The microphone must be dynamic. If condenser microphones can be used when recording in the studio, because they are more sensitive and record in more detail, then when recording outside a certain room without soundproofing, they will pick up a lot of extraneous noise. A microphone stand will be necessary to secure the microphone in a stationary position. The holder should fit the microphone (appropriate devices are often included with the microphone).

Therefore, you need a stand, as the recording quality may deteriorate if the artist holds the microphone.

Another important step is the choice of cables. Most often, these are special ready-made cables with the appropriate characteristics. Out-of-studio recording is unlikely to improve sound through cables, but it's more realistic to spoil everything. Choosing cables is a matter of practice, but it is important to remember that almost identical cables may have different characteristics.

For an experienced sound engineer, even appearance can tell a lot, but beginners should gain experience and make their choice in favor of world-famous brands such as Neutrik. Most of the extraneous noise comes through the cable. It, in turn, goes to the microphone. Therefore, a balanced connection will be of particular importance. From this, it follows that three contacts will be used to transmit a mono signal, as, for example, in unbalanced stereo. Such cables are characterized by the presence of a standard three-pin XLR connector or a stereo jack (TSR).

The most important thing for the artist is not the equipment and its quantity, but the pleasure of the recording process itself. In this sense, the best recording engineer will be a person who can communicate normally and who is willing to accept the wishes of the artist. In addition, it happens that the customer and the contractor are different people. And here it is necessary to take into account the interests of all parties.

When recording a non-professional performer, he needs to clearly explain what is required of him and create comfortable conditions for him during recording. When working with people, you always need to remain a bit of a psychologist,

because the final result directly depends on the performer and his mood. In favor of this, the words of Volodymyr Diachenko (2018, p.6) testify that it is worth "paying attention to the performance interpretation, which is fixed with the help of software complexes for measuring such objective sound parameters as the full spectral composition, intensity and dynamic range".

So, to record sound in the field you need a laptop, sound card, mixing console, and a microphone on the rack. As for the quality of the recording result, it will depend on the specific artist and the skill of the sound engineer.

In the course of our research, it is necessary to find out the means of sound, and voice, in this regard, it should be noted that sound information is a process of combining different soundtracks into a single whole. This assembly process can be divided into 5 components. In each part there is work with different sound parameters:

1. Magnitude (dynamic processing);
2. Working with frequency components of sound (equalizer);
3. Spatial processing;
4. Pitch;
5. Timing features.

Dynamic processing is volume control. There are two ways to adjust the volume – manual and compression.

Manual processing includes the normalization of all tracks, as well as normalizes phrases, words, or even syllables that are difficult to hear in the mix. This is usually done on your own, aural reception. Otherwise, the analyzer monitors the RMS value. The volume of each fragment should be sufficiently equal.

Compression is an automatic change in volume according to a certain law. The

compressor automatically makes the loud parts quieter.

As for the voice, it is even more difficult here. The microphone perceives the voice in an undistorted natural dynamic range, which means that there are both very quiet and very loud moments. In addition, even just one word can vary greatly in syllable volume. Therefore, the compressor should be one of the first at the top of the processing list.

The devices with dynamic processing, in addition to the usual compressor, can also include the following:

The limiter does not allow the passage of a signal with a volume above the set value (ratio = infinite or large number).

The extender makes quiet places even quieter (ratio <1).

The maximizer increases the volume of quiet components but does not affect the loud ones.

Multi-band compressor compresses individual frequency bands.

De-Esser compresses the high-frequency range from a certain value. It is effective against hissing noises.

Equalization. This is the next effect after the compressor. An equalizer is a device that controls the signal strength at certain frequencies.

A person hears from 20 Hz to 20,000 Hz. The range of the human voice depends on the timbre itself. The lower level for men is about 100 Hz, and for women – 200 Hz.

The frequency components of vocals and speech also depend on the note being recorded. The recitative does not contain any specific notes; the pitch varies depending on the intonation.

The equalizer is a complex device. You need to work with it carefully, you do not need to significantly increase or decrease

the volume of certain areas to control the dB level.

In the course of our research, it is expedient to determine the features of voice recording and to study voice recording on a button microphone. In this regard, it should be said that the human voice itself is expressive, but with the help of various methods of sound processing can achieve even more interesting and vivid language effects. The full range of existing processing methods, such as amplitude, frequency, phase, and time can be applied to the voice.

When processing a recorded voice, a 60-100 Hz high-pass filter is usually used first. In some cases, the bass reaches 150 Hz, depending on the type of voice of the narrator and his timbre. This eliminates, on the one hand, unnecessary low-frequency overtones and, on the other hand, if necessary, an excessive amount of low-frequency frequencies caused by the effect of the proximity of the directional microphone.

The frequency range from 800 to 1500 Hz gives speech performance and confidence, but the main thing here is not to overdo it, if the level in this range is increased, exceeding these frequencies can be disgusting. A small increase in the range of 2500-5000 Hz can lead to better speech intelligibility.

Thus, the main advantages of the button microphone are its small size and high-quality sound processing, which allows you to record speech and vocals almost imperceptibly. Speakers speak freely and forget about the availability of devices.

Conclusions

In the course of our research, the peculiarities of sound recording in an open

space were analyzed. The role of using special microphones to hide shortcomings has been established with the help of literature analysis. Structural components that form the news are elaborated in detail. The factors that affect the quality of the sound recording in an open space are summarized.

It was determined that there are three ways to record sound: mechanical, optical, and magnetic. In modern devices, the sound is recorded using electrical energy. Direct audio reproduction is only possible with mechanical recording. The optical and magnetic recording must be amplified, corrected, and converted on special electro-acoustic devices, which are called reproducing equipment. The optical method of the sound recording is used in sound cinematography and, in addition, in some studies.

It was also determined that to record sound in the field you need a laptop, sound card, mixing console, and a microphone on the rack. As for the quality of the recording result, it will depend on the specific artist and the skill of the sound engineer.

The process of combining sound and voice can be divided into 5 components. In each part there is work with different sound parameters:

1. Magnitude (dynamic processing);
2. Working with frequency components of sound (equalizer);
3. Spatial processing;
4. Pitch;
5. Timing features.

It was found that the main advantages of the button microphone are its small size and high-quality sound processing, which allows recording speech and vocals almost imperceptibly. Speakers speak freely and forget about the availability of devices.

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ОСОБЛИВОСТІ ЗАПИСУ ЗВУКУ НА ВІДКРИТОМУ ПРОСТОРІ

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Анотація

Мета дослідження – проаналізувати технологічні особливості запису звуку на відкритому просторі. Для цього слід виконати такі завдання: встановити роль відкритого простору, коли він виконує функцію панівного середовища під час запису мови або звуку; довести важливість отримання розбірливої мови з мікрофона під час запису звуку на відкритому просторі з урахуванням впливу сторонніх звуків. **Методологія дослідження.** Застосовано такі методи: аналітичний – для вивчення наукового підґрунтя розглянутої проблематики; теоретичний – для узагальнень теоретичних положень та практичних спостережень, систематизації отриманої теоретичної бази та практичних результатів; структурно-функціональний – для виділення складових частин успішного звукозапису в умовах відкритого простору та визначення їх функцій. **Наукова новизна:** вперше узагальнено інформацію щодо використання спеціалізованої техніки, яка допоможе приховати недоліки звучання. Також виділено значення подальшої обробки звуку технічними приладами. У статті виокремлено специфіку відкритого простору у контексті звукозапису; визначено основні джерела звуку на відкритій території і проаналізовано особливості роботи з ними. **Висновки.** У статті проаналізовано особливості запису звуку на відкритому просторі, встановлено роль специфічних чинників, здатних впливати на процес звукозапису з огляду на особливості роботи звукорежисера. За допомогою аналізу літературних джерел встановлено роль використання спеціальних мікрофонів для приховування недоліків. Узагальнено чинники, які впливають на якість запису звуку на відкритому просторі.

Ключові слова: запис звуку; аудіовізуальне мистецтво; мова; мікрофон; відкритий простір; шум

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