***KINO HÁM DRAMATURGIYA***

# ACOUSTIC CHARACTERISTICS OF RECORDING KARAKALPAK TRADITIONAL INSTRUMENTS (QOBIZ, SHINKOBIZ) IN STUDIO CONDITIONS AND THEIR ADAPTATION TO THE 5.1 SURROUND SYSTEM

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# QORAQALPOQ AN'ANAVIY CHOLG'ULARINI (QOBIZ, SHINKOBIZ) STUDIYA SHAROITIDA YOZIB OLISHNING AKUSTIK XUSUSIYATLARI VA ULARNI 5.1 SURROUND TIZIMIGA MOSLASHTIRISH

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# АКУСТИЧЕСКИЕ ОСОБЕННОСТИ ЗАПИСИ КАРАКАЛПАКСКИХ ТРАДИЦИОННЫХ ИНСТРУМЕНТОВ (КОБЫЗ, ШИНКОБЫЗ) В СТУДИЙНЫХ УСЛОВИЯХ И ИХ АДАПТАЦИЯ К СИСТЕМЕ 5.1 SURROUND

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**Key words:** sound directing, Karakalpak folklore, qobiz, shinkobiz, acoustic analysis, 5.1 Surround system, spatial audio, miking techniques, post-production, transients, audio frequency.

**Summary.** This article investigates the acoustic complexities and technical solutions involved in recording Karakalpak traditional instruments (qobiz and shinkobiz) under studio conditions. Transferring ethnic instruments into multi-channel (5.1 Surround) spatial formats is a serious engineering task. The study provides an in-depth analysis of the frequency spectra, specific transient behaviors, and resonance characteristics of these instruments. Furthermore, by proposing advanced miking methods (Mid-Side technique, off-axis positioning) and panning strategies during the post-production stage, a comprehensive methodological guide for sound directors has been developed. The primary objective is to seamlessly integrate the Karakalpak musical heritage into modern spatial audio platforms while preserving its authentic, ancient timbre.

**Tayanch so'zlar:** ovoz rejissurasi, qoraqalpoq folklori, qo'biz, shinkobiz, akustik tahlil, 5.1 qamrovli tizim, fazoviy audio, mikrofon texnikasi, post-prodakshn, tranzitlar, audio chastotasi.

**Rezyume.** Ushbu maqolada qoraqalpoq an'anaviy cholg'ulari (qobiz va shinkobiz) ni studiya sharoitida yozib olishda yuzaga keladigan akustik murakkabliklar va ularning texnik yechimlari tadqiq etilgan. Etnik cholg'ularni ko'p kanalli (5.1 Surround) fazoviy formatlarga o'tkazish jiddiy muhandislik vazifasi hisoblanadi. Tadqiqotda mazkur asboblarning chastota spektrlari, ularning spesifik tranzientlari va rezonans xususiyatlari chuqur tahlil qilingan. Shuningdek, ilg'or mikrofonlash usullari (Mid-Side texnikasi, off-axis joylashuv) va post-prodakshn bosqichida panoramalash strategiyalarini taklif qilish orqali, ovoz rejissyorlari uchun kompleks uslubiy qo'llanma ishlab chiqilgan. Asosiy maqsad – qoraqalpoq musiqiy merosining asl, qadimiy tembrini saqlab qolgan holda, uni zamonaviy fazoviy ovoz platformalariga nuqsonlarsiz integratsiya qilishdir.

**Ключевые слова:** звукорежиссура, каракалпакский фольклор, кобыз, шинкобиз, акустический анализ, система 5.1 Surround, пространственное звучание, техники микрофонов, постпродакшн, переходы, частота звука.

**Резюме.** В статье исследуются акустические сложности и технические методологии, необходимые для записи каракалпакских традиционных инструментов (кобыз и шинкобыз) в условиях студии. Переход этнических акустических инструментов в многоканальные форматы (5.1 Surround) представляет собой серьезную инженерную задачу. В исследовании представлен глубокий спектральный анализ этих инструментов с подробным описанием их специфических транзиентов и резонансных частот. Предлагая передовые методы микрофонирования (техника Mid-Side, смещенное расположение) и стратегии алгоритмического панорамирования на этапе пост-продакшна, исследование предлагает комплексную основу для звукорежиссеров. Главная цель — сохранить аутентичный, архаичный тембр каракалпакского музыкального наследия и гармонично интегрировать его в современные платформы пространственного звука.

## INTRODUCTION

The rapid technological evolution within contemporary audiovisual arts has drastically expanded the horizons of spatial audio and acoustic realism. The global cinematography and music industries have largely transitioned from conventional stereo (2.0) formats to highly immersive multi-channel systems, including 5.1, 7.1, and object-based Dolby Atmos environments. However, within the context of the regional film industry—particularly in Karakalpak and broader Uzbek national cinema—the adaptation of authentic traditional instruments to these spatial formats remains a critical, unresolved issue.

The musical heritage of Karakalpakstan is intrinsically linked to its unique ethnic instruments, most notably the qobiz (a bowed string instrument) and the shinkobiz (a traditional jaw harp). These instruments possess exceptionally complex timbres, unpredictable transient responses, and highly specific frequency spectra. Simply placing a microphone in front of the performer and recording the sound in a standardized manner often results in a sterile, harsh audio file that strips the instrument of its ancient, atmospheric resonance. The primary objective of the sound director is not mere documentation; rather, it is the accurate electro-acoustic translation of the instrument's authentic nature—capturing the friction of the horsehair bow, the internal resonance of the wooden body, and the performer's breathing—while constructing an immersive 5.1 Surround environment that places the audience directly in the epicenter of the narrative. This research aims to analyze the empirical acoustic properties of these instruments, determine optimal miking techniques, and establish a theoretical and practical methodology for spatial mixing in post-production.

## METHODS AND MATERIALS

This study employed a combination of empirical acoustic observation, frequency-spectral analysis, and comparative microphone testing. The recording sessions were conducted in an acoustically treated studio environment. To capture the diverse wave propagations of the qobiz and shinkobiz, a variety of microphones were tested, including large-diaphragm condensers (Neumann U87, AKG C414) and modern ribbon microphones (Royer R-121).

The captured audio signals were subsequently routed through high-end preamplifiers into digital audio workstations (DAWs), primarily Avid Pro Tools and Steinberg Nuendo. For post-production analysis and spatial mixing, we utilized spectral analyzers (iZotope RX Advanced) and parametric equalizers (FabFilter Pro-Q 3). The spatial distribution was tested using native 5.1 surround panners and algorithmic convolution reverbs designed to simulate specific acoustic environments relevant to Karakalpak epics (e.g., open steppes, traditional yurts).

## RESULTS AND DISCUSSION

Translating the acoustic footprint of ethnic instruments into a digital multi-channel environment is complicated by their non-standardized physical construction. Unlike classical orchestral instruments (such as the violin or flute), folk instruments require a highly individualized engineering approach during every recording session.

*Acoustic* Analysis and Miking Strategies for the Qobiz The qobiz is an archaic, fretless bowed instrument carved from a single block of wood, featuring an open resonator covered partially by camel skin. Both the strings and the bow are constructed from undyed horsehair. Spectrally, the qobiz is incredibly rich yet volatile. While its fundamental frequencies typically reside within the 120 Hz to 400 Hz range, the overtones that define its haunting, melancholic timbre extend well into the 5 kHz to 8 kHz spectrum. The most defining characteristic of the qobiz is the specific "rosin noise"—a raspy, textured friction generated by the horsehair bow scraping against the horsehair strings.

If a microphone is placed too close to the instrument (close-miking, at a distance of 10–15 cm), the "proximity effect" artificially inflates the low-frequency response (100–200 Hz), resulting in a muddy, booming sound that masks the intricate mid-range details. Furthermore, close-miking captures excessive high-frequency harshness from the bow. To circumvent this, our research identifies the Mid-Side (M-S) miking technique as the most acoustically transparent method for recording the qobiz.

In this configuration, a cardioid microphone (the "Mid") is pointed directly at the bridge of the instrument, while a bidirectional (Figure-8) microphone (the "Side") is positioned perfectly perpendicular to capture the lateral room reflections. As noted by acoustic engineer F. Alton Everest: "Bowed instruments do not radiate their sound uniformly in all directions; their high frequencies tend to project forward, while low frequencies wrap around the body of the instrument" [1, p. 142]. Therefore, positioning the M-S array at a distance of 45 to 60 cm, slightly above the bowing plane, captures the "breath" of the instrument naturally.

Additionally, utilizing a ribbon microphone rather than a condenser for the Mid signal helps naturally attenuate the harsh 4 kHz-6 kHz

transient spikes, imparting a warm, historically authentic tonality to the recording.

Transient Management in Recording the Shinkobiz The shinkobiz (Karakalpak Jew's harp) presents an entirely different set of acoustic hurdles. The instrument itself lacks a physical resonant chamber; instead, it relies entirely on the performer's oral cavity and pharynx to act as a dynamic resonator. When the performer strikes the metal reed, it produces a sound with extremely sharp initial transients. Furthermore, the formants—shaped by the continuous movement of the performer's tongue, jaw, and breath—fluctuate rapidly across a wide frequency band from 1 kHz up to 10 kHz.

The greatest technical adversary when recording the shinkobiz in a studio is the expelled air current and the unintentional percussive noises (plosives) generated by the performer's teeth and saliva. Standard on-axis miking inevitably results in low-frequency rumble and capsule clipping. To mitigate this, the microphone must be placed off-axis, approximately 30 degrees to the side of the performer's mouth, at a distance of 15–20 cm, utilizing a high-quality pop filter. Because the sharp metallic transients of the reed can easily overload analog-to-digital converters, it is highly recommended to apply gentle analog compression (e.g., an optical compressor at a 2:1 or 3:1 ratio) during the tracking phase to tame the peaks without crushing the instrument's dynamic range.

Spatial Panning Strategies for the 5.1 Surround System Once high-fidelity audio assets are recorded, they must be adapted to the 5.1 Surround format during post-production. The 5.1 system consists of six discrete channels: Center (C), Left (L), Right (R), Left Surround (Ls), Right Surround (Rs), and the Low-Frequency Effects (LFE) channel. To accurately convey the epic and historical atmosphere of Karakalpak narratives, the sound director must distribute the ethnic instruments strategically within this 360-degree soundscape.

Based on our experimental mixing sessions, we propose the following spatial distribution matrix for Karakalpak folk music:

The Center Channel (C): In traditional cinema mixing, the center channel is strictly reserved for dialogue. However, in Karakalpak jiraw (epic storytelling) performances, the voice of the narrator and the sound of the qobiz are a unified sonic entity. Therefore, the direct, "dry" signal of the qobiz should be partially bled into the Center channel alongside the vocals to anchor the acoustic focus to the center of the screen. The Front Lateral Channels (L / R): The stereophonic width of the qobiz is established here. The Mid-Side recording is decoded, and the "Side" spatial information is routed hard-left and hard-right. This prevents the instrument from sounding like a point-source emitting from a speaker, creating instead the illusion that the qobiz is filling the physical width of the viewing room.

The Surround Channels (Ls / Rs): It is a critical error to route the direct, dry signal of the instrument to the rear speakers, as this causes phase cancellation and distracts the viewer. Instead, only the spatial processing (Reverb and Delay) should be routed to the Ls and Rs channels. By utilizing convolution reverbs with impulse responses (IR) of open steppes or traditional wooden yurts, the sound director envelops the audience in the acoustic reflections of the specific historical environment.

The LFE Channel (Subwoofer): Although the qobiz is not a sub-bass instrument like a synthesizer, during moments of high dramaturgical tension—specifically when the jiraw utilizes deep guttural throat singing (tolgaw) and bows the thickest string—routing the lowest resonant frequencies (below 80 Hz) to the LFE channel creates a profound psychoacoustic effect. The physical vibration impacts the viewer's chest, maximizing emotional immersion.

Conversely, the shinkobiz must strictly be filtered out of the LFE channel (using a high-pass filter at 120 Hz) to prevent muddy low-end rumble, as the jaw harp contains no musical information in the sub-bass register.

As T. Holman asserts regarding multi-channel audio: "Surround sound is not merely louder sound; it is an independent instrument of storytelling" [2, p. 75]. Adapting Karakalpak instruments to surround formats is not just an act of volume adjustment, but the delicate art of translating ancient acoustics into modern psychological spaces.

Psychoacoustic Automation of the Shinkobiz The sound of the shinkobiz inherently possesses a hypnotic, almost trance-like quality.

In psychological cinema, particularly during scenes depicting a protagonist's internal conflict or altered states of consciousness, the spatial automation of the shinkobiz across the 5.1 matrix serves as a powerful expressive tool.

By utilizing surround panners, the sound director can automate the shinkobiz to physically rotate around the audience—moving from the front-left, sweeping through the rear surrounds, and returning to the front-right.

This 360-degree panning mirrors the circular, obsessive nature of human thought, turning an

ethnic instrument into a profound tool for psychological narrative.

## CONCLUSION

The successful integration of Karakalpak national instruments—namely the qobiz and shinkobiz—into modern cinema and media requires the sound director to possess not only technical engineering skills but also a refined ethnomusicological sensitivity.

Firstly, recording these instruments demands the abandonment of standardized acoustic templates. Sound directors must employ specialized techniques, such as Mid-Side configurations and off-axis ribbon microphone placement, to capture the archaic friction and transients of the instruments without artificial harshness. Secondly, adapting these recordings to a 5.1 Surround system must serve the dramaturgical purpose of the film. Retaining the physical body of the instrument in the front channels while utilizing the surround channels exclusively for environmental acoustic reflections ensures naturalism without sacrificing immersion.

Ultimately, digital audio technologies should not be viewed as a threat that sterilizes acoustic heritage. Instead, when utilized with scientific precision and artistic respect, modern audio engineering becomes the most powerful vehicle for preserving the imperceptible, miraculous nuances of traditional Karakalpak folklore and delivering them intact to the consciousness of the global, contemporary audience.

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