

The Discourse of an Instrument, and a Thousand Machines

弦语千机

RUILEI DUAN, Zhejiang Conservatory of Music, China

ZHENGYANG KENNY MA*, The Hong Kong University of Science and Technology, Hong Kong SAR



Fig. 1. Audience smartphones joined to the Qianji framework during the performance, forming a distributed luminous and acoustic field.

Additional Key Words and Phrases: Distributed performance, Web Audio, Guqin, Audience-as-instrument, Cosmotronics, Macro-granular synthesis, Server-Sent Events

1 Program Notes

The *Guqin* is historically an instrument of quiet intimacy, played not only in the scholar's studio but in mountain retreats and secluded gardens, where the surrounding environment—stone, wood, water—served as a resonating extension of its delicate voice. *The Discourse of an Instrument, and a Thousand Machines* reconstructs this relationship at the scale of a modern venue: hundreds of audience smartphones are not treated as independent instruments accompanying the zither, but are sublated into its **Resonant Body**—a distributed *qinzhao* (琴桌, “zither table”) that receives and extends the instrument's voice across the entire hall.

By transforming each personal device into a discrete passive resonator, the piece composes a digital *shanshui* (山水, “mountains and water”), a networked acoustic ecology that responds to the zither's gestures [1]. Grounded in the framework of musical cosmotronics [2], the work reconciles the characteristic intimacy of the traditional *Guqin* with the macro-granular digital presence of the crowd. Enmeshed within this resonant web, the audience member is liberated from the impulse to broadcast: the smartphone is hollowed out of its social-media function and returned to the audience as a vessel of listening.

*Corresponding author.

Authors' Contact Information: Ruilei Duan, Zhejiang Conservatory of Music, Department of Music Engineering, Hangzhou, China, drl@zjcm.edu.cn; Zhengyang Kenny Ma, The Hong Kong University of Science and Technology, Hong Kong, Hong Kong SAR, zmaaf@connect.ust.hk.



This work is licensed under a Creative Commons Attribution 4.0 International License.

NIME '26, June 23–26, 2026, London, UK

© 2026 Copyright held by the owner/author(s).



Fig. 2. The lone *Guqin* performer on stage during the premiere performance. The singular acoustic authority of the instrument is the source from which the distributed audience array resonates.

2 Project Description

This performance is powered by **Qianji** (literally “a thousand machines”), a web-based framework engineered for massive distributed audio over audience members’ own 4G/5G cellular networks. To overcome the severe packet loss and jitter typical of orchestrating hundreds of co-located devices in a single physical space, Qianji adopts a *resilience-first* unidirectional broadcast architecture using Server-Sent Events (SSE), trading per-client bidirectional interactivity for the survival of the collective texture.

The spatial orchestration is achieved through a **Video-to-Volume** workflow that treats the audience as pixels in a low-resolution display. Spatial gestures—a wave sweeping across the hall, a granular cloud condensing toward the stage—are composed offline as grayscale motion graphics, sampled per seat, quantised into 8-bit amplitude envelopes, and downloaded by each client as a compact binary file (.bin) based on its self-reported seat coordinate. During the performance, each smartphone acts as a discrete grain generator playing heavily processed *Guqin* samples, effectively turning the audience into a macro-scale granular instrument in the sense of Roads [3].

The piece has been deployed in two public concert performances, with the largest live array reaching 421 audience smartphones in a 500-seat venue. While first conceived for the hushed intimacy of a recital hall, the architecture is venue-agnostic: it scales naturally to larger auditoriums and outdoor spaces, and can be combined with a front-of-house spatial audio system to layer the distributed audience field over a stage-anchored acoustic image. As such, the work also offers a small, deliberate gesture toward NIME’s theme of communities: a Chinese literati tradition—historically solitary—is here re-staged as an act of communal resonance, where the cultural specificity of the *Guqin* is preserved precisely *by* being distributed across the bodies and devices of a contemporary audience.

3 Performance Notes

- **Duration:** approximately 6 minutes. **Instrumentation:** solo *Guqin* performer with a distributed audience-smartphone array (typically 100–500 devices; tested at scale up to 421). **Venue:** a recital hall or theatre with house lights dimmed; the piece adapts to spaces from intimate concert halls to larger auditoriums and outdoor settings.
- A live *Guqin* performer is seated centre-stage, amplified using two boundary microphones and one small-diaphragm condenser, routed to a left-centre-right speaker array at the front of the audience.
- At the start of the show, audience members scan a QR code via their phone’s native camera or messaging app and self-report their seat (section, row, seat number). No Wi-Fi is required; the system runs over the audience’s own cellular data.
- Once joined, devices operate under a deliberate **Zero-Interaction** design. The screen displays a dynamic luminosity field—a single, monochrome luminance channel that mirrors the device’s current amplitude envelope, brightening and dimming in sync with the audio gain. There are no buttons, no gestures, no taps to perform. This restraint is an aesthetic stance: stripping the screen of graphical and interactive incident allows the device to recede into the acoustic field, so that the audience’s attention belongs to the *Guqin* and to the room rather than to the phone in their hand.
- The conductor issues timestamped cues from a “fire-and-forget” console (executing $\delta \approx 2$ s in the future), orchestrating sweeping spatial textures—granular clouds moving across the hall, rain-like washes from the back of the room toward the stage—that perceptually merge into a cohesive, organic texture supporting rather than overpowering the acoustic instrument.

On the Restraint of the Visual and Interactive Surface

Two design choices in this piece are deliberately, and conceptually, under-stated: the screens are monochrome rather than chromatic, and there is no audience interaction layer. Both are constitutive of the work rather than expedient defaults.

The luminosity field is monochrome because its role is acoustic, not graphic: it must read, from anywhere in the hall, as an extension of the *Guqin*’s amplitude rather than as a competing visual event. Introducing chromatic variety—rainbow palettes, randomised hues, varying stroke weights—would convert the audience array into a light show that sits *beside* the music. Restraint preserves the hierarchy: the zither speaks; the array resonates.

The interactive surface is similarly absent by design. The conceptual core of the piece is a sublation of the smartphone: it is precisely the suspension of the device’s social and broadcast functions that re-opens the act of listening. Re-introducing taps, gestures, or voting interactions would invite the audience back into the posture of *user*, undoing the work’s central proposition. The audience’s role here is to listen *into* the instrument through a thousand small bodies, not to play alongside it.

4 Stage & Technical Requirements

- **Stage:** a small playing area (approximately 2×2 m) for one seated *Guqin* performer and the instrument on its own low table.
- **Lighting:** a dimmed house with a single warm spotlight on the performer; minimal stage lighting otherwise so that the audience’s screens contribute meaningfully to the visual field.
- **Audio (front of house):** a left-centre-right speaker array driven by the venue’s standard PA. The *Guqin* is captured with two boundary microphones and one small-diaphragm condenser, mixed at front of house. No dedicated subwoofer or surround system is required, though the piece composes well with an existing spatial audio rig if the venue has one.
- **Network:** *venue Wi-Fi is not required.* Audience devices connect through their own cellular data (4G/5G). A clear cellular signal in the auditorium is the only network prerequisite.
- **Server:** the Qianji broadcast server runs on a cloud-hosted VPS provided by the artists; the venue does not need to host any infrastructure.
- **Conductor station:** one laptop with a wired or cellular internet connection at front of house, running a web-based console.
- **Setup time:** approximately 30 minutes for sound check and a brief audience-onboarding rehearsal of the QR scan and seat self-report.

5 Media Links

A spatial audio recording, video documentation, and project notes are available at the project page: <https://zmk5566.github.io/qianji/>.

6 Ethical Standards

All participants in both pilot tests and public performances were informed in advance that they were taking part in a research study involving their personal devices. Participation was strictly voluntary; audience members could decline simply by not scanning the QR code.

By design, the Qianji framework does not collect any personally identifiable information from audience devices—no IP addresses, device identifiers, carrier information, or usage analytics are recorded. The smartphone is treated as a borrowed acoustic resource for the duration of the piece and nothing more. Source code of the framework will be released under an open-source license upon publication.

The *Guqin* repertoire and performance practice featured in this work draw on a living Chinese musical tradition. The performer is a trained *Guqin* musician participating as a co-author of the piece, and the use of Chinese cultural references (*shanshui*, *qinzhuo*) is anchored in primary sources [4] rather than employed as decoration.

References

- [1] Yuk Hui. 2021. *Art and Cosmotronics*. University of Minnesota Press.
- [2] Iurii Kuzmin, Zhengyang Ma, and Raul Masu. 2024. Toward Musical Cosmotronics: the case of *zhu nao* 竹竽—a bamboo-based instrument. In *Proceedings of the International Conference on New Interfaces for Musical Expression (NIME)*.
- [3] Curtis Roads. 2002. *Microsound*. The MIT Press.
- [4] James Watt. 1981. The Qin and the Chinese Literati. *Orientalism Magazine* (Nov. 1981), 38–49.