

To Perform/ To Live: Decolonizing of Digital Music Instruments and Feminism with Human-AI Co-Created Embodied Experience of Daily Objects

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Fig. 1. **To Perform / To Live** — Workshops and an exhibition featuring three stages of digital musical instrument performances, held in Winter 2025.

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This paper proposes a decolonial approach to interactive music performance grounded in Chinese everyday life. Responding to critiques that dominant interaction models and evaluation norms often reflect Western legacies, we design locally situated digital musical instruments (DMIs) that treat domestic routines as primary interface logic. Our embodied performance system, *To Perform/To Live*, repurposes familiar objects used in Chinese women's daily lives: an abacus, a vegetable washing basin, a soup pot, a fan, and a massage hammer. Across three stages, performers transform counting, soup-making, and restoration gestures into musical control through tempo, pressure, repetition, and pause, rendering gendered labor audible without romanticizing it. After each performance, we extend the work through human-AI co-creation: recorded audio is analyzed to generate a terrain-like surface, 3D printed as a tactile disk that encodes the performance for touch and re-performance. We contribute a China-situated decolonial DMI strategy, a feminist sonic practice of performable labor, and the E2E framework linking embodied knowledge to AI-enabled material extensions.

CCS Concepts: • **Human-centered computing**; • **Applied computing** → **Sound and music computing**; • **Computing methodologies** → *Artificial intelligence*;

Additional Key Words and Phrases: Digital Music Instrument, Decoloniality, Feminism, Human-AI Co-creation, Embodied Knowledge

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1 Introduction

Debates on decolonial issues and coloniality become central in media art [Demerson 2020; Kuzmin et al. 2024; Roy 2022]. Decolonial scholars distinguish *colonialism* as a historical system from *coloniality* as an ongoing structure of power and knowledge, with coloniality maintaining the idea of universal standards that globally rank ways of knowing, bodies, and cultural practices [Mignolo 2013; Quijano 2000]. Tuck and Yang argue that decolonial work should build new frameworks rather than reuse dominant paradigms [Tuck and Yang 2012]. This matters in interactive music, where interaction models, toolkits, and evaluation norms often follow Western legacies. When treated as defaults, they can obscure local histories of touch, meaning, and lived practice [Kuzmin et al. 2024; Roy 2022].

We explore a decolonial approach to performance design grounded in Chinese everyday life. We examine locally situated feminist expression through performance and music making. Daily routines become compositional gestures. Players shape sound through culturally familiar objects, sounds, and habits, not imported categories alone. We do not romanticize labor. Instead, we make its skills and effects audible.

We devise *To Perform/ To Live*, an embodied performance system built from everyday objects used by Chinese women: an abacus, a vegetable washing basin, a soup pot, a fan, and a massage hammer (Figure 1). The performance unfolds in three parts. Stage 1 addresses mental labor through the abacus, linking counting to everyday family budgeting and decision making. Stage 2 uses soup making to represent unpaid domestic and care work. Stage 3 shifts to leisure and restoration through massage hammer gestures. Across stages, performers shape sound through tempo, pressure, repetition, and pauses, which echo the rhythms and effort of domestic work.

We close the loop with a human-AI co-created embodied extension by analyzing each player's performance audio and generating a terrain-like surface on a circular disk. We fabricate the disk as

a solid object that players can hold, touch, and re-perform. It encodes the performance as tactile form and becomes a second instrument for reflection and replay.

Overall, this project makes three contributions:

- It offers a China-situated, decolonial Digital Music Instrument (DMI) strategy that treats domestic objects and routines as primary interface logic.
- It explores a feminist sonic practice that renders gendered labor audible and performable as artistic agency.
- It proposes the E2E Framework, *Embodied Knowledge to Embodied Extension*, a reusable pipeline that links situated objects, expressive sensing, trace capture, and AI-enabled material artifacts. E2E also supports embodied experience into material feedback, including craft, cultural heritage and community storytelling.

2 Related Work

2.1 Embodied Knowledge and Materiality in DMI Design

Embodied knowledge refers to culturally learned ways of sensing, moving, and engaging everyday tools; in HCI terms, interaction becomes meaningful through situated practice rather than mappings alone [Dourish 2001]. Embodied interaction is further shaped by social intelligibility and culturally learned action. John Cage’s *Living Room Music* (1940) situates this logic in household objects [Cage 1976]. Closer to our approach, Martha Rosler’s *Semiotics of the Kitchen* (1976) offers an explicitly feminist critique of “domestic industry”, positioning itself as “the antithesis of the perfect TV housewife.”¹ Data physicalization likewise shows that tangible artifacts provide distinct cognitive and affective affordances [Jansen et al. 2015], while Bae shows their potential to support personal reflection [Bae et al. 2022].

Building on Ingold’s account of materiality as an ongoing relation among materials, bodies, and environments rather than a static property [Ingold 2007], prior DMI research shows that physical, spatial, and social dimensions shape which actions feel possible and expressive [Hornecker and Buur 2006]. Mappings between digital and physical materialities can recast labor gestures as participatory art [Lind and Nylén 2016], while calls for a “material lens” emphasize materiality as a design and evaluation concern [Zheng et al. 2022]. Deformable instruments such as SulpTon show how deformation and exploratory gesture co-produce a sound-making vocabulary [Boem 2014], and craft-oriented approaches frame making as knowledge production [ARMITAGE et al. 2018]. Yet sensing and mapping remain culturally situated: when an interface fails to align with what a body expects to be legible, it can frustrate or distort expressive intent [Pigrem and McPherson 2018].

We argue that embodied knowledge and materiality co-constitute each other over time. Embodied knowledge shapes how materials are played and interpreted, while hacking, crafting, and rematerializing performance generate new embodied knowledge [Young and Crowley 2020]. However, accounts of DMI systems that intentionally connect everyday practice with durable material augmentations, allowing both to evolve together, remain limited.

2.2 Decolonizing Digital Musical Instruments: Chinese Culture

Recent music technology research challenges the assumption that DMIs follow a single “global” design logic [Kuzmin et al. 2024; Roy 2022]. Decolonial scholarship uses *coloniality* to describe how apparently neutral standards hierarchize epistemologies, bodies, and cultural practices [Mignolo 2013; Quijano 2000]. A similar legacy appears in media art, where dominant frameworks shape what counts as valid form, method, and innovation [Demerson 2020; Roy 2022]. In DMI design, the Latin American NIME community shows how decolonial discourse can emerge through situated making

¹<https://www.martharosler.net/semiotics-of-the-kitchen>

practices [Avila et al. 2022; Cadavid 2020; Tragtenberg et al. 2021]. For example, Khipu articulates the decoloniality of South American music by translating an Indigenous Andean knowledge system into a contemporary musical interface. It frames knotting, touch, and material interaction as embodied knowledge practices that reconnect sound-making with cultural memory and resistance disrupted by colonialism [Cadavid 2020]. HCI and design similarly critique “universal” technologies that overlook local histories and power relations [Alvarado Garcia et al. 2021; Irani et al. 2010; Philip et al. 2012]. In parallel, sonic arts and electronic music research has developed China-grounded compositions and aesthetics [Battier and Fields 2020; Kuzmin et al. 2024; Wang 2021].

Methodologically, decolonization shows how research agendas, formats, and evaluation criteria can reproduce colonial ethos [Tuck and Yang 2012]. Scholars argue that research often treats technology as the primary problem, while local culture and communities are reduced to “context” [Alvarado Garcia et al. 2021; Costanza-Chock 2020; Irani et al. 2010; Philip et al. 2012]. This critique also applies to DMIs, which often assume general mappings from bodily action to parameter control, even though bodily techniques and object relations are culturally learned [Kuzmin et al. 2024]. Classic tangible interface research defines interaction as coupling digital information with graspable objects [Ishii and Ullmer 1997]. Building on this, Kuzmin and colleagues developed Zhu Nao, grounding the design in Chinese culture and memory, and showed how locality emerges through embodied knowledge and practice [Kuzmin et al. 2024].

Overall, practice-based work rarely treats Chinese everyday life, materials, and embodied routines as interface logic. DMI toolkits and evaluation norms continue to travel as defaults. Without China-situated research, “local” design risks becoming surface styling, while core models and assumptions remain imported.

2.3 Feminism and Self-expression in China

Feminist self-expression is situated in social roles, everyday routines, and embodied skill, requiring designers to account for their positionality, relations, and commitments while supporting agency, embodiment, and representation [Bardzell 2010; Haraway 2013]. These concerns are particularly salient in design work engaging gendered domestic labor.

Domestic and care labor includes physical chores and cognitive work such as planning, monitoring, and coordinating [Daminger 2019]. It often stays invisible because it spreads across daily life [Daminger 2019]. Feminist political economy links these efforts to the undervaluation of unwaged social reproductive labor² and argues for equal recognition [Dong and An 2015; Federici 1975; Fraser 2016; Rost 2018]. In China, feminist discourse grows in public culture [Croll 2013; Spakowski 2011]. Yet many terms circulate through translation, and scholars stress local genealogies beyond an imported Western frame [Barlow 2004].

From technology-based art, sound and music technologies can ground feminist expression in everyday culture. Feminist scholarship notes that what remains unheard often goes socially unrecognized, so audibility can shape labor, value, and voice. *Bad Mother / Good Mother* turns a domestic device into an instrument that makes invisible labor audible [Rüst 2021]. *FinHERtip* explores human–AI co-creation for feminist and queer self-expression through a DMI made from familiar materials [Zhang et al. 2025]. *Women’s Labor* and *Housework Commons* repurpose domestic tools to support shared revaluation of reproductive labor [Ho et al. 2024; Schedel et al. 2019]. Yet sonic art rarely centers China-specific objects and routines, or treats women’s everyday labor as an affirmative, situated repertoire for musical self-expression.

²Reproductive labor is used here in a Marxist sense, i.e., the work performed at home required to reproduce and maintain the labor force and laboring capacity

3 Methodological Framework: Autoethnography Procedure

Autoethnography is a qualitative, self-reflective method that uses researchers' lived experience as primary data to connect the self with broader cultural, social, and technological contexts in HCI, design studies and practice-based research [Ellis 2004; Furuta et al. 2025; Kaethler and Schouwenberg 2021; Lucero et al. 2019; Rapp 2018; Reed-Danahay 2021; Xue et al. 2025]. We adopt autoethnography to generate embodied, culturally situated insights for design (Figure 2). The first and second authors conduct this work and reflect on personal routines, bodily gestures, cultural associations, and emotional responses to the objects transformed into DMIs.

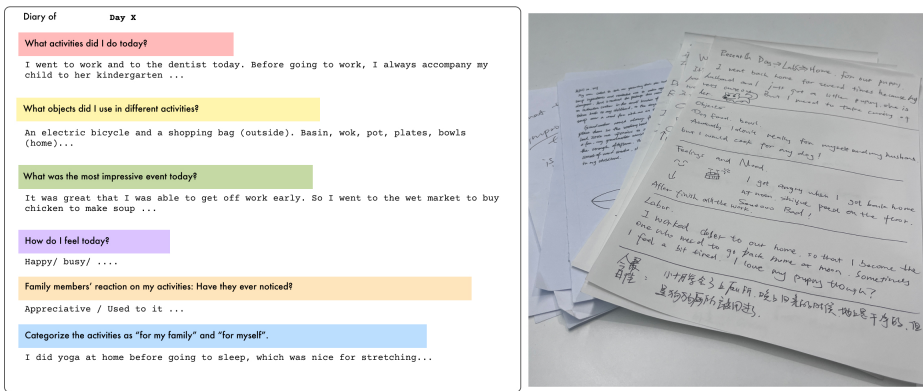


Fig. 2. A template illustrating the researchers' autoethnographic approach, along with handwritten autoethnography.

4 Artistic Concepts: Toward a Conceptual Framework

Using autoethnography, we examine women's routines, labor, and everyday objects. Combining insights of autoethnography with Related Work (Section 2), we define three concepts: (1) routine objects as DMIs; (2) daily activities as feminist self-expression; (3) human-AI co-created experience as material extension.

4.1 Characteristic Daily Objects in Woman's Routine as DMIs

Since decolonial scholarship warns that a single "universal" knowledge standard can reproduce coloniality when it ignores local culture and community practice [Mignolo 2013; Quijano 2000], we ground our DMI design in China-specific objects and everyday embodied knowledge. This responds to critiques of DMI logics that travel across settings and reshape the player's intuitive bodily actions formed in local routines [Irani et al. 2010; Ishii and Ullmer 1997; Kuzmin et al. 2024; Roy 2022]. Therefore, we build each DMI from a domestic object commonly used by Chinese women: an abacus, a vegetable washing basin, a soup pot, a fan, and a back massage hammer. Each object carries local histories and habits of touch, character, and effort [Kuzmin et al. 2024; Pigrem and McPherson 2018]. We group the objects into three stages of a woman's daily routine in China (Figure 3):

- **Stage 1** refers to *household financial labor*. The abacus evokes counting and calculation, foregrounding cognitive work that is often invisible or undervalued. Players trigger sounds by performing calculations with different numbers.
- **Stage 2** refers to *unpaid domestic and care labor*. The washing basin, soup pot, and fan evoke cooking and everyday caregiving, which involves both cognitive and physical labor. The

washbasin is designed to enact the action of “selecting and washing ingredients,” while the fan metaphorically represents “stoking the flame” in the soup-making process.

- **Stage 3** refers to *personal leisure and restoration*. The massage hammer relates to rest and self-care. Players trigger sounds by massaging different body areas, and vary angle and gesture to elicit desired sounds.

4.2 Performative Daily Activities as Feminist Self-expression in China

We treat women’s labor as a source for expression [Barlow 2004; Ho et al. 2024; Rüst 2021]. In China, feminist language often circulates through translation, so feminist self-expression needs local grounding rather than a single imported template [Barlow 2004]. We stage music making in a domestic setting. Feminist self-expression becomes performative when women play the DMIs through embodied knowledge shaped by roles, routines, and skills [Bardzell 2010; Haraway 2013]. We use sounds from our autoethnography to match the three stages in Section 4.1: street sounds for Stage 1, soup recipes and guzheng recordings for Stage 2, and relaxed music for Stage 3. This links labor gestures to compositional decisions and lets players define “their” action and “their” voice, aligning with feminist HCI values of embodiment and representation [Bardzell 2010].

4.3 Human-AI Co-created Embodied Experience as Materiality Extension

After each player finishes an expressive music creation, we analyze the recording and extract audio features. An AI model uses these features to generate a terrain-like surface on a circular disc that references a vinyl record. We fabricate the disc as a solid object that players can hold, touch, and re-perform. Its ridges and valleys encode changes in the player’s creation, so the disc becomes a second instrument for reflection [Bae et al. 2022; Ingold 2007]. Players trace grooves, press peaks, and follow edges, which returns an embodied experience grounded in their own music. The artifact also serves as visible evidence of play labor, which often stays invisible, especially in planning and coordination [Daminger 2019; Federici 1975; Fraser 2016]. We treat the AI result as a material extension of embodied music making, not an automatic artwork generator. This aligns with materiality as ongoing relations among bodies, materials, and environments [Ingold 2007], and with tangible interaction accounts where physical, spatial, and social conditions shape what actions feel possible and expressive [Hornecker and Buur 2006]. A material lens also clarifies how tangible music interfaces are designed and evaluated [Zheng et al. 2022]. Overall, the system connects domestic gestures, musical sound, and lasting artifacts to support shared recognition of everyday labor as skilled, temporal, and creative.

5 Technical Realization

We reframe daily objects as feminist expressive music interfaces in Chinese culture. Players perform these DMIs through lived technique, and agency emerges from embodied knowledge. We then transduce expressive audio traces into material forms through human-AI co-creation.

5.1 DMI Design

We integrate electronics into daily objects without erasing their original affordances or cultural resonance. We present the technical details across the performance’s three stages (Figure 4).

5.1.1 Abacus at stage 1. Two piezo contact pickups on the abacus’ high- and low-order ends (hundreds of millions vs tens) capture bead vibration. We compute a real-time spectral descriptor and quantize band energy to select and modulate layered street sounds. Gestures on the high-order end bias playback toward advertisement calls; stronger force yields louder, more exaggerated voices.

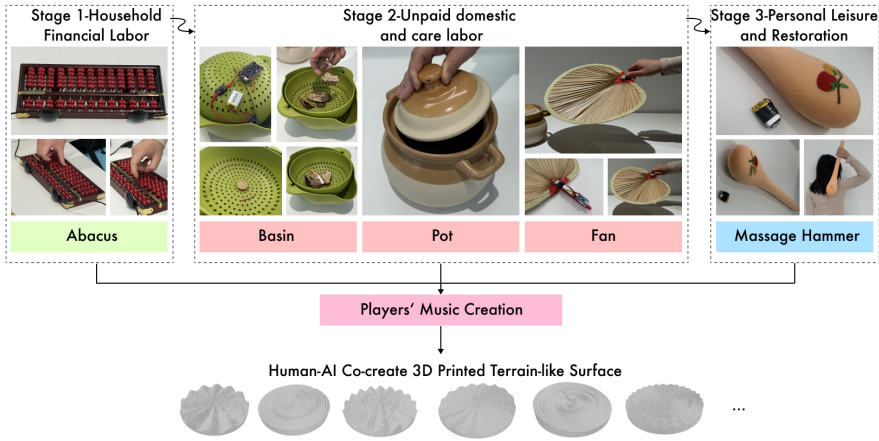


Fig. 3. How our conceptual framework aligns with player interaction.

Gestures on the low-order end trigger domestic scenes, with complexity increasing with impact. A drum bed from short chopping samples underpins the stage.

5.1.2 Washing basin, pot and fan at stage 2. The DMIs use impact sensing and spatial control. Embedded sensors capture physical interactions, transmit them wirelessly, and map them to real-time synthesis in Pure Data. The washing basin and soup pot form a soup-making metaphor. Players drop ingredients into the basin and create percussive impacts. A piezo pickup on the basin captures impacts and streams audio via an ESP32 over Wi-Fi. We extract impact features and map them to discrete pitch sequences from two pentatonic guzheng scales. These trigger samples that emphasize material resonance and cultural reference. The fan forms a fire-control metaphor. A Seeed Studio XIAO nRF52840 on the fan reads orientation from its onboard IMU. It sends motion data via BLE to a Python client. These data modulate a granular engine in Pure Data that processes a field recording of a Guangzhou woman narrating soup-making. The sound morphs with rotational gestures and plays through the system audio interface.

5.1.3 Massage hammer at stage 3. The massage hammer embeds a battery-powered Seeed Studio XIAO nRF52840 Sense board, enabling fully handheld interaction. Its IMU captures rotational velocity and direction across three axes. We encode three-axis motion as OSC and transmit it via Bluetooth to Pure Data. These parameters drive real-time synthesis and modulation. Gestural intensity governs amplitude, temporal density, and grain size. The sound engine blends acoustic and synthetic layers. Guqin, Tibetan singing bowls, and ambient recordings form a stable base. Digital glitches and harmonic tones emerge through gesture-driven modulation. Accelerometer data control velocity and granularity, allowing elements to accumulate and overlap over time. This yields a dense, evolving sonic texture that reflects continuous embodied motion.

5.2 Audio to 3D-printed Objects

Players' musical creations become embodied extensions through human-AI co-created 3D models. Our approach couples a learned control model with procedural geometry to convert audio into 3D-printed objects. TerrainNet maps each audio frame to interpretable terrain knobs, and polar, rule-based height synthesis turns them into a printable, legible tactile disk. We resample a monaural

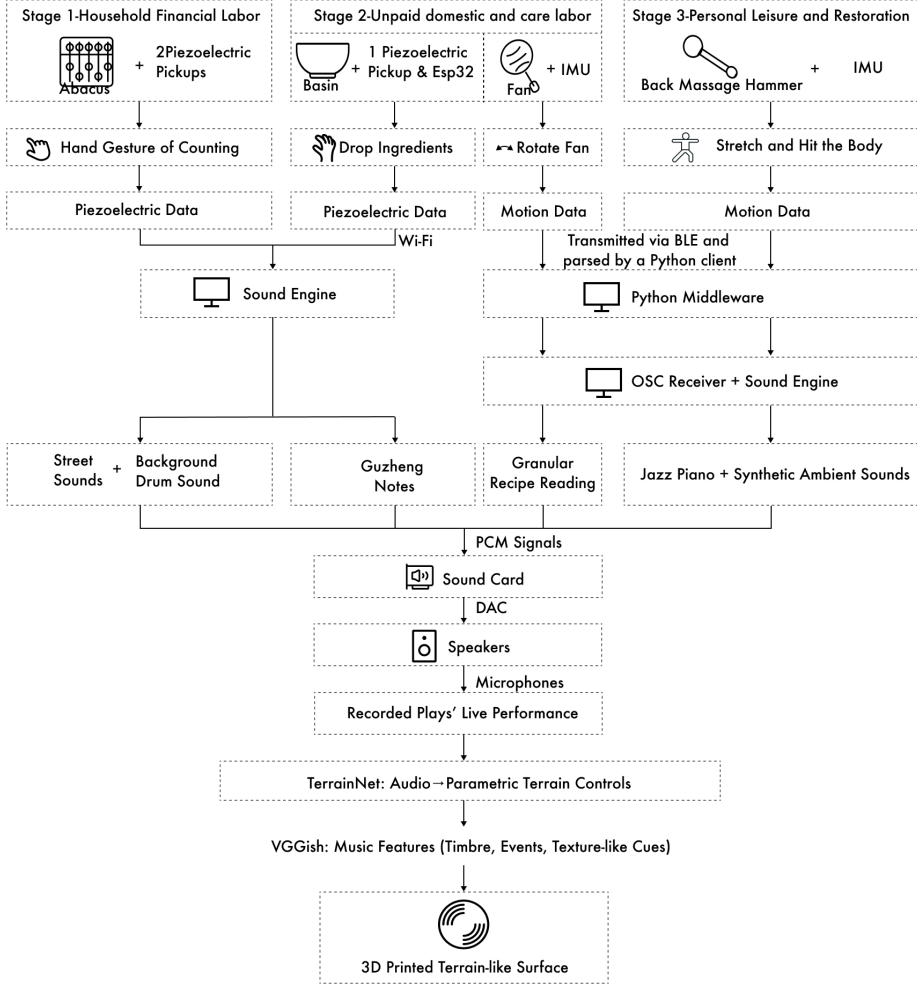


Fig. 4. Our system pipeline.

waveform and split it into N_r non-overlapping frames,

$$f_i = y[iL : (i+1)L], \quad i = 0, \dots, N_r - 1, \quad (1)$$

then map frame index i to radius r_i so time becomes radius. For each frame, we compute pitch, loudness, spectral centroid, and spectral flatness, then min-max normalize them to $[0, 1]$. We also extract a 128-D VGGish embedding to stabilize the mapping and add timbre cues. We concatenate low-level features and the embedding (132 dims) and predict six controls with TerrainNet,

$$z_i = f_\theta(x_i) \in \mathbb{R}^6, \quad (2)$$

which parameterize ridge, valley, texture amplitude, texture frequency, roughness, and angular asymmetry.

We sample the disk on a polar grid (r_i, θ_j) and synthesize a heightfield. Pitch and loudness set a base radial amplitude,

$$\text{base_amp}_i = A_{\text{pitch}} p_i + A_{\text{loud}} l_i, \quad (3)$$

then we combine an asymmetry-driven envelope, ridge and valley shaping, sinusoidal timbre textures, and Perlin micro-noise scaled by roughness to form $H(i, j)$. We apply multi-scale box blurs, clip at the 2nd and 98th percentiles, and normalize heights to $[0, Z_{SCALE}]$. We add a central bump and a directional ridge for tactile navigation. Finally, we convert the heightfield to a closed mesh with a top surface, bottom plate, and side wall.

5.3 Workshop and Exhibition Settings and Sound Delivery

Since the instrument design is grounded in the first authors' self-reflective accounts as Chinese young women and in engagement with the source objects and situated cultural knowledge, we seek broader feedback on the design and its articulation of our decolonial and feminist commitments. We therefore conduct two workshops and an exhibition (Figure 5). We hold two workshops with seven Chinese women (three in the first, four in the second), recruiting through an open call. The exhibition also welcomes male players. After a brief introduction, they explore object-based DMIs, create short compositions, and take home a printed terrain-like disk. Objects rest on a table as everyday tools for "counting", "cooking", or "holding". Players choose one or more objects and perform routine actions such as washing, stirring, fanning, counting, or tapping with a hammer. They shape sound by varying speed, pressure, pauses, and repetition. We capture live audio with microphones, including instrumental sounds, speech, and ambient noise. We buffer the audio, output PCM to the system sound card, convert it via its DAC, and play it through external speakers.

During the workshops and exhibition we use:

- A Focusrite Scarlett 2i2 sound card;
- A set of Genelec 8030C speaker for music playing;
- A Yamaha MG10XU mixer;
- An MSI Titan GT77 laptop for processing and synthesis and recording;
- A pair of Rode M5 Compact 1/2" Condenser Microphone and an Apple M1 laptop for recording.
- A Prusa Research MINI+ 3D printer.

Figure 5 illustrates the installation layout.



Fig. 5. (a) shows the installation layout in the workshops and exhibition. (b) shows the discussion in the first workshop.

6 Players Feedback

As an artistic apparatus, the work can evoke shared memories within a community [Zhang et al. 2024]. Yet the same object can elicit different stories and meanings, consistent with prior work on diverse personal readings of the same instrument [Zappi and McPherson 2014]. Many players remark on the fan's sound during the discussion (Figure 5). The music players create by rolling the fan reminds them of family, including children, elders, and voices of all genders. These effects make the voices feel unreal, prompting reflection. In the second workshop, one mother murmurs lines from her housework routine, then strikes the massage hammer harder to express anger about unequal care labor. This leads us to keep the mapping simple and user-controlled.

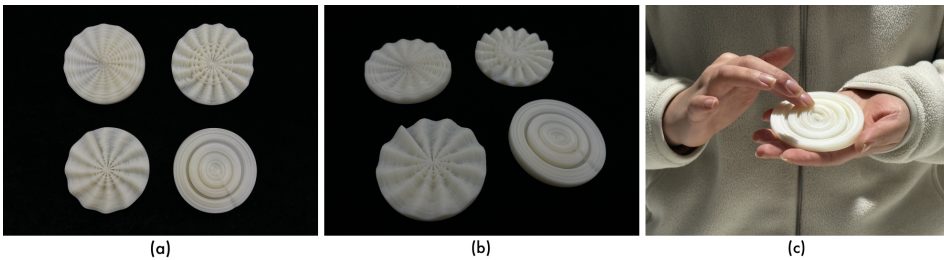


Fig. 6. Re-performable 3D-printed terrain-like disks. (a–b) show the disks from different angles. In (c), a player holds and touches a disk to re-perform the embodied experience.

7 E2E Framework

The *E2E Framework* comprises four phases:

- **Phase 1: Selecting Situated Objects.** This stage anchors the work in real-world practice with social texture (e.g., gendered domestic labor, craft). We identify embodied competencies already present (grip, rhythm, resistance, routine, etiquette) and the histories these objects carry.
- **Phase 2: Reframing Objects as Expressive Interfaces.** Converting everyday tools into expressive interfaces cannot erase affordances or cultural resonance. Instrumentation such as sensor augmentation (e.g., piezo, IMU, pressure, capacitive), acoustic pickups, conductive materials, or mechanical modification preserves recognizability and keeps interaction legible through prior use.
- **Phase 3: Embodied Performance and Trace Capture.** Players perform through lived technique, and agency emerges through bodily causation. This stage foregrounds exploration, personal tempo, and idiosyncratic gesture. We capture audio and gesture–material coupling as traces for continuity, not surveillance. Recording remains transparent, consensual, and limited to what sustains the loop.
- **Phase 4: Generating Embodied Extensions** Expressive traces become material form through an AI/generative process. AI acts as a co-creator, not an author, so the transformation stays interpretable and adjustable for participants. We close the loop by fabricating a re-performable artifact that materializes self-expression and extends embodied experience across time.

8 Conclusion

To Perform/To Live reframes Chinese women's everyday objects and routines as decolonial digital musical instruments, making gendered labor audible without romanticizing it. By closing the loop

through human–AI co-created, 3D-printed tactile disks, the work extends embodied performance into material extension. Workshops and exhibition suggest that familiar gestures can support agency, reflection, and replay, offering the E2E framework for culturally grounded DMI practice.

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