

Sonification of 361 Standard Acupoints: Development of a Reproducible Auditory Mapping Framework

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Research Article

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Abstract

Acupoint selection varies across studies and therapeutic approaches even when the same condition is treated, making it difficult to compare the structural characteristics of different acupoint combinations. Sonification may provide an additional way to represent such relationships through sound. This study developed a reproducible framework for sonifying 361 standard acupoints using fixed rules based on acupoint location, meridian structure, and Five-Phase relationships. The 12 primary meridians were assigned to 12 chromatic pitch classes according to their traditional circulation sequence. Longitudinal acupoint position was primarily mapped to pitch, whereas transverse position was represented by harmonic structure. Five-Phase relationships were additionally represented as relative pitch intervals. Calculated pitch values were retained without rounding, allowing microtonal representation. Using these rules, all 361 standard acupoints were converted into individual sounds, and aggregate sounds were generated for each primary meridian and for all 361 acupoints. The 12 meridians showed different pitch distributions, with pitch ranges varying from 9.0 semitones for the Pericardium meridian to 37.2 semitones for the Bladder meridian. Some conflicts between mapping rules were observed; for example, the location-derived pitch of Erjian (LI2) did not correspond to the relative interval expected from the Five-Shu Five-Phase rule. As an exploratory application, Sanyinjiao (SP6), Guanyuan (CV4), and Diji (SP8), identified as a core combination in a previous data-mining study of primary dysmenorrhea, were represented as a combined auditory pattern. These findings demonstrate that standard acupoints and multi-acupoint combinations can be represented within a common sonification framework, although the current rules do not fully preserve all traditional acupoint relationships. Further refinement and direct evaluation of its educational and communication value are required.

Introduction

Acupuncture treatments for the same disease or symptom do not necessarily use identical combinations of acupoints. The selected points may differ according to therapeutic school, traditional theory, clinical experience, or previous evidence. Consequently, it is not always straightforward to determine whether acupoint prescriptions derived from different therapeutic approaches share common structural features or represent distinct patterns [1, 2].

Sonification is the systematic mapping of data or information into non-speech sound [3]. If acupoints can be represented using a common auditory mapping rule, prescriptions derived from different studies or therapeutic approaches may potentially be compared within the same auditory framework. However, few studies have attempted to represent the spatial and theoretical structure of acupuncture points as sound.

The relationships among meridians and acupoints may also be difficult for beginners to understand using words and diagrams alone [4, 5]. Adding auditory information to conventional visual or verbal explanations may provide an additional sensory modality for representing acupoint locations and relationships.

Therefore, as an initial step toward such applications, this study developed a fixed-rule method for sonifying the 361 standard acupoints on the basis of acupoint location, meridian structure, and Five-Phase relationships. As an exploratory application, a representative acupoint combination identified in a previous data-mining study was also sonified to examine whether a combination of multiple acupoints could be represented as a distinct auditory pattern.

Materials and Methods

1. Study design and objective

This exploratory methodological study aimed to develop a reproducible framework for converting the 361 standard acupoints into sound using fixed rules based on acupoint location, meridian structure, and Five-Phase relationships.

The purpose of the study was not to validate the therapeutic effects of acupoints or the biological validity of traditional acupuncture theory, but to establish a sonification framework that could potentially support future education and treatment explanation.

2. Base pitch classes of the 12 primary meridians

The 12 primary meridians were assigned to the 12 chromatic pitch classes according to their traditional circulation sequence. The hand taiyin lung meridian was assigned C, followed by the hand yangming large intestine meridian (C#), foot yangming stomach meridian (D), foot taiyin spleen meridian (D#), hand shaoyin heart meridian (E), hand taiyang small intestine meridian (F), foot taiyang bladder meridian (F#), foot shaoyin kidney meridian (G), hand jueyin pericardium meridian (G#), hand shaoyang triple energizer meridian (A), foot shaoyang gallbladder meridian (A#), and foot jueyin liver meridian (B).

This 12-pitch-class assignment formed the basic meridian framework. Five-Phase relationships were incorporated separately as relative intervals, as described below. The detailed mapping rules are summarized in Table 1.

Table 1

Fixed sonification rules used to map the 361 standard acupoints to pitch and timbre LU: Lung, LI: Large Intestine, ST: Stomach, SP: Spleen, HT: Heart, SI: Small Intestine, BL: Bladder, KI: Kidney, PC: Pericardium, TE: Triple Energizer, GB: Gallbladder, LR: Liver, MIDI: Musical Instrument Digital Interface.

Category	Input information	Sonification rule
Meridians	Classical circulation sequence of the 12 primary meridians	LU = C, LI = C#, ST = D, SP = D#, HT = E, SI = F, BL = F#, KI = G, PC = G#, TE = A, GB = A#, LR = B
Acupoint position (longitudinal)	Position along the meridian course, B-cun distance, or vertebral level	Linear interpolation on a semitone/MIDI scale; values were not rounded to integer semitones, allowing microtonal pitches
Acupoint position (transverse)	Distance from the body midline	Pitch remains unchanged; transverse distance is represented by the relative amplitudes of the 2nd–5th harmonics
Five Phases	Earth, Metal, Wood, Fire, and Water	Relative intervals of 0, + 2, +4, + 7, and + 9 semitones, respectively
Five-Shu points	Five-Phase attribution of each Five-Shu point relative to the meridian's own phase	Relative interval from the meridian's Ben point according to the Five-Phase interval rule
Interior–exterior pairing	Traditional paired yin and yang meridians	Base pitch classes of paired meridians are placed one semitone apart
Conception Vessel (CV)	Anterior midline position	CV8 = C4; abdominal span of 13 B-cun corresponds to 12 semitones
Governing Vessel (GV)	Posterior midline / vertebral level	GV14 = G4; pitch decreases by 1 semitone per vertebral level in the caudal direction
Rule conflicts	Cases in which location-derived and traditional-theory-derived rules do not agree	Location-derived pitch is retained and the discrepancy is documented; LI2 is not post-hoc corrected
No post-hoc tuning	Perceived consonance, dissonance, pleasantness, or unpleasantness of the generated sound	No point-specific adjustment is made on the basis of auditory impression

3. Conversion of acupoint location into pitch and timbre

The locations of the 361 standard acupoints were based primarily on the WHO standard acupuncture point locations in the Western Pacific Region [6].

Longitudinal position along the meridian course was primarily mapped to pitch. For the limbs, B-cun or along-meridian distance was used, whereas vertebral levels and major anatomical landmarks were used for the trunk. Pitch values between predefined anchor points were obtained by linear interpolation on a semitone scale.

Calculated values were not rounded to integer semitones; therefore, microtonal pitches were retained when generated by the mapping procedure.

Transverse distance from the body midline was not used to modify pitch. Instead, it was normalized within each regional coordinate system and mapped to timbre by modifying the relative amplitudes of the second to fifth

harmonics while keeping the fundamental frequency unchanged.

4. Region-specific spatial mapping

Local coordinate rules were defined for the limbs, Conception Vessel, Governing Vessel, back, sacral region, and head and face using B-cun, vertebral levels, midline position, and major anatomical landmarks.

For the Conception Vessel, Shenque (CV8) was assigned C4, and an abdominal distance of 13 B-cun was mapped to 12 semitones. For the Governing Vessel, Dazhui (GV14) was assigned G4, and pitch decreased by one semitone for each vertebral level in the caudal direction.

The anchor points, regional reference distances, and interpolation rules used to determine the final pitch values are summarized in Table 1 and Supplementary Table 1.

5. Five-Phase and Five-Shu point mapping

The Five Phases were represented as relative rather than absolute pitch intervals. Earth, Metal, Wood, Fire, and Water were assigned relative intervals of 0, +2, +4, +7, and +9 semitones, respectively.

For the Five-Shu points, the Ben point of each meridian was used as the reference, and the pitch offset of each point was determined from the relative difference between the Five-Phase interval assigned to the point and that assigned to the corresponding meridian.

When a pitch derived from spatial location conflicted with a pitch implied by the traditional relative-interval rule, the location-derived pitch was retained and the discrepancy was documented.

6. Audio generation

For each acupoint, the calculated Musical Instrument Digital Interface (MIDI) value was converted to frequency according to

$$f = 440 \times 2^{((M - 69)/12)},$$

where M is the MIDI value and f is the frequency in hertz.

Each acupoint sound was generated from a sinusoidal fundamental together with the second to fifth harmonics. The fundamental frequency was determined by the calculated pitch, whereas the relative amplitudes of the higher harmonics were determined by the normalized transverse-position value.

Aggregate sounds were generated by summing the waveforms of all acupoints belonging to each of the 12 primary meridians, as well as all 361 standard acupoints. Audio signals were normalized for practical listening and to prevent clipping; loudness was not treated as an analytical variable.

Numerical processing and audio generation were performed using Python with NumPy and SciPy at a sampling rate of 44.1 kHz. The generated sounds were not subsequently modified on the basis of consonance,

dissonance, pleasantness, or other subjective auditory impressions. The overall sonification workflow is shown in Fig. 1. The generated aggregate and sequential audio outputs are provided as Supplementary Audio 1, Supplementary Audio 2, and Supplementary Audio 4, and the code used to reproduce these outputs is provided as Supplementary Code 1.

7. Exploratory application to a data-mining-derived acupoint combination

To illustrate a potential application of the framework, a representative acupoint combination from a previous data-mining study of primary dysmenorrhea was selected.

Sanyinjiao (SP6), Guanyuan (CV4), and Diji (SP8) were selected because they were frequently used and were identified as a core combination in association-rule analysis [1].

Each point was converted to sound using the same fixed rules as those used for the 361-acupoint model. Individual point sounds and a simultaneous three-point auditory pattern were then generated.

This analysis was performed solely as a demonstration of auditory representation and was not intended to assess therapeutic effectiveness or clinical validity. The individual and simultaneous sounds generated for this three-acupoint combination are provided as Supplementary Audio 3.

8. Descriptive acoustic measures

For each of the 12 primary meridians, the number of acupoints, minimum and maximum MIDI values, pitch range, median MIDI value, and standard deviation were calculated to summarize the pitch distribution.

These measures were descriptive only. No inferential statistical analysis was performed because the study was methodological and did not test a statistical hypothesis.

9. Ethics statement

This study did not involve human participants or animals and used only publicly available anatomical and published data; therefore, institutional ethics approval and informed consent were not required.

Results

1. Sonification of the 361 standard acupoints

Using the predefined mapping rules, pitch and timbral information were assigned to all 361 standard acupoints belonging to the 12 primary meridians, Conception Vessel, and Governing Vessel.

Longitudinal position was primarily represented by pitch, whereas transverse position was represented by harmonic structure. Because interpolated pitch values were not rounded to integer semitones, microtonal pitches occurred for some acupoints.

Single-acupoint sounds, aggregate sounds for each of the 12 primary meridians, and an aggregate sound containing all 361 standard acupoints were generated.

2. Pitch distributions of the 12 primary meridians

The 12 primary meridians differed in the number of acupoints, pitch range, median pitch, and pitch dispersion (Table 2).

The narrowest pitch ranges were observed for the Pericardium meridian (9.0 semitones), Heart meridian (10.0 semitones), and Lung meridian (10.2 semitones). In contrast, the Bladder meridian (37.2 semitones) and Gallbladder meridian (36.0 semitones) showed substantially wider pitch ranges.

Thus, the sets of acupoints composing each meridian produced different pitch distributions.

Table 2

Descriptive statistics of pitch distributions across the 12 primary meridians MIDI: Musical Instrument Digital Interface, SD: Standard Deviation.

Meridian	n	Minimum MIDI	Maximum MIDI	Pitch range (semitones)	Median MIDI	SD	Close-pair rate ≤ 1 semitone (%)	Consonant-interval rate (%)
LU Lung	11	61.8	72.0	10.2	66.5	3.46	10.9	41.8
LI Large Intestine	20	61.0	80.1	19.1	68.9	4.72	12.6	37.9
ST Stomach	45	55.4	82.2	26.8	66.0	7.68	6.5	36.5
SP Spleen	21	55.4	73.1	17.7	63.0	4.90	7.1	41.4
HT Heart	9	61.0	71.0	10.0	66.0	3.28	16.7	47.2
SI Small Intestine	19	60.0	81.0	21.0	67.0	5.19	12.9	25.7
BL Bladder	67	45.4	82.6	37.2	62.1	10.36	6.6	36.7
KI Kidney	27	55.4	75.0	19.6	63.8	5.58	9.1	35.0
PC Pericardium	9	61.0	70.0	9.0	65.0	2.81	8.3	36.1
TE Triple Energizer	23	62.0	83.0	21.0	69.0	6.51	8.3	35.2
GB Gallbladder	44	46.0	82.0	36.0	68.6	8.78	6.4	32.8
LR Liver	14	55.0	71.0	16.0	64.2	4.36	11.0	37.4
Notes								
MIDI values are those generated by the final 361-acupoint sonification rule set.								
Close-pair rate: proportion of all within-meridian point pairs separated by ≤ 1 semitone.								
Consonant-interval rate: exploratory proportion of within-meridian pitch-class intervals falling within the predefined consonant interval bands used in this study.								

3. Conflicts between mapping rules

Most acupoints could be assigned pitches using the predefined spatial and structural rules. However, some discrepancies were observed between pitch values derived from location and those implied by traditional relative-interval relationships.

For example, the location-derived pitch of Erjian (LI2) did not correspond to the interval expected from the Five-Shu Five-Phase rule. In accordance with the predefined procedure, the location-derived value was retained.

Traditional relationships among Yuan-Source, Front-Mu, and Back-Shu points were also not consistently represented as simple pitch proximity or common intervals within the present framework. No post-hoc adjustment was made to force these relationships into closer agreement.

4. Exploratory application to a data-mining-derived combination

Sanyinjiao (SP6), Guanyuan (CV4), and Diji (SP8), identified from a previous data-mining study of primary dysmenorrhea, were sonified using the same mapping rules (Fig. 2).

The three acupoints were represented by distinct pitch values, and their simultaneous presentation produced an auditory pattern that differed from the individual point sounds.

Discussion

This study developed a fixed-rule framework capable of converting all 361 standard acupoints into sound using information on acupoint location, meridian structure, and Five-Phase relationships. Using the same rules, the combination of Sanyinjiao (SP6), Guanyuan (CV4), and Diji (SP8), derived from a data-mining study of primary dysmenorrhea, could also be represented as a single auditory pattern. Thus, the framework enabled not only individual acupoints but also combinations of multiple acupoints to be represented using a common auditory system.

However, the present framework did not consistently represent every component of the traditional acupoint system. For Erjian (LI2), the location-derived pitch conflicted with the relative interval expected from the Five-Shu Five-Phase rule. In addition, traditional relationships among Yuan-Source, Front-Mu, and Back-Shu points were not consistently expressed as simple pitch proximity or common intervals. Therefore, the present model should be regarded as an initial framework for auditory representation rather than a complete sonification of the entire traditional acupuncture system. Further refinement of the spatial mapping and representation of meridian and Five-Phase relationships will be required.

Learning meridians and acupoints can be challenging for students, particularly when spatial and systematic relationships must be understood through terminology, text, and two-dimensional diagrams [4, 5]. Sonification provides an additional sensory modality by translating information into non-speech sound [3, 7]. The present framework is not intended to replace conventional diagrams or verbal explanations; rather, it may provide a complementary means of presenting the relationships among acupoints and meridians.

The exploratory example using the primary dysmenorrhea combination also suggests a possible future use of this approach. Frequently used acupoints identified by data mining, acupoint prescriptions used in randomized controlled trials, or prescriptions derived from different acupuncture traditions could potentially be mapped using the same auditory rules. Such an approach may make it possible to examine whether apparently different prescriptions produce similar or clearly distinct auditory patterns.

This study has several limitations. First, some mappings between anatomical information and acoustic parameters were defined by the investigators, and their validity has not yet been independently established. Second, the current framework does not preserve all traditional relationships among acupoints. Third, neither learning outcomes in students nor comprehension among patients was evaluated. Accordingly, this framework

should not yet be considered a validated educational or communication tool. Future studies should refine the mapping rules and directly examine whether adding auditory representation improves understanding of acupoints, meridians, or acupoint combinations.

Conclusion

A reproducible sonification framework for the 361 standard acupoints was developed using fixed rules based on acupoint location, meridian structure, and Five-Phase relationships. The same framework could also represent a multi-acupoint prescription as an auditory pattern.

However, several conflicts between spatial and traditional-theory-based rules remained, indicating that the current framework does not fully represent the entire acupuncture point system. Further refinement and educational evaluation are required before the method can be considered a practical teaching or communication tool.

Declarations

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author used ChatGPT (OpenAI) to assist with manuscript organization, language refinement, and English translation. The author reviewed and edited all generated content and takes full responsibility for the content of the published article.

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Declaration of competing interests

The author declares no financial or nonfinancial conflicts of interest related to this study.

CRediT authorship contribution statement

Eisuke IWAMOTO: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Visualization, Writing – original draft, Writing – review & editing.

Data availability statement

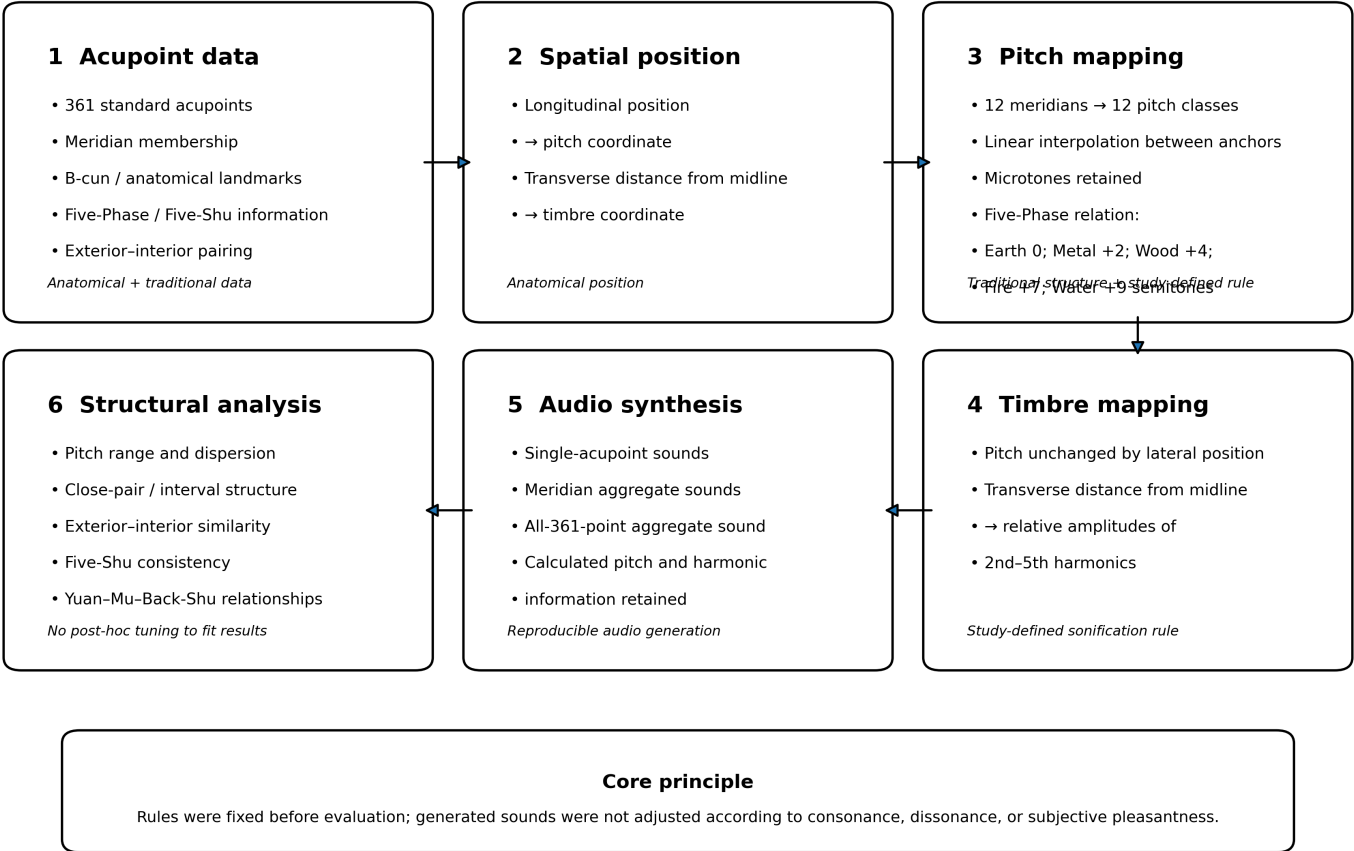
The data and code supporting the findings of this study, including the 361-acupoint mapping table, sonification rules, audio-generation code, and supplementary audio files, are provided in the article and its supplementary materials.

References

1. Yang T, Guo W, Deng C, Zhang L (2026) Core acupoint prescription patterns for primary dysmenorrhea: data mining and network-based analysis. J Pain Res 19:579686. 10.2147/JPR.S579686

2. Dong Y, Xu Y, Wu S, Lai Q, Wang F, Zha W et al (2026) Core Acupoints and Acupoint Combination Patterns for Acupuncture Treatment of Discogenic Low Back Pain: A Data Mining Study. J Pain Res 19:624742. 10.2147/JPR.S624742
3. Hermann T, Hunt A, Neuhoﬀ JG (eds) (2011) The Soniﬁcation Handbook. Logos Publishing House, Berlin
4. Urayama H, Matsushita M, Funamizu T (2025) Diversity in Oriental Medicine Education: classical education and electronic materials, classroom development and initiatives. Zen Nihon Shinkyu Gakkai Zasshi 75:35–42. 10.3777/jjsam.75.35
5. Kim SH, Kim SN (2025) 3D visualized anatomy model software for teaching acupoints and related neurovascular musculature in Korean acupoint practice classes. Med Acupunct 37:50–53. 10.1089/acu.2024.0112
6. World Health Organization, Regional Office for the Western Paciﬁc (2008) WHO standard acupuncture point locations in the Western Paciﬁc region. WHO Regional Office for the Western Paciﬁc, Manila
7. Pfeiﬀer DG (2008) Listen and learn: an investigation of soniﬁcation as an instructional variable to improve understanding of complex environments. Comput Hum Behav 24:475–485. 10.1016/j.chb.2007.02.006

Figures



Provenance: anatomical position data + traditional meridian/Five-Phase structure + explicitly defined sonification rules.

Figure 1

Sonification workflow for 361 standard acupoints.

The 361 standard acupoints were mapped to sound using predefined rules based on acupoint location, meridian structure, and Five-Phase relationships. Longitudinal position was primarily mapped to pitch, whereas transverse position was represented by harmonic structure. Audio outputs included single-acupoint sounds, aggregate sounds for each primary meridian, and an aggregate sound of all 361 acupoints. The mapping rules were fixed before evaluation, and no post-hoc adjustment was made on the basis of consonance, dissonance, or subjective auditory preference.

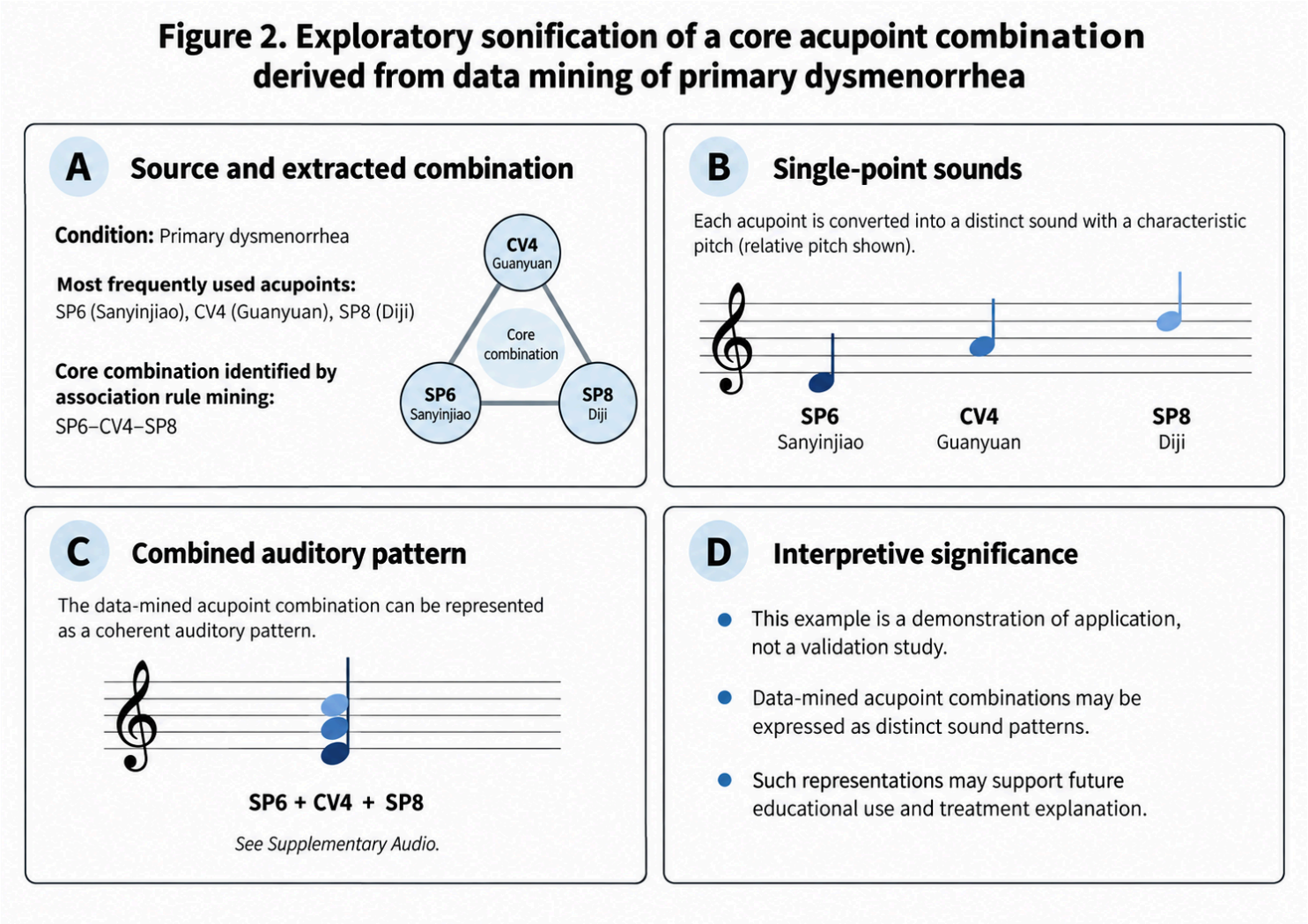


Figure 2

Exploratory sonification of a data-mining-derived acupoint combination for primary dysmenorrhea.

Sanyinjiao (SP6), Guanyuan (CV4), and Diji (SP8), identified as a representative core combination in a previous data-mining study of primary dysmenorrhea, were converted to sound using the same fixed mapping rules as those used for the 361-acupoint model. Each acupoint was represented by an individual pitch, and simultaneous presentation of the three points generated a combined auditory pattern. This figure is presented as an exploratory application of the sonification framework and does not represent therapeutic efficacy or clinical validity.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryTable1361acupointfinalpitchassignments.xlsx](#)
- [SupplementaryAudio1All361acupoints.wav](#)
- [SupplementaryAudio2Twelveprimarymeridians.wav](#)
- [SupplementaryAudio3Primarydysmenorrheacorecombination.wav](#)
- [SupplementaryAudio4All361acupointssequential.wav](#)
- [SupplementaryCode1generatesonificationaudio.pdf](#)