

Neuro-cultural rhythmic entrainment as a predictor of electronic dance music subgenre preference: a Kuramoto-model framework drawing on the multi-traditional musical landscape of Sri Lanka

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Abstract

Globalised music recommendation systems implicitly assume cross-cultural uniformity in genre adoption, yet regional listening data show persistent geographic and community-level segmentation. We propose a neuro-cultural framework that uses Sri Lanka—a multi-ethnic island whose rhythmic landscape includes Sinhala Buddhist ritual drumming (Beravā traditions), Tamil *parai mēlam* and *periya mēlam*, Sri Lankan Moor devotional music, and Afro-Sri Lankan/Burgher *kaffrinha* and *baila*—as a natural laboratory for examining how lifetime passive exposure to a region’s predominant rhythmic textures shapes the adoption of contemporary electronic dance music (EDM) subgenres. Focusing on the affinity for progressive house among young listeners enculturated to the non-isochronous, start–stop dynamics of Magul-Bera and Thovil drumming, we argue that progressive house is structurally isomorphic to a tension-and-release architecture already encoded in these listeners’ auditory-motor and predictive-coding systems. We make the hypothesis quantitatively concrete and falsifiable through (i) parameterised amplitude and tension envelopes for both reference genres, (ii) idealised spectral profiles demonstrating a shared sub-bass void at ≤ 70 Hz, (iii) a stimulus-driven Kuramoto-model simulation of neural phase coherence under high versus low auditory-motor coupling, and (iv) inter-onset-interval distributions with coefficients of variation and Shannon entropies for three reference rhythmic systems. Six testable predictions for electrophysiology, behavioural and corpus studies are proposed.

1 Introduction

The global dissemination of electronic dance music (EDM) provides a natural laboratory for examining how local cultural heritages interact with globalised media consumption (Porcaro et al. 2024). Within this landscape, youth listening behaviour functions as a sensitive indicator of cultural identity and post-conflict societal change in Sri Lanka (Lecamwasam 2015). Sri Lanka is a particularly informative site for this question because its musical landscape is exceptionally plural: alongside the Sinhala Buddhist ritual drumming of the Beravā caste (Sykes 2018a, 2018b, 2018c), the island carries a rich Tamil tradition of *parai mēlam* and *periya mēlam* in Jaffna and the East (Sivathamby and Velauthapillai 2016), Sri Lankan Moor devotional vocal forms, and the Afro-Sri Lankan *kaffrinha* and Burgher *baila* lineages that grew out of the island’s Portuguese-colonial encounter (Jayasuriya 2018; Sheeran 2004).

Field observation and platform-level genre data point to a striking but under-theorised pattern: young listeners enculturated to the non-isochronous, start–stop dynamics of Sinhala temple drumming (notably the Magul-Bera and Thovil traditions) show a marked preference for progressive house—a subgenre characterised by extended build-ups, abrupt breakdowns and intense low-frequency drops (Smith 2024). We do not claim that this is the only interesting pattern in the Sri Lankan musical ecology, nor that it characterises every Sinhala-speaking listener; it is one specific case in which a structural-acoustic argument can be made with unusual clarity. The same framework, applied to listeners enculturated to the continuous-cyclical metres of Carnatic-derived Tamil traditions, predicts a different set of contemporary affinities, including sustained Carnatic-influenced filmi pop and the cross-community *baila* lineage.

This paper proposes that auditory preferences are shaped by lifelong passive exposure to a region's predominant rhythmic textures—the process known as musical enculturation (Haumann et al. 2018; Mehr et al. 2018)—and that the sensorimotor and predictive-coding systems of Sinhala youth enculturated to Magul-Bera and Thovil performance are pre-tuned to a four-phase tension-and-release topology that progressive house, despite its globalised electronic surface, structurally instantiates.

The contribution of this paper is theoretical and methodological rather than empirical. We do not present new listener data; instead, we (a) explicate the proposed structural isomorphism quantitatively, (b) provide a mechanistic model grounded in Kuramoto-type neural-oscillator dynamics of how the isomorphism would manifest in cortical phase coherence, and (c) operationalise the hypothesis into a programme of six testable predictions that we hope will support empirical work across all of Sri Lanka's musical communities.

2 The multi-traditional rhythmic landscape of Sri Lanka

Sri Lanka's rhythmic ecology is plural rather than singular. Although the bulk of the analysis below concerns one specific tradition—the Sinhala Buddhist ritual drumming of the Beravā community in the Low Country and Up Country—we explicitly situate that tradition within the broader landscape, because (a) the theoretical framework we propose applies in principle to all of these traditions, and (b) recent ethnomusicological scholarship has emphasised the importance of treating Sri Lankan music history as one of cross-community exchange rather than as a set of isolated ethnic blocks (Sykes 2018c).

2.1 Sinhala Buddhist ritual drumming (Beravā tradition)

Sinhala drumming is an ancient, highly structured art form historically integrated with Buddhist religious rituals, healing ceremonies and state communication, carried by the Beravā community (Sykes 2018a). Its rhythmic system is distinct from both the Hindustani and Carnatic *tala* structures (Samarasinghe 2023; Sykes 2018b). The pan-South Asian term *tala* is, notably, not used: rhythms are instead generated by drum syllables (*aksaras*) of long and short duration set in lines of drum poetry (*padas*), so that the drumming sometimes resembles unmetered speech (Sykes 2018a; Peiris 2024).

A defining characteristic of traditional Sinhala drum music is *visama nadi*—the irregular pulse movement first systematically described in ethnomusicological terms by C. de S. Kulatillake (Samarasinghe 2023). Unlike Western popular music and standard EDM, which rely on a strict isochronous 4/4 beat, Sinhala drumming employs metrical dissonance in which the temporal spacing between accents is dynamic. During healing rituals such as the Thovil (exorcism) or the Devol dance, performances oscillate between high-arousal active phases at approximately 80–150 BPM and dramatic decelerations to 20–50 BPM (Turan 2024).

These shifts depend on the deliberate violation of temporal expectations. Tension is generated by extreme rhythmic density on the Yak-Bera (Low Country cylinder drum) or Geta-Beraya (Kandyan barrel drum), followed by an abrupt cessation of rhythmic activity. The silence—frequently filled by spoken

vocalisations, ritualistic chanting or a physical pause from the dancer—creates an intense rhythmic void (Peiris 2024). In the neural-dynamic frame proposed by Wu et al. (2024), such a structural pause disrupts steady-state cortical oscillations and forces the listener into an active state of anticipation. The suspense is then resolved by a high-density re-entry on the full drum ensemble (Thaut et al. 2015).

Sinhala drumming also functions as surrogate speech: non-lexical vocables (*thath, jith, thong, nang, tak, jek, takata*) map directly onto chanted verse syllables, producing a communicative, narrative-driven rhythmic structure (Peiris 2024; Sykes 2018a). Table 1 summarises the four principal drum classes of the tradition.

2.2 Tamil traditions: *parai mēlam* and *periya mēlam*

Tamil-speaking communities, concentrated in the Northern Province (notably Jaffna), the East and parts of the central plantation region, sustain two principal rhythmic traditions of relevance here. *Parai mēlam*—performed on the double-headed cylindrical *parai* drum—has roots in the Sangam period and remains central to Hindu ritual life in Jaffna, particularly at high-profile festivals such as the Nallur Kandaswamy Kovil festival (Sivathamby and Velauthapillai 2016). *Periya mēlam*—the temple ensemble combining the *thavil* drum with the *nadaswaram* double-reed instrument—is the principal sound of Hindu temple ceremonies. Unlike the *visama nadi* of Sinhala ritual, both these traditions, together with the Carnatic *tala* system that frames much of Tamil concert music, are characterised by continuous, mathematically cyclical metres. The contrast is not one of relative sophistication: both systems are structurally rich, but they encode different rhythmic ‘shapes’ in the listener.

2.3 Sri Lankan Moor, Afro-Sri Lankan and Burgher contributions

The Sri Lankan Moor community sustains devotional vocal and percussion traditions associated with Sufi and broader Islamic practice. The Afro-Sri Lankan community—descendants of African (largely Mozambican) people brought to the island during the Portuguese period—developed *kaffrinha*, an Afro-Portuguese genre played originally on violin, hand-clapping, *rabana* frame drum and coconut shells, characterised by 6/8 metre and a syncopated three-against-two beat (Jayasuriya 2018). Through Wally Bastiansz and a generation of Sinhala and Burgher musicians from the 1940s onward, *kaffrinha* gave rise to *baila*—today widely heard as a quintessentially Sri Lankan popular form that is sung in Sinhala but carries African-Portuguese rhythmic DNA (Sheeran 2004; Jayasuriya 2018). *Baila* is genuinely cross-community: it is heard at weddings and celebrations across Sinhala, Tamil, Moor, Burgher and Afro-Sri Lankan settings, and stands as a reminder that ‘enculturation’ in Sri Lanka is not neatly mapped onto ethnic group.

Table 1

The four principal drum classes of Sinhala Buddhist ritual percussion. Acoustic profiles synthesised from ethnomusicological descriptions in Samarasinghe (2023), Peiris (2024) and Sykes (2018a, 2018b); approximate spectral peaks are indicative

Drum class	Physical characteristics	Spectral/acoustic profile	Primary ritual context
Geta-Beraya (Kandyan)	Barrel-shaped, tapering at ends; monkey skin on right face, cow hide on left	Midrange-focused; dual-head tuning produces contrasting high and low pitches	Up-country Buddhist processions, Kandyan court dance
Yak-Bera (Low Country)	Long cylindrical body; thin cattle-stomach lining on both openings	Low-frequency resonance (~ 30–60 Hz peak) with sharp transient attacks	Southern Thovil exorcism, Devol Madu healing
Daula (Sabaragamuwa)	Cylindrical barrel; cow/goat hide on both faces; played with stick and hand	Warm midrange with dual-skin harmonic modulation and rapid decay	Hevisi temple services; Sabaragamuwa processions
Thammattama (twin)	Hemispherical twin wooden kettle drums; played with curved cane sticks	High-pitched rapid transients; left face low, right face high	Rapid metrical accents; temple ceremonies (with Daula)

3 Structural symmetries in progressive house

The composition of progressive house exhibits a structural organisation closely parallel to the Sinhala ritual cycle described above (Solberg and Dibben 2019). To make the comparison concrete, we anchor the analysis to a single landmark track widely cited in music-theory literature: deadmau5's *Strobe*.

3.1 Track analysis: *Strobe* (deadmau5)

Composed in G# minor at 128 BPM, *Strobe* opens with an extended four-minute ambient introduction. Warm synth pads, deep piano chords and high bell timbres build a calm sonic landscape that is then gradually thickened with strings and tambourines as tension accumulates. The track's chord progression employs modal borrowing, using Lydian and Dorian elements to delay harmonic resolution and thereby prolong cognitive tension. The progression alternates between G# minor (i), F# major (bVII) and the borrowed A major (bII), creating a continuous cycle of major-to-minor shifts. The arpeggiator uses a shifting pattern of 6, 6, 7, 6, 6, 8 notes, producing a melodic loop that operates across the boundaries of the 4/4 rhythm—itself a form of metrical dissonance reminiscent, at the melodic level, of *visama nadi*.

The core structural device is the 'break routine'—the now-canonical EDM sequence of breakdown, build-up and drop (Smith 2024). At 6:48 the heavy rhythmic kick is removed: all frequencies below approximately 70 Hz are stripped, leaving only a filtered square synth panning across the stereo field in the 2–10 kHz range. This sudden removal of the low-frequency rhythmic anchor disrupts motor entrainment and induces a subjective sensation of spatial disorientation (Solberg and Dibben 2019).

Tension is rebuilt through ascending filter sweeps, white-noise risers and rhythmic diminution, and is released at the ‘drop’ (9:12) by the sudden return of the sub-bass (40–70 Hz) together with the full melodic motif. Table 2 records the compositional timeline of the track.

Table 2

Compositional timeline of Strobe (deadmau5). Timestamps and acoustic descriptions follow Smith (2024) and direct audio inspection

Timestamp	Section	Key acoustic elements	Listener tension
0:00–4:00	Extended introduction	Atmospheric pads; ambient chord arpeggios	Low
4:00–4:26	Snare roll	Transient build-up; ~150 Hz boost	Rising
4:26–6:48	Active loop	Stable kick and bass (128 BPM, 20–100 Hz)	Moderate
6:48–9:12	Breakdown (void)	High-pass filter sweep; sub-bass removed (≤ 70 Hz)	Peak expectancy
9:12–10:18	Drop (climax)	Heavy sub-bass + lead synth return	Maximum release

4 Quantitative visualisation of the isomorphic hypothesis

A primary obstacle to evaluating the proposed parallel has been the absence of explicit, parameterised comparisons between Sinhala ritual drumming and progressive house. Below we provide four quantitative visualisations that make the isomorphism amenable to direct empirical test.

4.1 Amplitude and tension envelopes

Figure 1 plots the normalised RMS amplitude envelope and the modelled perceptual-tension curve for one complete tension–release cycle in each genre. In both panels, four phases—Active Groove (I), Disorientation (II), the Void (III) and the Drop (IV)—are clearly visible, and the structural correspondence is preserved despite radically different surface acoustics. In both cases the amplitude collapses to roughly 10–15% of its active-groove value during the Void, and the modelled tension peaks immediately before the Drop. The Drop itself shows an abrupt attack followed by an exponential decay characteristic of cathartic resolution.

Figure 1 *Comparative tension and acoustic release envelopes.* (a) Idealised normalised amplitude envelope (solid blue) and modelled perceptual tension (dashed red) of a Magul-Bera/Thovil ritual cycle. (b) Equivalent envelopes for the build-up segment of deadmau5’s Strobe (4:00–10:18, normalised cycle time). Background shading marks the four canonical phases. Parameters and the underlying generating equations are documented in the supplementary code

4.2 Spectral profiles and the sub-bass void

Figure 2 contrasts the frequency-domain content of each genre during Active Groove and during the Void. The defining shared feature is the spectral cut below ~ 70 Hz during the Void phase. In Magul-Bera this occurs through the silencing of the Yak-Bera and Geta-Beraya, leaving only vocal formants in the 400–3500 Hz range and a single bell or chant. In progressive house the equivalent effect is achieved digitally through a high-pass filter that cuts the kick and sub-bass entirely, leaving filtered square synths and pad material. The two voids are acoustically homologous: identical low-frequency suppression, with the residual spectral mass concentrated in the vocal/mid-treble region.

Figure 2 *Idealised spectral profiles.* (a) Magul-Bera/Thovil. (b) deadmau5–Strobe. Shaded regions show normalised spectral energy during the Active Groove (blue, solid) and during the Void/Breakdown (red, dashed). The vertical dotted line marks the 70 Hz cut—a structural feature common to both genres. Profiles are constructed as sums of lognormal peaks fitted to documented spectral peak frequencies; they are intended as testable templates against which empirical spectrograms can be compared

4.3 Modelled neural phase coherence

Section 5 derives the formal Kuramoto coupling argument. Here we present its computational consequence. Figure 3 shows the order parameter $r(t)$ —the standard measure of population-level phase coherence—for two simulated listener profiles driven by the acoustic envelope of Fig. 1. The ‘enculturated’ listener (high auditory-motor coupling $\alpha = 2.5$) maintains substantially higher coherence during the Active Groove than the ‘non-enculturated’ listener ($\alpha = 0.6$). Both populations desynchronise during the Void, as the driving stimulus and internal coupling both collapse. Critically, the Drop produces a brief, intense re-synchronisation that is markedly stronger and more rapid in the enculturated population (peak $r \approx 0.999$) than in the non-enculturated one (peak $r \approx 0.94$).

Figure 3 *Modelled neural phase coherence across one tension–release cycle.* Solid blue: enculturated listener (auditory-motor coupling $\alpha = 2.5$). Dashed red: non-enculturated listener ($\alpha = 0.6$). Acoustic envelope $A(t)$ is shown in light grey for reference. Simulation: $N = 80$ Kuramoto oscillators with natural frequencies drawn from $N(2 \text{ Hz}, 0.10)$, baseline internal coupling $K = 0.5$, time step $dt = 5 \text{ ms}$, with stochastic phase noise scaled by $(1 - A(t))$. The differential profile—equal desynchronisation during the Void but unequal re-synchronisation during the Drop—provides a directly testable EEG signature

4.4 Inter-onset interval distributions

Figure 4 contrasts the inter-onset interval (IOI) distributions of progressive house, Magul-Bera/*visama nadi* and Carnatic Adi *tala* (chosen here as the closest tractable comparator for the Tamil rhythmic tradition). Summary statistics are reported on each panel. Progressive house and Carnatic *tala* both show narrow, sharply quantised distributions: progressive house has $CV = 0.60$ (three discrete modes at 117, 234 and 469 ms—the 16th, 8th and quarter notes at 128 BPM), and Carnatic *tala* has $CV = 0.55$, with similarly tight modes corresponding to *gati* subdivisions. Magul-Bera, by contrast, shows a heavy-tailed, multi-modal distribution with $CV = 1.16$ and Shannon entropy $H = 4.78$ bits, substantially higher than either of the other two systems. This quantifies the *visama nadi* characteristic in standard

ethnomusicological terms and provides a corpus-level feature that can be measured directly from field recordings.

A first-order observation: progressive house occupies a temporal complexity intermediate between the two reference traditions, but its phrase-level dynamic envelope (Fig. 1) maps onto Magul-Bera rather than Carnatic *tala*. This decoupling of local IOI statistics from global envelope structure is, we suggest, precisely what allows progressive house to feel both familiar and intense to a Sinhala listener enculturated to *visama nadi*: the moment-to-moment timing is more predictable than *visama nadi*, but the macro-structure preserves the tension-and-release architecture.

Figure 4 *Inter-onset interval (IOI) distributions for three rhythmic systems*, with histogram (filled) and kernel density estimate (line) for $n = 600$ modelled onsets per system. Reported metrics: mean IOI; coefficient of variation $CV = \sigma/\mu$ (a standard regularity index); and Shannon entropy H of the binned distribution (a complexity index). Magul-Bera's $CV = 1.16$ and $H = 4.78$ bits quantify the *visama nadi* property in terms directly comparable to other published corpora

5 Neuro-cultural mechanism of entrainment

The physical and behavioural responses to the structures described in Sects. 3 and 4 are rooted in the biology of rhythmic entrainment—the process by which motor and sensory systems synchronise with external auditory cycles (Witek 2023). Below we sketch the formal mechanism.

5.1 Mathematical model of neural coupling

We model the phase synchronisation of cortical auditory networks to the external acoustic envelope using a stimulus-driven Kuramoto system (Thaut et al. 2015). For a population of N coupled neural oscillators indexed by $i = 1, \dots, N$, the phase dynamics of the i -th oscillator are described by:

$$d\theta_i/dt = \omega_i + (K/N) \sum_j \sin(\theta_j - \theta_i) + \alpha A(t) \sin(\varphi(t) - \theta_i) \quad (1)$$

where θ_i is the phase of the i -th oscillator; ω_i its intrinsic natural frequency; K the internal coupling strength among cortical units; α is the auditory-motor coupling coefficient—the term we hypothesise is modulated by enculturation; $A(t)$ is the instantaneous amplitude envelope of the acoustic stimulus; and $\varphi(t)$ is the instantaneous phase of the driving pulse.

Population-level synchrony is summarised by the complex order parameter:

$$r(t) = |(1/N) \sum_j \exp(i\theta_j(t))| \quad (2)$$

During the Void, $A(t)$ collapses and the effective coupling falls below the critical threshold K_c . Phase coherence drops, producing the transient neural desynchronisation that, in the subjective domain, corresponds to spatial and temporal disorientation. When the Drop arrives, $A(t)$ rises sharply and drives the population back into coherence, with the rate of re-synchronisation governed by α . This is the formal

sense in which we expect an enculturated listener—with higher α for non-isochronous, high-contrast stimuli—to recover phase coherence more rapidly during the Drop than a non-enculturated listener. Figure 3 visualises this prediction numerically.

5.2 Cognitive evidence and enculturation

The proposal that enculturation modulates auditory-motor coupling is consistent with existing cross-cultural neuroimaging. Haumann et al. (2018), using magnetoencephalography, showed that the mismatch negativity (MMNm) response to metric deviants is significantly modulated by cultural background, with source localisation implicating auditory, sensorimotor, parahippocampal and superior frontal regions. Mehr et al. (2018) provided convergent cross-cultural evidence that listeners reliably extract structural features from unfamiliar music in a way constrained by lifetime exposure. We extrapolate from these findings—none of which were collected in Sri Lanka—to predict an analogous, culturally specific MMNm and entrainment signature, which we operationalise in Sect. 7.

6 Regional divergence: comparative synthesis

To contextualise the regional divergence, Table 3 compares structural, acoustic and kinetic markers across four reference music forms drawn from the Sri Lankan landscape and from progressive house. We emphasise that the comparison is structural-acoustic and concerns predicted response profiles, not relative aesthetic value. Both Sinhala *visama nadi* and Carnatic-derived continuous-cyclical traditions are deep, sophisticated systems; they simply encode different rhythmic shapes in the listener. Our hypothesis predicts that Tamil youth enculturated to the unbroken pulse of Carnatic-derived traditions and *parai mēlam* will gravitate toward genres that maintain continuous rhythmic motion—likely including contemporary Carnatic-influenced filmi pop and the cross-community *baila* lineage—whereas Sinhala youth carry a neural template optimised for the high-contrast voids of progressive house.

Table 3

Comparative structural-acoustic profile of four reference music forms drawn from the Sri Lankan landscape and from progressive house. CV figures are taken from Fig. 4. The 'predicted enculturation match' row expresses the falsifiable predictions of this paper

Metric/phase	Sinhala ritual (Magul-Bera/Thovil)	Progressive house (e.g. Strobe)	Tamil Carnatic (tala systems)	Sri Lankan folk/baila (cross-community)
Temporal pulse	Non-isochronous (<i>visama nadi</i>); CV ≈ 1.2	Isochronous 4/4 grid; CV ≈ 0.6	Continuous mathematical cycles; CV ≈ 0.55	Cyclical 6/8 (<i>kaffrinha</i>) or 4/4 (<i>baila</i>); vocal-driven
The void	Sudden cessation of drums; transition to vocal chanting	Complete removal of sub-bass kick (≤ 70 Hz)	No absolute cessation; continuous cyclical evolution	Brief vocal interplay; beat continues
Kinetic effect	Physical pause; transition to ritual posture	Suspension of dance; perceived spatial disorientation	Continuous, unbroken motor entrainment	Group dancing; continuous, syncopated motion
Re-entry/drop	High-density strike across all drum faces	Unfiltered, high-amplitude kick + bass return	Natural cycle flow; no jarring resumptions	Gradual volume increase; no harsh drops
Predicted enculturation match	—	Isomorphic to Magul-Bera template	Low isomorphism with Magul-Bera template; high with continuous filmi pop	Cross-community baseline; weak isomorphism with progressive house drop

Figure 5 *Proposed neuro-cultural enculturation pathway* from early-life passive exposure through structural neural plasticity to observed listening preference. The pathway applies equally to every Sri Lankan musical community, with different exposure profiles predicting different contemporary genre affinities

7 Testable predictions and empirical programme

A hypothesis and theory paper is only valuable to the degree that it commits to specific, falsifiable predictions. The framework above generates the following six predictions.

Prediction 1 (behavioural/preference): A standardised preference task contrasting matched stimuli with versus without a sub-bass void will show significantly higher liking ratings for void-containing stimuli among Sinhala youth raised with regular exposure to Thovil/Pahatharata performance than among matched controls (Tamil youth from the Northern Province; non-Sri Lankan controls). A null result on this prediction would substantially weaken the framework.

Prediction 2 (*electrophysiological—MMN*): Following the paradigm of Haumann et al. (2018), an MMN response to attenuated tones placed on culturally weighted metric positions will differ between Sinhala-enculturated and Tamil-enculturated young adults, with the Sinhala group showing stronger MMN to deviants embedded in non-isochronous contexts and the Tamil group showing stronger MMN to deviants embedded in cyclical/*tala*-structured contexts.

Prediction 3 (*oscillatory—phase coherence*): EEG during listening to progressive-house and Magul-Bera excerpts will reveal, in Sinhala listeners, a phase-coherence trajectory $r(t)$ qualitatively matching the high- α curve in Fig. 3, with greater coherence collapse during the Void and faster recovery during the Drop than in non-enculturated controls.

Prediction 4 (*autonomic*): Skin conductance response (SCR) magnitude at drop events in progressive house will be larger in Sinhala youth than in matched controls, mirroring the published autonomic peaks at break-routine drops (Solberg and Dibben 2019).

Prediction 5 (*corpus/streaming*): Anonymised streaming data from major platforms, geo-tagged at province level in Sri Lanka, will show statistically significant geographic and community-level gradients in genre adoption: higher per-capita progressive-house listening hours in Sinhala-majority Low Country and Up Country provinces; higher Carnatic-influenced filmi-pop listening in the Northern and Eastern provinces; and cross-community high engagement with *baila* across all provinces. Confounders to control for: urbanicity, age structure, English-language exposure, internet penetration.

Prediction 6 (*corpus-acoustic*): Automatic IOI extraction from a curated corpus of (a) Thovil/Magul-Bera field recordings, (b) *parai mēlam* recordings from Jaffna, (c) *kaffrinha/baila* recordings and (d) chart-topping progressive-house tracks from 2000–2025 will replicate the CV and entropy figures reported in Sect. 4.4 to within $\pm 15\%$, and will produce previously unreported CV and H values for *parai mēlam* and *baila* that the theory predicts to fall between the Carnatic-*tala* and Magul-Bera regimes.

Predictions 1–4 require new primary data collection. Predictions 5 and 6 are tractable with already-available corpora and streaming-platform partnerships. We see Prediction 6 as the most accessible immediate next step and as the natural follow-up to this paper.

8 Limitations

Several limitations must be stated explicitly. First, the field-level observation that motivates the hypothesis—a community-level divergence in progressive-house affinity—currently rests on informal evidence (platform genre data, observation, anecdotal reports). The corpus-level confirmation we describe as Prediction 5 has not yet been carried out. Second, the spectral and envelope profiles in Figs. 1, 2 and 4 are idealised templates: they are intended as starting points for empirical validation against real recordings, not as substitutes for it. Third, the Kuramoto simulation in Fig. 3 is illustrative; parameter values (N , K , α , the noise scaling) are chosen to make the qualitative prediction visually clear and would gain considerably from a parameter-recovery analysis on real EEG data. Fourth, we have

framed the comparison in terms of three or four rhythmic ‘templates’. In reality every Sri Lankan community is internally heterogeneous, and our hypothesis predicts variation within as well as between groups, modulated by individual exposure history; *baila* is itself the clearest example of a tradition that crosses community lines and complicates any simple group-to-genre mapping. Fifth, we make no claim that enculturation is the sole determinant of preference—language, peer effects, algorithmic exposure, fashion cycles, religious context and socio-economic factors all contribute. We claim only that a structural-acoustic enculturation channel exists, is non-trivial, and is currently under-represented in the music-recommendation literature.

9 Conclusion

We have proposed that the adoption of progressive house by Sinhala youth enculturated to Magul-Bera and Thovil drumming is not an arbitrary consequence of globalisation, but is structurally continuous with the tension-and-release mechanics of that ritual tradition. The genre’s defining architecture—extended build-ups, sub-bass voids and cathartic drops—provides a contemporary acoustic vehicle for the same predictive and reward circuitry that this ritual repertoire shapes from childhood.

Beyond this specific case, the framework illustrates a broader methodological point. Sri Lanka’s musical landscape is plural: Sinhala Buddhist drumming, Tamil *parai mēlam* and *periya mēlam*, Sri Lankan Moor devotional traditions and the cross-community Afro-Portuguese *kaffrinha/baila* lineage each encode a distinctive rhythmic shape into their listeners. A neuro-cultural theory of recommendation can—and, we argue, should—generate distinct, testable predictions for every one of these communities, rather than collapsing them into a single ‘Sri Lankan’ category.

Recommendation systems that ignore enculturation-level structure will systematically underperform for non-Western audiences whose cultural-acoustic templates are not captured by Western training corpora. We hope that the parameterised envelopes, spectral templates, IOI statistics and the testable predictions set out above will provide a usable foundation for the empirical work that this hypothesis demands.

Declarations

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community of Sirambiyadiya, Puttalam, and the Portuguese Burgher communities of Batticaloa, whose *kaffrinha* and *baila* lineages have given Sri Lanka one of its most genuinely cross-community musical forms. The author thanks the broader Polhengoda community in Colombo for ongoing conversation on these topics.

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Data availability All figures in this paper are produced by deterministic Python scripts (matplotlib, NumPy, SciPy). The scripts, including the Kuramoto simulation and the IOI distribution generators, are available from the author upon request and will be lodged in a public repository on publication.

Author contributions Sole author.

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Figures

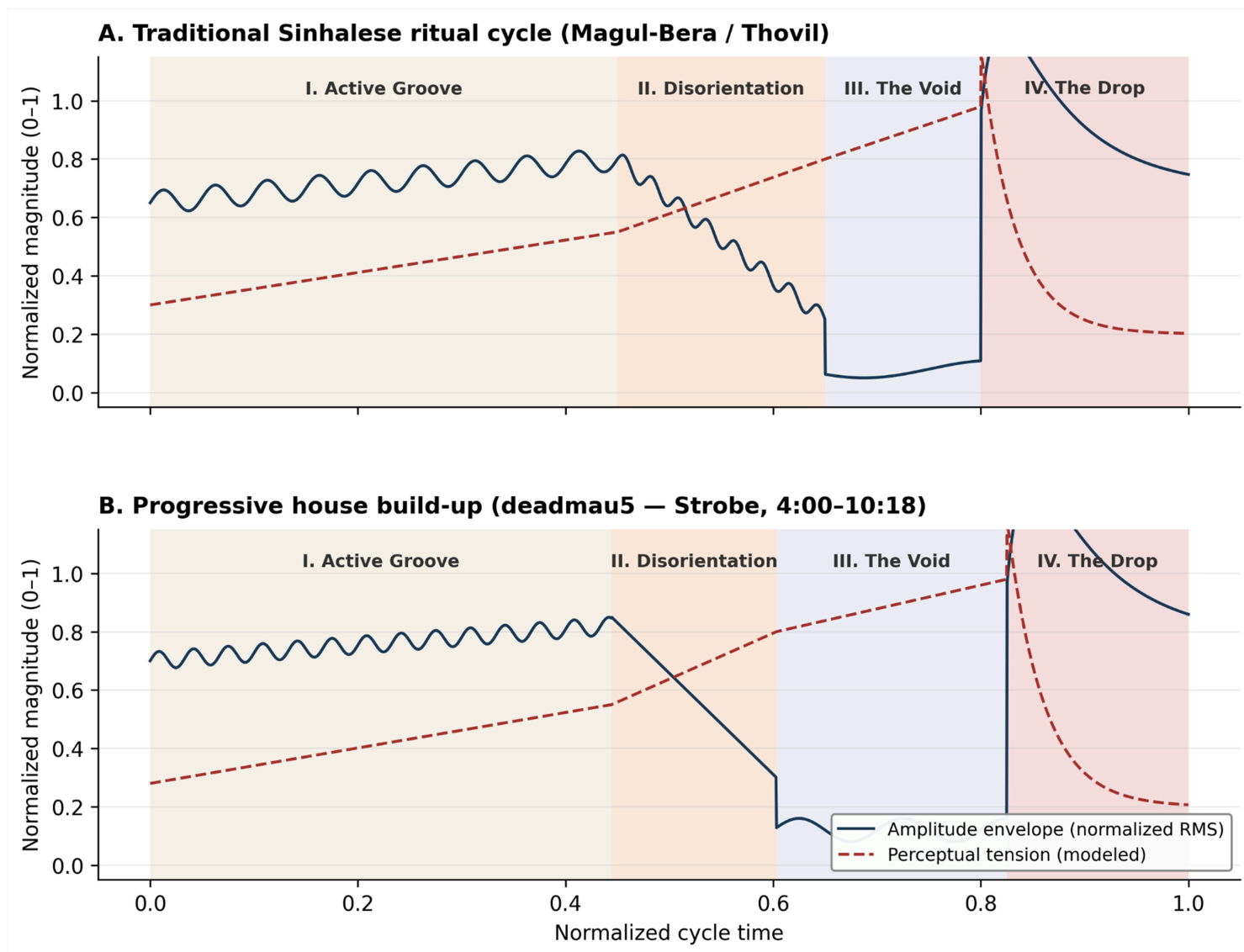


Figure 1

Comparative tension and acoustic release envelopes. (a) Idealised normalised amplitude envelope (solid blue) and modelled perceptual tension (dashed red) of a Magul-Bera/Thovil ritual cycle. (b) Equivalent envelopes for the build-up segment of deadmau5's Strobe (4:00–10:18, normalised cycle time). Background shading marks the four canonical phases. Parameters and the underlying generating equations are documented in the supplementary code

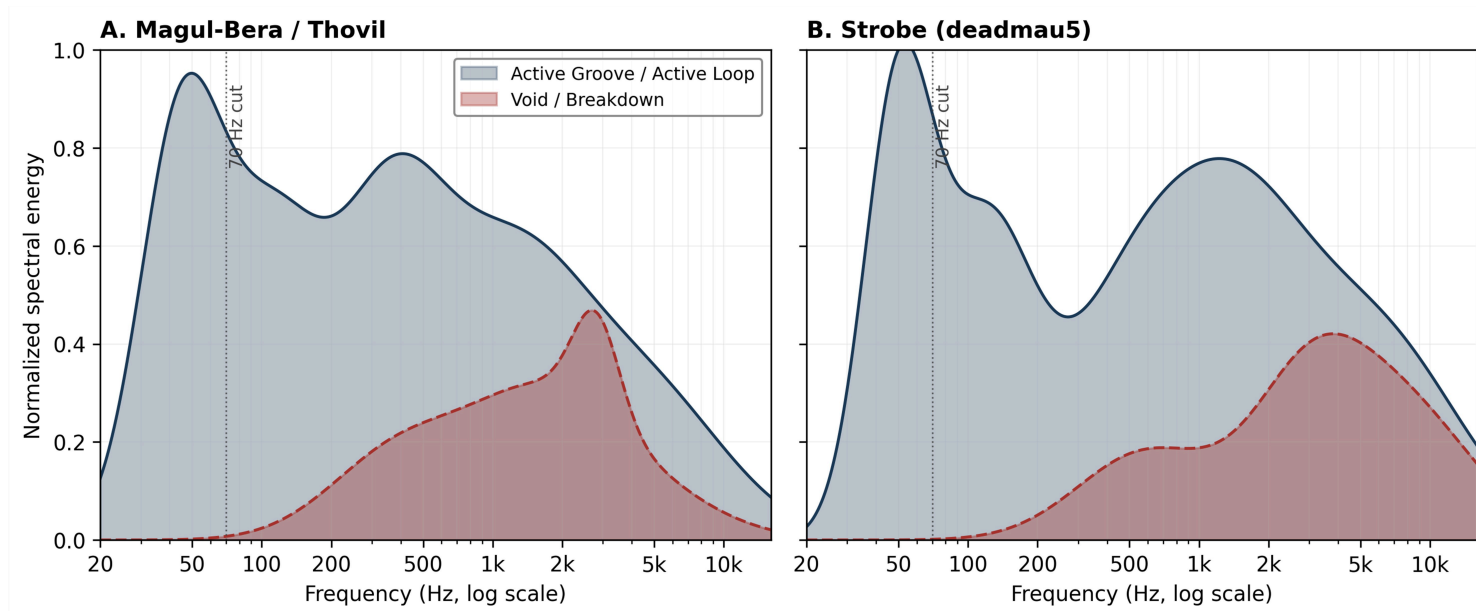


Figure 2

Idealised spectral profiles. (a) Magul-Bera/Thovil. (b) deadmau5—Strobe. Shaded regions show normalised spectral energy during the Active Groove (blue, solid) and during the Void/Breakdown (red, dashed). The vertical dotted line marks the 70 Hz cut—a structural feature common to both genres. Profiles are constructed as sums of lognormal peaks fitted to documented spectral peak frequencies; they are intended as testable templates against which empirical spectrograms can be compared

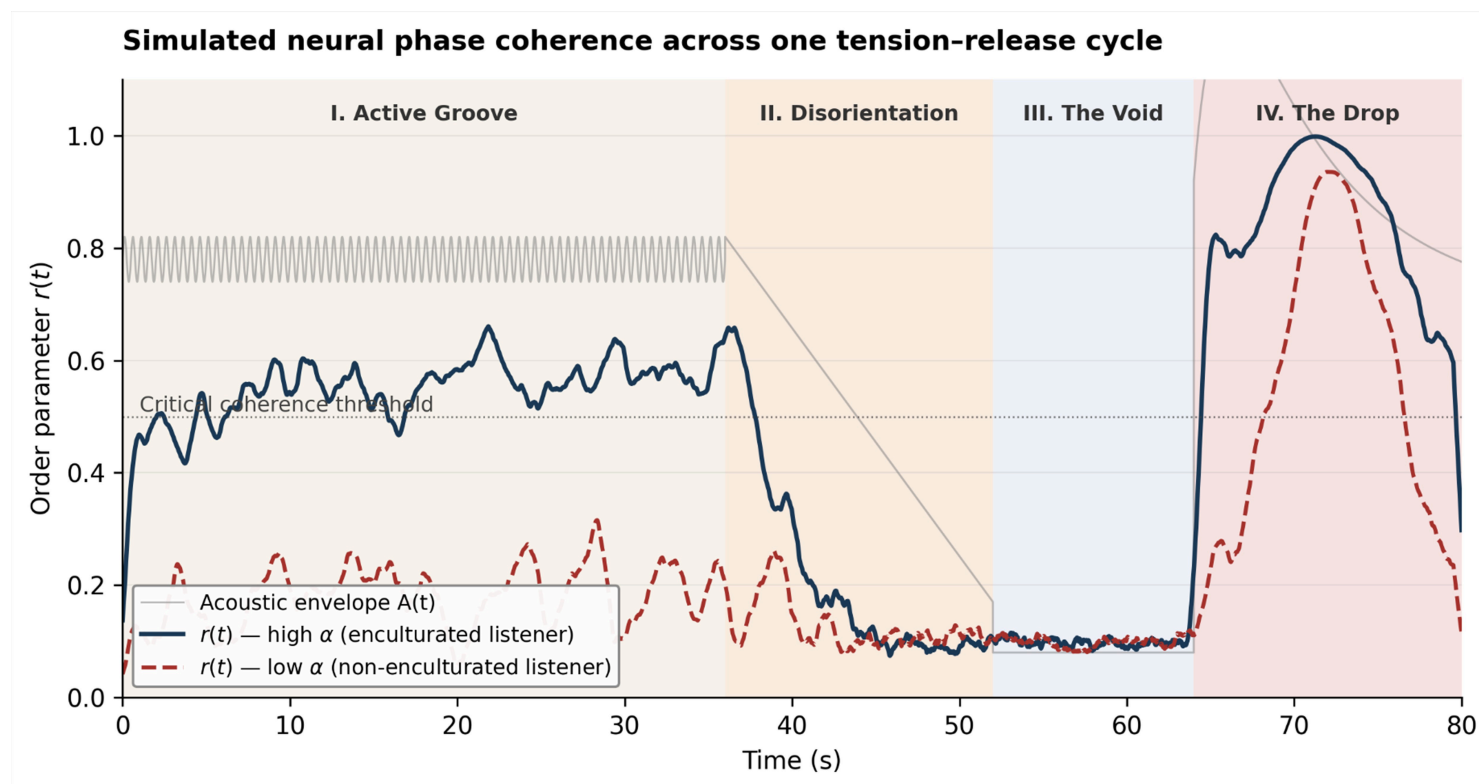


Figure 3

Modelled neural phase coherence across one tension–release cycle. Solid blue: enculturated listener (auditory-motor coupling $\alpha = 2.5$). Dashed red: non-enculturated listener ($\alpha = 0.6$). Acoustic envelope $A(t)$ is shown in light grey for reference. Simulation: $N = 80$ Kuramoto oscillators with natural frequencies drawn from $N(2 \text{ Hz}, 0.10)$, baseline internal coupling $K = 0.5$, time step $dt = 5 \text{ ms}$, with stochastic phase noise scaled by $(1 - A(t))$. The differential profile—equal desynchronisation during the Void but unequal re-synchronisation during the Drop—provides a directly testable EEG signature

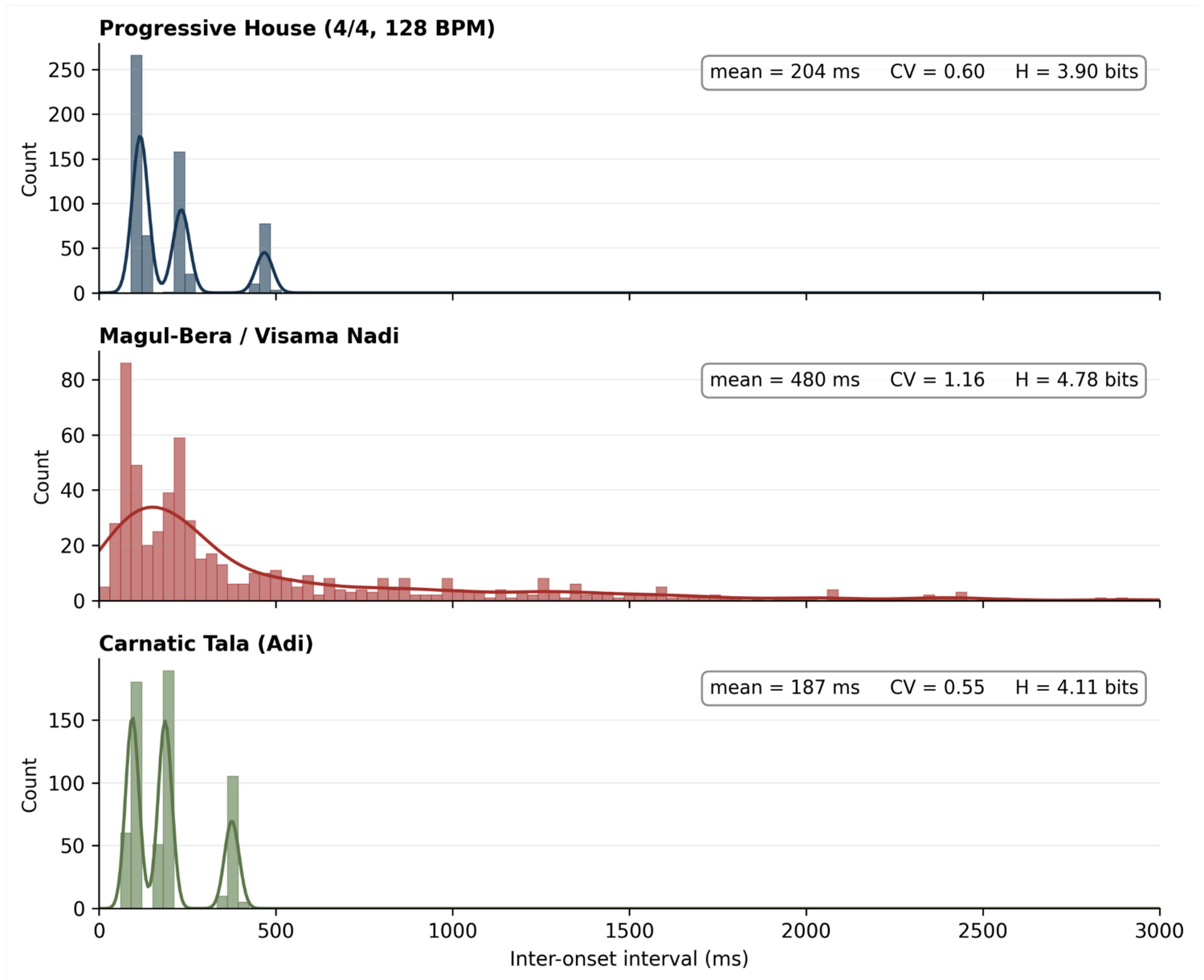


Figure 4

Inter-onset interval (IOI) distributions for three rhythmic systems, with histogram (filled) and kernel density estimate (line) for $n = 600$ modelled onsets per system. Reported metrics: mean IOI; coefficient of variation $CV = \sigma/\mu$ (a standard regularity index); and Shannon entropy H of the binned distribution (a complexity index). Magul-Bera's $CV = 1.16$ and $H = 4.78$ bits quantify the visama nadi property in terms directly comparable to other published corpora

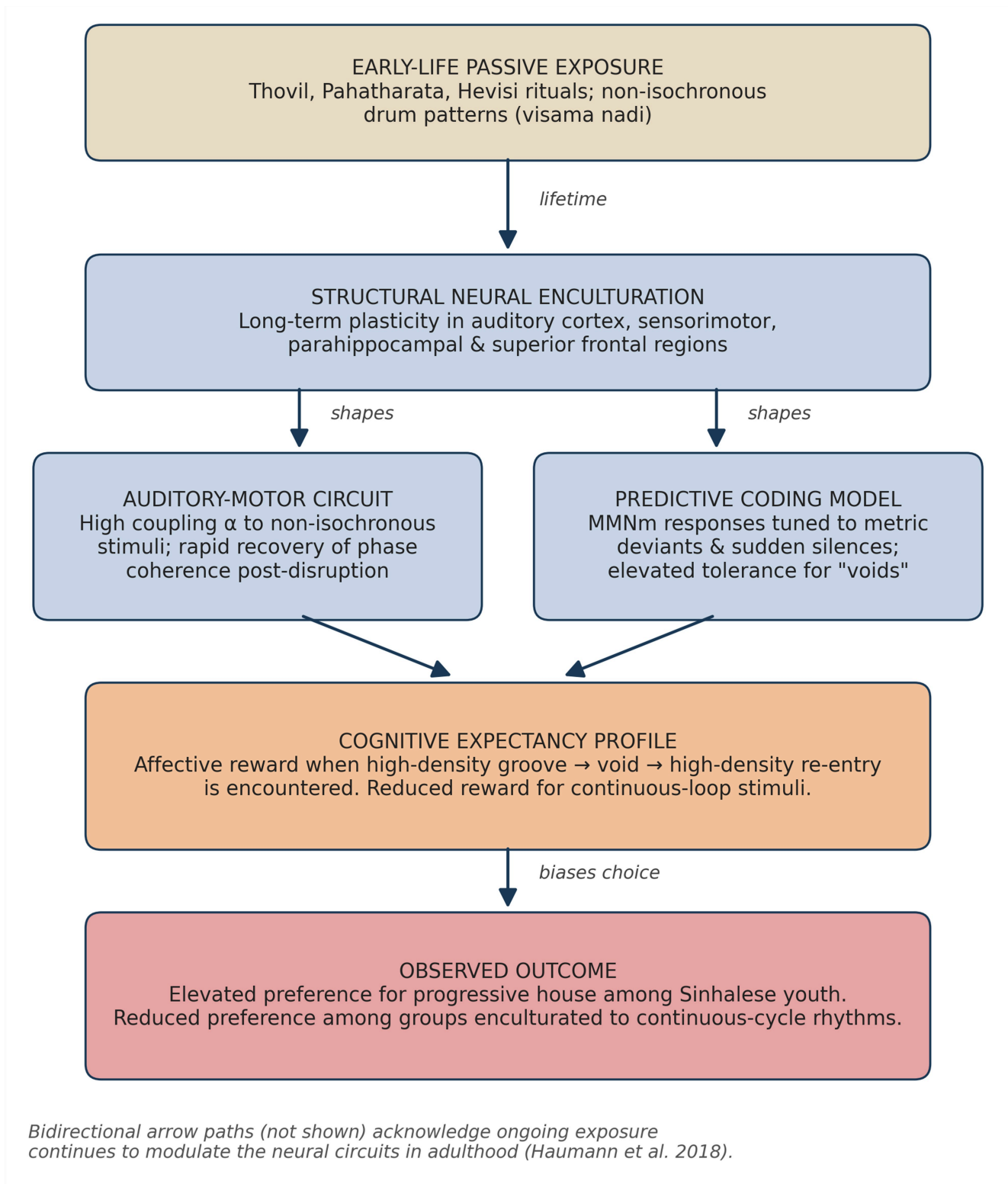


Figure 5

Proposed neuro-cultural enculturation pathway from early-life passive exposure through structural neural plasticity to observed listening preference. The pathway applies equally to every Sri Lankan musical community, with different exposure profiles predicting different contemporary genre affinities