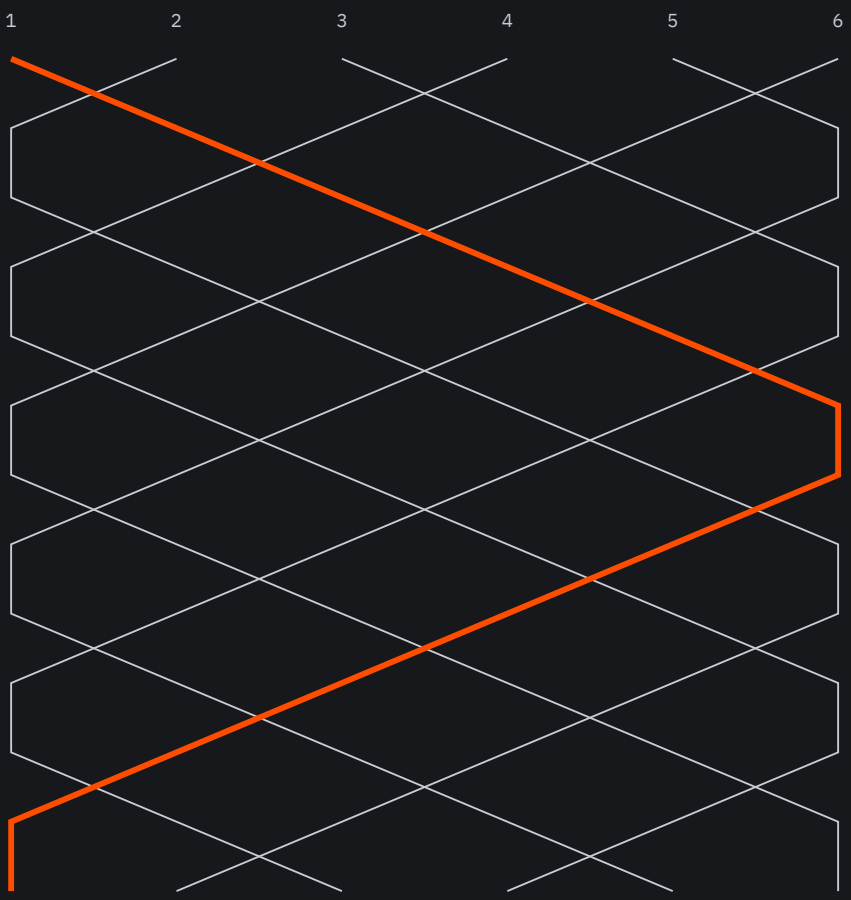
RESEARCH NOTE



PLAIN HUNT ON SIX BELLS: EACH LINE ONE BELL'S PLACE, ROW BY ROW; THE TREBLE IN ACCENT

RITUAL

DRUMS, BELLS AND BREATH IN THE SACRED

The companion to DB-WP-006 PERCUSSION

> *trance and the drum, and what the evidence shows · the Siberian and Sámi frame drum · rhythm that calls a god: batá, Candomblé, the Gnawa lila · dhikr and the Mevlevi ayin · Tibetan ritual · change ringing, the shofar, Kerala's melam · Noh, deeper, and the Korean gut · the living drum, with care · the music of the spheres · 53 rows of data; what is restricted stays out*

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ABSTRACT

Ritual percussion is often explained from outside by one mechanism: the drum drives the brain into trance. Section 1 tests that story. Neher's 1962 paper, its source, proposed rates near 8 to 13 per second, not the 4 to 7 Hz now attributed to it; the modern studies that played a 4.2 Hz drum to practitioners found no cortical driving, and Rouget's survey of possession found no universal link between a rhythm and trance at all. What the rites themselves do with rhythm is more specific and more interesting: a toque names an orisha (section 2); a dhikr accelerates on a measured curve and the Mevlevi ayin permits acceleration in exactly one section (3); English bells walk through permutation groups and a shofar sequence is fixed by a legal code (4); Noh shapes time by breath and call (5); in North America and Aboriginal Australia the drum and the didjeridu sit inside law and kinship that outsiders do not get to use (6). Section 7 covers cosmological readings of rhythm, from the medieval perfection of three to the Mexica slit drum. The last section lists what the lab could build from public material, and what it should not build.

1 / THE DRUM AS VEHICLE

1.1 TRANCE AND THE DRUM: WHAT THE EVIDENCE SHOWS

Neher's claim. A. Neher, A physiological explanation of unusual behavior in ceremonies involving drums, Human Biology 34(2), 1962, 151-160 (JSTOR 41448545; read). He tested the hypothesis "that the behavior is the result primarily of the effects of rhythmic drumming on the central nervous system", by analogy with photic driving. The laboratory half (A. Neher, Auditory driving observed with scalp electrodes in normal subjects, Electroencephalography and Clinical Neurophysiology 13, 1961, 449-451; not read) played a drum to subjects and reported changes in auditory-region EEG, unusual perceptions and some muscle twitching. The 1962 paper then compares laboratory reports with ethnographic ones. Three points are often lost:

- The rates. Neher expected ceremonial drumming "in the range of slightly below 8 to 13 cycles per second", near the alpha rhythm, slightly lower for sound. The rates he cites are 7 to 9 per second (A. M. Jones's "resultant rhythm" of African dances) and 8 or 9 for Haitian dances (Folkways recordings). He does not claim 4 to 7 Hz. The theta-band figure attached to his name today comes from later practice, below.
- The ceremony data. No participant in a ceremony was measured. The ethnography is quoted from Herskovits (1937), Gorer (1944) and others.
- His own caveat. "Two additional steps are needed to confirm this conclusion: 1. Measurement of physiological and psychological responses of actual participants in drum ceremonies. 2. Replication of the laboratory part of this study." Fachner notes Neher's EEG reading was visual, not quantitative, and still awaits replication (J. Fachner, chapter on music and altered states, 2011, https://jyx.jyu.fi/bitstream/123456789/36926/1/acvol1ch16fachner.pdf ; read in search excerpt only; title and volume unchecked).

Where 4 Hz came from. Michael Harner's "core shamanism", a modern Western practice, uses a steady frame drum near 4 per second. Gingras et al. quote it as "220 beats per minute, corresponding to a little less than 4 Hz" (3.67 Hz, asserted); the commercial recordings used in two studies below run at 4.24 Hz. M. Maxfield, Effects of rhythmic drumming on EEG and subjective experience, PhD dissertation, Institute of Transpersonal Psychology, 1990 (ProQuest 303885457), had twelve participants hear three drumming tapes including one at about 4 to 4.5 beats per second. Its results are unchecked: the dissertation was not read, and the theta claims made for it online are not sourced. E. Jovanov and M. Maxfield, Entraining the brain and body, ch. 2 in J. Berger and G. Turow (eds), Music, Science, and the Rhythmic Brain, Routledge, 2011, exists; not read. A "Szabó 2006" on drumming and bodily self-perception is cited by Aparicio-Terrés et al. (2025); its title and venue were not found.

Rouget's answer. G. Rouget, Music and Trance: A Theory of the Relations between Music and Possession, trans. B. Biebuyck, University of Chicago Press, 1985 (French 1980). As Herbert summarises him: there are several kinds of trance; many musics accompany it; the relation is therefore not causal; music's efficacy does not lie in "immanent formal 'trance properties' such as particular rhythms", and the response is culturally conditioned. R. Herbert, Reconsidering music and trance, Ethnomusicology Forum 20(2), 2011, 201-227, doi:10.1080/17411912.2011.592402 (read). Rouget's reply to Neher, "If Neher were right, half of Africa would be in a trance from the beginning of the year to the end" (p. 175), is quoted from a search excerpt and unchecked against the book. Herbert's critique of Rouget is also worth keeping: his model is high-arousal and communal, and leaves out solitary trancing.

Hamayon's answer, for Siberia. R. Hamayon, Are "trance", "ecstasy" and similar concepts appropriate in the study of shamanism?, Shaman 1(2), 1993, 17-40 (abstract read). She argues the words fuse a culturally defined behaviour with an assumed mental state, and calls for text-based ethnography of what the ritual actually says and does.

Measured.

1 / THE DRUM AS VEHICLE

study	who	stimulus	finding
Oohashi et al. 2002	3 Balinese men in a dedicatory ritual drama, field EEG telemetry	the rite itself	1 entered trance; theta and alpha power rose in that one; no epileptic discharges
Kawai et al. 2017	12 Balinese participants, 7 entranced	the rite itself	EEG differences before, during, after (abstract only)
Hove et al. 2016	15 experienced core-shamanism practitioners, fMRI with EEG	recorded drum, mean interval 236 ms (4.24 Hz), SD 6.7 ms; control the same rate with SD 16.5 ms	trance raised hub centrality in posterior cingulate, dorsal anterior cingulate, left insula; auditory-pathway connectivity fell; EEG theta power was comparable in both conditions
Gingras et al. 2014	39 novices	254.7 bpm drum or meditation music, shamanic or relaxation instructions	cortisol fell in every group alike; drum plus shamanic instructions gave more reports of heaviness, slower heart, dreamlike states; no EEG
Gordon et al. 2026	40 listeners, EEG	drumming at 4 per second against delta- and alpha-range rates, 10 min each	stronger theta-band tracking of the 4 Hz drum went with stronger altered experience across all rates (correlational)
Aparicio-Terrés et al. 2025	19 listeners, EEG	electronic music at 1.65, 2.25, 2.85 Hz, 1 min each	entrainment higher at 1.65 than 2.85 Hz; feelings of unity likewise at group level; no individual-level link

T. Oohashi et al., Electroencephalographic measurement of possession trance in the field, Clinical Neurophysiology 113, 2002, 435-445, doi:10.1016/S1388-2457(02)00002-0 (abstract). N. Kawai et al., Electroencephalogram characteristics during possession trances in healthy individuals, Neuroreport 28, 2017, 949-955 (citation via Aparicio-Terrés 2025). M. Hove et al., Brain network reconfiguration and perceptual decoupling during an absorptive state of consciousness, Cerebral Cortex 26(7), 2016, 3116-3124, doi:10.1093/cercor/bhv137 (read, PMC4898667). M. Gingras, G. Pohler, W. T. Fitch, Exploring shamanic journeying, PLOS ONE 9(7), 2014, e102103, doi:10.1371/journal.pone.0102103 (read). Y. Gordon, G. Karvat, N. Dagan, A. Landau, Neural tracking at theta predicts drumming-induced altered states of consciousness, Scientific Reports 16, 10204, doi:10.1038/s41598-026-37700-x (abstract only; the institutional record dates it December 2026). R. Aparicio-Terrés, S. López-Mochales, M. Díaz-Andreu, C. Escera, The strength of neural entrainment to electronic music correlates with proxies of altered states of consciousness, Frontiers in Human Neuroscience 19, 2025, doi:10.3389/fnhum.2025.1574836 (read); it reports that entrainment to drum sounds and clicks peaks near 2 Hz (Will and Berg 2007, via this paper).

Hove et al. say it directly: "the current data did not support auditory driving of cortex". Their own caveats: no naive controls, a small sample, and a control drum that differs in timing.

What this shows. Experienced practitioners can enter and leave a state on instruction while hearing the same drum, with measurable network changes. Instruction and expectation change what listeners report (Gingras). People differ in how strongly their EEG tracks a 4 Hz drum, and that difference goes with how altered they feel (Gordon, correlational). What it does not show. That a drum at any rate causes trance; that 4 to 7 Hz is special in ceremonies (no ceremony tempo survey supports it; Neher's own figures are 7 to 9); that cortical theta is driven (Hove). Rouget's position, that the rite, not the rate, does the work, has not been overturned.

1 / THE DRUM AS VEHICLE

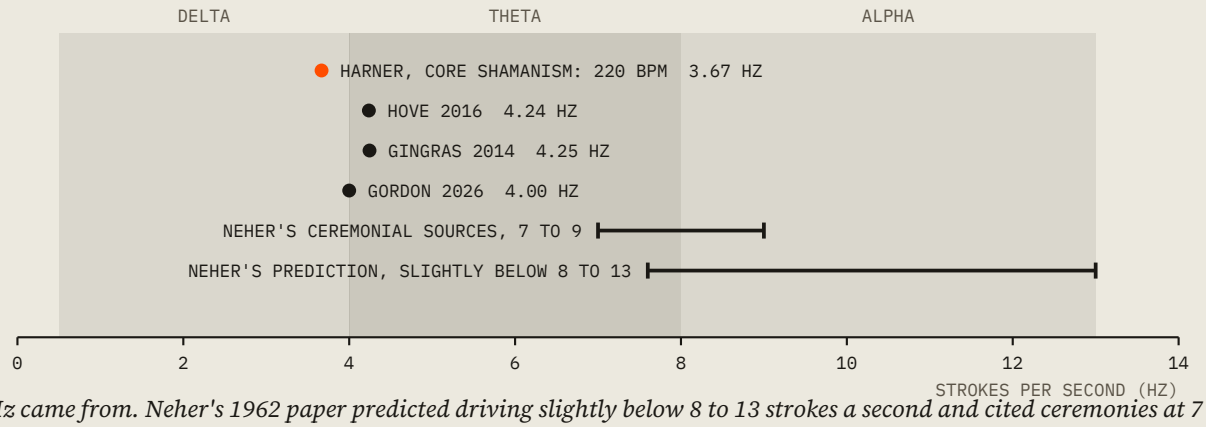


fig. 1: where 4 Hz came from. Neher's 1962 paper predicted driving slightly below 8 to 13 strokes a second and cited ceremonies at 7 to 9; the 4 Hz figure is Harner's core-shamanism drumming, a modern Western practice, and the laboratory studies since have played it. Hove et al. (2016) found theta power the same in trance and out of it.

1.2 SIBERIAN FRAME DRUMS

The English word "shaman" came from Evenki, a Tungusic language, through Russian; its root is disputed (Janhunen calls the "to know" etymology far-fetched). https://en.wikipedia.org/wiki/Shaman (etymology via encyclopedia, unchecked against Janhunen). For Siberian practice the word is the scholars' and often the practitioners' own; elsewhere it is an outside label.

Account and ethnography. S. I. Vajnštejn, The Tuvan (Soyot) shaman's drum and the ceremony of its "enlivening", in V. Diószegi (ed.), Popular Beliefs and Folklore Tradition in Siberia, Budapest, 1968, 331-338 (German version 1963) describes a ceremony that brings a new drum to life. Title confirmed; contents not read. That the Tuvan drum is called the shaman's horse or mount appears in secondary writing only; unchecked. G. B. Sychenko, "You can only reach Tyazhin with a drum...": phono-instruments in shamanic traditions of southern Siberia, Traditional Culture 20(4), 2019, 57-69, doi:10.26158/TK.2019.20.4.005 (abstract read), argues that ritual practice among the Turkic peoples of southern Siberia used many instruments besides the drum, that the less conspicuous drum-less forms survived Soviet repression better, and, after Dyrenkova, that they may be older than drum shamanism.

1.3 THE SÁMI DRUM

Instrument. Oval frame drums (more common in the south) and bowl drums hollowed from a burl (more common in the north), with an untanned reindeer-hide membrane painted with alder-bark dye. A T- or Y-shaped horn hammer strikes it; a pointer (vuorbi, árpa, Southern Sámi viejhkie) of brass, horn or bone moves on the skin as the drum is struck, and where it stops among the figures is read. Each owner chose his own figures; no two known drums share a set. Southern drums centre on a sun; northern drums divide the skin into levels. Rheen (17th c.) listed four uses: distant knowledge, luck and illness, healing, which deity to sacrifice to. https://en.wikipedia.org/wiki/S%C3%A1mi_drum , after E. Manker, Die lappische Zaubertrommel, 1938 and 1950, and R. Kjellström and H. Rydving 1998. The practitioner is the noaidi; "shaman" is the outside term.

History. Missionaries treated the drums as "the Bible of the Sámi". Thomas von Westen collected about 100 South Sámi drums; about 70 burned in the Copenhagen fire of 1728. In Åsele, 26 drums were taken on New Year's Day 1725 (same source). H. Rydving, The End of Drum-Time: Religious Change among the Lule Saami, 1670s-1740s, Uppsala, 1993 (not read), takes its title from the Lule Sámi name for the period, "the time when one had to hide the drums" (Rydving 1991, Scripta Instituti Donneriani Aboensis, excerpt). Anders Paulsen's drum, seized at Vadsø in 1691, was returned to Sámi keeping in 2022; Freavnantjahke gievrie, taken by von Westen in 1723, was returned from Meiningen to Saemien Sijte in Snåsa in 2023.

1 / THE DRUM AS VEHICLE

https://sametinget.no/oddasat/sardni-freavnantjahke-gievrie-sirdinseremoniijas.28095.aspx ; https://munin.uit.no/handle/10037/29732 .

Not reproduced. The figures. They are the owners' cosmologies, the drums are being returned as heritage, and their reading was the noaidi's knowledge.

2 / RHYTHM THAT CALLS A GOD

2.1 LUKUMÍ BATÁ (CUBA AND DIASPORA)

Instruments. Three double-headed hourglass drums: iyá ("mother", largest), itótele, okónkolo. Account. Consecrated drums hold the oricha Añá; only men sworn to Añá (omo Añá) play them in ceremony. Unconsecrated sets (aberíkula) serve secular settings. A tambor (drum ceremony) opens with the oru seco (oru del igbodú), a suite of about 23 standard unsung rhythms for the orichas. https://en.wikipedia.org/wiki/Bat%C3%A1_drum . Women are barred from consecrated batá in Cuban practice (K. Hagedorn cites fear for the drum's power); in Nigeria, Marcuzzi and Villepastour found no evidence of such a bar (Smithsonian Folklife, https://folklife.si.edu/magazine/gender-taboos-cuban-bata-drumming , excerpt). Since the early 1990s the all-women Obiní Batá plays aberíkula. K. Schweitzer, The Artistry of Afro-Cuban Batá Drumming, University Press of Mississippi, 2013, describes a continuum of toques from those bound to one oricha, song or dance to generic ones played for most (publisher's description). The consecration is secret.

Not reproduced. The toques. Many are taught and recorded in public, but a toque named for an oricha is a call to that oricha in the tradition's terms, and this paper does not need the notes.

2.2 CANDOMBLÉ (BAHIA, BRAZIL)

Instruments. Three atabaques, rum (largest, the lead), rumpi, lé; the agogô bell gives the timeline. Account. Each orixá has toques: alujá for Xangô (hot, fast), ijexá for Oxum (cool, gentle, and played for most orixás), opanijé for Omolu (heavy, slow), adarrum, often for Ogum, said to hasten possession. https://bahia.ws/en/ritmo-candomble/ ; Correio (Salvador), https://www.correio24horas.com.br/somsalvador/cantos-para-os-orixas-com-toques-proprios-musicalidade-permite-conex . Both are press sources. The pairings vary by house and nation (Ketu, Angola, Jeje) and are unchecked against G. Béhague, Patterns of candomblé music performance, 1984, or Â. N. Cardoso, A linguagem dos tambores, PhD, UFBA, 2006, which quotes: in candomblé music is not ornament, and many rites are inconceivable without it (via an ANPPOM 2024 paper).

2.3 THE GNAWA LILA (MOROCCO)

Instruments. Guembri (three-string bass lute, played by the maâlem), qraqeb (heavy iron castanets), tbel (drum). Account. The lila or derdeba is an all-night healing rite after a sacrifice: an opening (aâda) that consecrates the space, then seven suites (mluk), each calling a family of spirits with its own colour, incense, rhythm and dance, in a fixed order (treq), until dawn; participants enter jedba. The music plays "between triple and duple" meters. Inscribed by UNESCO in 2019. https://en.wikipedia.org/wiki/Gnawa_music . Which colour belongs to which spirit varies between Marrakech, Essaouira and the southern oases, and the online tables disagree; none is given here. D. Kapchan, Traveling Spirit Masters, Wesleyan, 2007, and T. Fuson's work are the sources to read.

2.4 ZAR (EGYPT, SUDAN) AND VODOU (HAITI)

H. El Hadidi, Zar: Spirit Possession, Music, and Healing Rituals in Egypt, AUC Press, 2016, rests on two years' fieldwork with groups in Cairo, Alexandria, Fayoum and Upper Egypt and more than three hundred zar songs (publisher's description; not read). Vodou appears in this note only through Neher's sources (Herskovits 1937; M. Deren, Divine Horsemen, 1953); nothing about Vodou drumming here is checked. Both are gaps.

3 / BREATH, NAME AND CYCLE

3.1 DHIKR: A MEASURED ACCELERANDO

Measured. R. Jankowsky, Ambient Sufism: Ritual Niches and the Social Work of Musical Form, University of Chicago Press, 2021, ch. 2, with audio and tempo data online (https://sites.tufts.edu/ambientsufism/?p=716). The 'Īsāwiyya of La Marsa, Tunisia, reciting a ḥizb on pilgrimage to the shrine of Sīdī 'Alī Ḥaṭṭāb: over the first 10 min 41 s the tempo rises 68, 72, 80, 90, 97, 108, 110, 118, 122, 122, 124, 128, 131 bpm (never falling, asserted); at 21:33 to 22:28 it decelerates and drops in pitch; then it reaches 395 bpm, 5.8 times the start (asserted). The deceleration before the peak is the detail a sequencer would miss.

Heart rates of 20 members of an Uşşaki congregation in Istanbul were reported to synchronise during dhikr (D. Xygalatas and C. Manoharan, reported in Sapiens and Big Think, https://www.sapiens.org/biology/sufi-ritual-istanbul/ ; described there as unpublished).

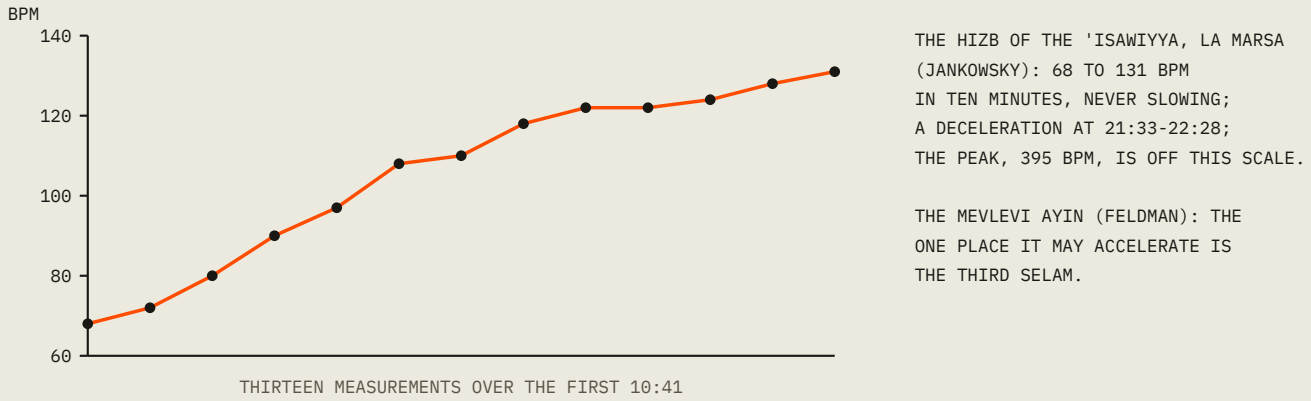


fig. 2: a measured accelerando: the tempo of a Sufi dhikr as Jankowsky measured it. The ritual's shape is the rise; the source gives tempi, which is why it can be drawn.

3.2 THE MEVLEVI AYIN: ONE PLACE TO ACCELERATE

Form. W. Feldman, Structure and evolution of the Mevlevi ayin: the case of the third selam, in A. Hammarlund, T. Olsson, E. Özdalga (eds), Sufism, Music and Society in Turkey and the Middle East, Swedish Research Institute in Istanbul, Transactions 10, 2001 (read). The later 18th-century order (p. 51): na'at; ney taksim; peşrev in muza'af devr-i kebir (56/4, the 28 doubled, asserted); first selam in devr-i revan (14/8) or düyek (8/4); second in evfer (9/4); third beginning in devr-i kebir (28/4) and continuing in sema'i (6/8); fourth in evfer; ney taksim; son peşrev in düyek; son yürük sema'i (6/8). The third selam's sema'i "gradually increases in tempo, being in fact the only section of the ayin where acceleration is permitted" (p. 53). The kudüm (volume one, 5.2) keeps the usul throughout.

For a sequencer: acceleration as a privilege of one section, not a global control. Herbert notes that Rouget found the sema hard to fit his arousal model (Herbert 2011).

3.3 TIBETAN BUDDHIST RITUAL: CYMBALS THAT LEAD, CHANT THAT IS DRAWN

Source. Y. Liou, Wrathful and peaceful sound: musical and religious logics of the two-armed Mahākāla ritual, Revue d'Etudes Tibétaines 54, 2020, 66-94 (read; fieldwork at Rumtek, Karma Kagyu). Instruments: rattle drum (ḍa ma ru), hollow cymbals (rol mo), flat cymbals (sil snyan), drum (rnga), shawm (rgya gling), trumpet (rkang gling), long horn (dung chen), vajra and bell, conch.

3 / BREATH, NAME AND CYCLE

- Three kinds of chant. 'don, recitation, no notation, drum strokes even if any; gdangs, tone or melody, no notation, stronger drum strokes on odd syllables, seven- and nine-syllable lines; dbyangs, the prolonged vowel, very slow, the only kind notated. Its score (dbyangs yig, "yang notation") is curved lines whose contour is the melodic contour, with the text beneath.
- Cymbals lead. The chanting master plays the rol mo; drums and rattle drum follow its rhythm. The rol mo has its own notation of numbers, lines and words. Liou names the techniques: 'bebs (falling: a strong stroke that weakens), 'bebs ring (the long form), bzhag (putting down, at the end: one stroke, or two light and one heavy), and two-, three- and four-beat figures chosen by deity (gnyis brdung, gsum brdung, bzhi brdung).
- Peaceful and wrathful. After Ellingson and others: flat cymbals, conches and shawm for peaceful deities; hollow cymbals, human-bone drums and bone trumpets for wrathful ones (T. Ellingson, The Mandala of Sound, PhD, University of Wisconsin, 1979, pp. 645, 684, via Liou).

T. Ellingson, The mathematics of Tibetan rol mo, Ethnomusicology 23(2), 1979, 225-243, analyses the cymbal patterns; not read. Liou says Ellingson drew the cymbal music on a timeline with lines for "a fall or prolonged acceleration".

The damaru. The thod rnga, a double-headed rattle drum made from two skull caps, is the form of damaru tied to gcod (chöd), the practice of offering one's body in charnel grounds; the practice needs the damaru and the rkang gling, a thighbone trumpet (A. Fuentes, dissertation on human remains in Tibetan ritual objects, 2020, search excerpt; J. Cupchik, chapter "The Chöd Damaru Drum", not read). Wooden and resin damaru are the common form.

Restricted. Mahākāla and chöd are tantric practices transmitted with initiation. Only the technique names Liou published are used; the monastery's score is not reproduced.

4 / THE SACRED CLOCK

4.1 CHANGE RINGING: PERMUTATION GROUPS IN A TOWER

The practice. English bells hung for full-circle ringing turn through nearly 360 degrees each stroke, so each bell's place in the order can change by at most one between rows. Ringers start in rounds (123456), ring a sequence of rows (changes), each a permutation of the bells, and must not repeat a row; ringing every permutation once is an extent, n! rows. A repeated row makes a touch false. https://en.wikipedia.org/wiki/Method_ringing (place notation after R. G. T. Morris, Place Notation, Central Council, 1984). F. Stedman, with R. Duckworth, Tintinnalogia (1668), and Stedman alone, Campanalogia (1677), set it out; A. T. White, Fabian Stedman: the first group theorist?, American Mathematical Monthly 103(9), 1996 (volume and pages unchecked), reads them as group theory. Ringing calls to service; its rules are combinatorial, not doctrinal.

Place notation. x swaps every adjacent pair; digits list the places that stay.

Plain hunt. Every bell moves one place per change, from lead to back and down again, pausing two rows at each end. On 6: x.16 repeated:

The script asserts for n = 3 to 9: rounds returns after exactly 2n changes, not before; no row repeats in the cycle; no bell moves more than one place.

Plain Bob. Plain hunt with the lead end (the last change of each 2n) altered so that the bells other than the treble shift work. Minor: x16x16x16x16x16x12; a bob changes the lead end to 14, a single to 1234. Doubles: 5.1.5.1.5.1.5.1.5 with lead end 125, bob 145, single 123.

What the script asserts:

- Minimus. The plain course, three leads, is 24 rows: every permutation of four bells once. The plain course is the extent.
- Doubles. The plain course is 40 rows, true. A change that keeps one of five places swaps two pairs, an even permutation; a method built only from such changes can reach at most the 60 even rows of 120. Plain Bob's lead end keeps three places and is odd, and exhaustive search finds a true 120 with bobs alone: a bob every fourth lead, three times (pppbpppbpppb). Derived here; not checked against published compositions.
- Minor. The plain course is 60 rows. Exhaustive search finds no true 720 from rounds with plain leads and standard bobs (14) only; with singles it finds one (7 bobs, 10 singles, a machine-found touch with no musical merit, in the CSV). John Holt's historical bobs-only 720 is reported to use bobs that make the treble dodge, a different call (https://lists.ringingworld.co.uk/pipermail/ringing-theory/2015-March/018524.html , list post).

For a sequencer: see section 8. The point here is that a ringing method is a deterministic walk through a symmetric group, with performer calls choosing among branches, and a hard constraint (truth) that the player can check.

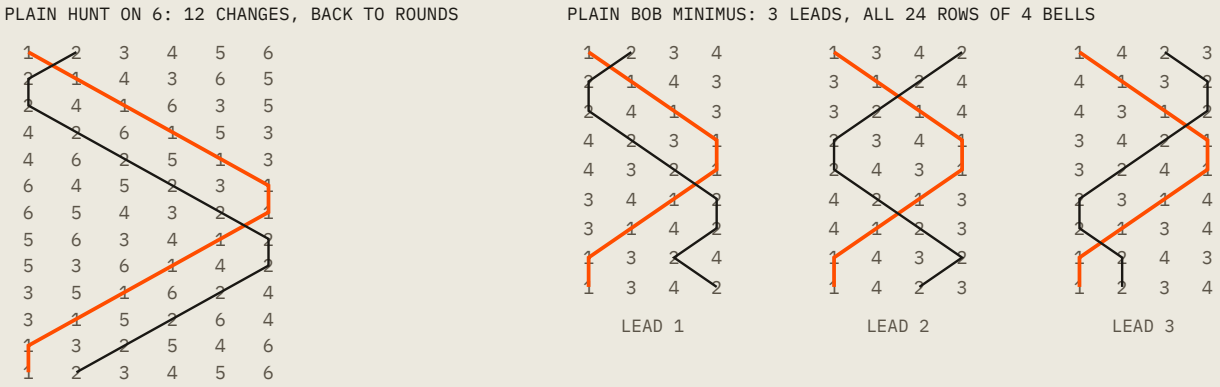


fig. 3: change ringing. Each row is one stroke of every bell, in the order shown; between rows, pairs of bells swap places. Left: plain hunt on six, the treble (accent) and the 2 (ink) weaving lead to back. Right: Plain Bob on four; its plain course rings each of the 24 orders once, the extent (asserted). Rounds closes each.

4.2 THE SHOFAR (ROSH HASHANAH)

Text. Shulchan Arukh, Orach Chayim 590 (Sefaria community translation, CC0, https://www.sefaria.org/Shulchan_Arukh,_Orach_Chayim.590 ; read). Nine blasts are required: three teruot, each with a tekiah before and after (590:1). Because it is in doubt whether the Torah's teruah is the wail (shevarim), the sobbing short blasts (teruah) or both, the custom blows TaShRaT (tekiah, shevarim, teruah, tekiah) three times, TaShaT three times, TaRaT three times (590:2): 30 sounds, 18 of them tekiot (asserted). The tekiah's minimum length equals the teruah's; one opinion makes a teruah three short sounds (terumitin), another nine (590:3). Shevarim should ideally be one breath (590:4). The code itself carries the dispute about lengths.

For the lab: the shofar order is an exact grammar of three gestures, public and printed. See 8.

4.3 THE KEBERO AND THE DANCING CLERGY (ETHIOPIA)

In the Ethiopian Orthodox Tewahedo Church, liturgical chant (zema), credited by tradition to Saint Yared (6th c.; the earliest manuscripts are 14th c.), is sung by debtera, unordained clergy trained in liturgy. Their schools (aqwaqwam bét) teach chant together with movement and instruments: the kebero (large drum), the tsenatsel (sistrum) and the meqwamiya (prayer staff). The notation, melekket, codified in the 16th century, sets signs over the Ge'ez text. https://en.wikipedia.org/wiki/Ethiopian_chant ; K. K. Shelemay, P. Jeffery, I. Monson, Oral and written transmission in Ethiopian Christian chant, Early Music History 12, 1993 (not read); K. K. Shelemay and P. Jeffery (eds), Ethiopian Christian Liturgical Chant: An Anthology, A-R Editions, 1993-1997. Kebero rhythms in aqwaqwam are not sourced here; the anthology is where to look.

4.4 KERALA TEMPLE DRUMMING: STAGES THAT HALVE

Panchari melam. Chenda (lead valanthala and uruttu), ilathalam (cymbals), kombu (horn), kuzhal (reed). A six-beat tala, played in five stages of 96, 48, 24, 12 and 6 beats, closed by a three-beat muri-panchari; more than four hours; a lead drummer (melapramani) sets duration and style. Pandi melam: a seven-beat tala in four stages of 56, 28, 14 and 7. https://en.wikipedia.org/wiki/Panchari_melam (no inline citations); Kerala Tourism, https://keralatourism.org/kerala-article/traditional-orchestras/134 . Each stage halves the last and the last is the tala itself (asserted: 96 = 16 x 6, 56 = 8 x 7). No tempi are given in these sources; that the beat quickens stage by stage is the usual description, unchecked as numbers. R. Groesbeck, Cultural constructions of improvisation in tāyampaka, a genre of temple instrumental music in Kerala, Ethnomusicology 43(1), 1999, 1-30, is the scholarly

entry (not read).

Theyyam. In northern Kerala (Kannur, Kasaragod) a performer, accompanied by chenda, becomes a deity for the duration of the rite. R. Freeman, The teyyam tradition of Kerala, in G. Flood (ed.), The Blackwell Companion to Hinduism, 2003 (not read; details unchecked).

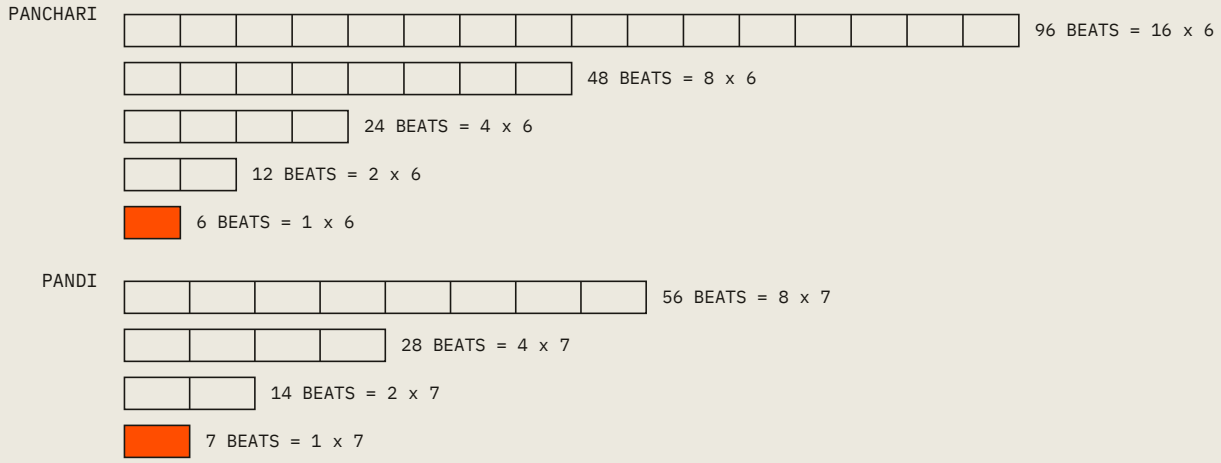


fig. 4: Kerala temple melam: each stage is half as long as the one before, counted in cycles of the tala (six beats for panchari, seven for pandi). The sources give the beats, not the tempi; the halving is what is drawn. The last stage of each in accent.

4.5 TALA AND GONGAN AS CYCLIC TIME

Volume one and rhythm-systems.md cover how tala and the gong cycle count. Two readings of them as time itself: M. Clayton, Time in Indian Music, Oxford, 2000, on metre as cyclic (not read here); J. Becker on the Javanese gong cycle as Hindu-Buddhist cyclic time (volume one, 5.1). The popular etymology of tāla from Śiva's tāṇḍava and Pārvatī's lāsya is a tradition's account, unchecked against a Sanskrit source.

5 / SPACE AND THE THRESHOLD

5.1 NOH, DEEPER

Jo-ha-kyū. Zeami adapted the gagaku idea of jo-ha-kyū (slow opening, developing and accelerating middle, fast close) and made it five sections by nesting a jo-ha-kyū inside ha: jo, ha-jo, ha-ha, ha-kyū, kyū (asserted). The principle applies at every level, from a line of chant to a day's programme. Stanford Noh project (Fujita, Kapuscinski, Rose 2020), https://noh.stanford.edu/form . No source found gives tempi or time proportions; a 10:50:40 ratio attributed to Zeami online is unsourced and not used. The primary texts: S. Quinn, Developing Zeami, Hawai'i, 2005; Rimer and Yamazaki, On the Art of the Nō Drama, 1984 (not read).

Komi, call, stroke. "The komi is a particular kind of breath that is taken in silence, marking the beginning of drumming patterns." The drummers take it together; its length is flexible. Then a call (kakegoe), then the stroke: build-up and release, repeated at larger scales as a gradual build-up, a quick release and a brief slowing. https://noh.stanford.edu/noh-as-intermedia .

Named patterns (https://noh.stanford.edu/music/otsuzumi-kotsuzumi ; descriptions read, notation images not): parts sit in the eight-beat honji and usually start on the upbeat before 1; the ōtsuzumi is busier in beats 1 to 4, the kotsuzumi in 5 to 8. Mitsuji has few strokes and leans on the calls; tsuzuke is about one stroke a beat; uchikiri restores the strict setting and is known by the ōtsuzumi's call "ha hon yo"; shikake, the ōtsuzumi's closing pattern, is six steady strokes then a call, and starts a cadential deceleration; in dance music the kotsuzumi's nagaji spans 16 beats against the ōtsuzumi's ji of 8. Patterns run from two to thirty-two beats. Calls: ōtsuzumi yo, ho, iya, yoi, hon-yo; kotsuzumi yo, ho, iya. RUDE's Noh entry and its sources are in plugins/rude/docs/rudiments.md.

Okina. Called "Noh, yet not Noh": a rite performed at New Year, theatre dedications and memorials, by three kotsuzumi with the flute, the ōtsuzumi joining for the Sanbasō dance. The Okina figure becomes a kami; the piece follows a Shintō rite, invoking, appearance, dance and sending-off. https://en.wikipedia.org/wiki/Okina_(Noh) ; https://db2.the-noh.com/edic/2011/02/okinamai.html . Secondary sources; S. Rath, The myth of Okina, is the scholarly source to read.

Kagura. Not researched in this note.

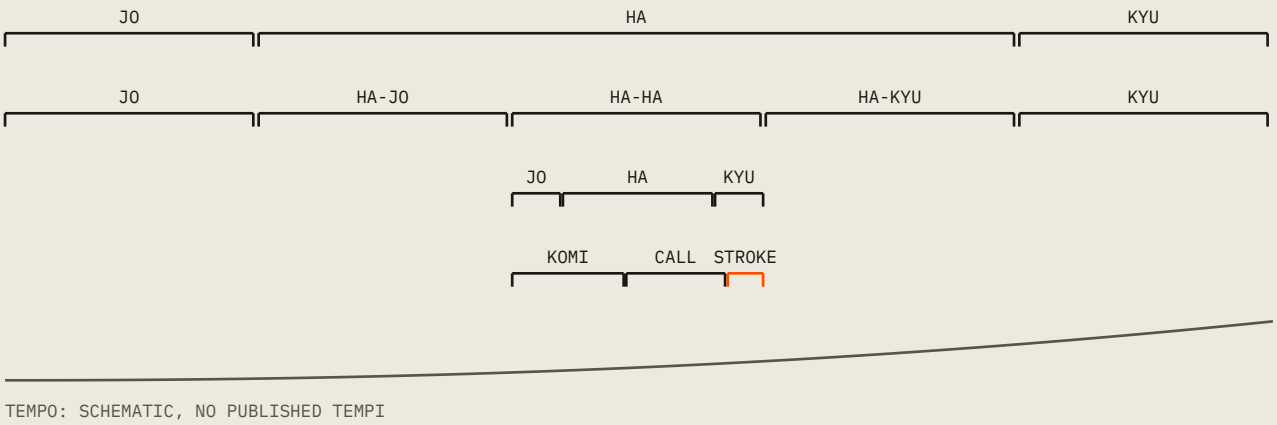


fig. 5: jo-ha-kyu, nested: the slow opening, the developing middle and the fast close, at the scale of a programme, of the five dan of one play, of one dan, and of one breath (komi, the call, the stroke). Proportions and the tempo line are schematic.

5.2 THE KOREAN GUT: A DRUM WITHOUT TRANCE

Tradition. On South Korea's east coast, hereditary mudang families, the Kim family troupe among them (designated cultural assets), perform village rites (pyŏlsin-gut) and rites for the dead (ogu-gut). S. Mills, Healing Rhythms: The World of South Korea's East Coast Hereditary Shamans, Ashgate, 2007. A review notes that scholars

often class these hereditary mudang as priests because they do not practise the ecstatic forms (Journal of Folklore Research review, excerpt). Here is a rich drum tradition that is not, in its own terms, a trance tradition.

Rhythm. Changgo (hourglass drum, the lead), kkwaenggwari (small gongs), ching (large gong). Mills calls the east-coast cycles (changdan) "the most complex rhythmic cycles" in Korea, long, irregular and flexible. Ch'ŏngbo (ch'ŏngbae) is a multi-part cycle framing extended sung prayers; in its first chapter tokkaekki patterns mark atypical subdivisions, repeated enough to set up a temporary new order. S. Mills and Park, The musical faces of South Korea's East Coast shaman tradition, Ethnomusicology Forum 26(1), 2017, 69-92 (on p'unŏri and ch'ŏngbo); S. Mills, "Release hitting", Analytical Approaches to World Music 8(1), 2020 (on tchoshigae in ogu-gut). Abstracts and excerpts only; cycle lengths are not given here.

6 / THE LIVING DRUM (WITH CARE)

6.1 INDIGENOUS NORTH AMERICA

"Shamanism" is an outside label for Native American religious practice, contested by many of the nations it is applied to, and many ceremonies are private. This section uses published, public material only.

The powwow drum. At the intertribal powwow a large drum is played by several singers at once. A teaching published by the Chicago American Indian Center, as adapted by the University of Illinois, calls the drum Grandfather: "our relation, an immediate family member", a living elder and teacher, not merely an instrument. https://cdn.citl.illinois.edu/courses/aiiopcmpss/essays/powwow/powwow3.htm . Teachings differ by nation and drum keepers carry their own; this one is quoted as published, not generalised. T. Browner (Choctaw), Heartbeat of the People: Music and Dance of the Northern Pow-wow, University of Illinois Press, 2002, is the scholarly study (not read).

The Native American Church. D. McAllester, Peyote Music, Viking Fund Publications in Anthropology 13, 1949 (a Columbia thesis; not read), studied peyote song with water drum and gourd rattle. The meetings are private prayer; nothing from them is reproduced.

The recordings. Frances Densmore recorded more than 2,500 songs between 1907 and 1941, now at the Library of Congress American Folklife Center. From 1979 its Federal Cylinder Project transferred the cylinders to tape and returned copies to tribal archives so communities could hear their own recordings. https://blogs.loc.gov/folklife/2013/11/indigenous-american-cylinder-recordings-and-the-american-folklife-center/ ; https://www.loc.gov/collections/ancestral-voices/about-this-collection/ . The project's count is given as about 9,000 cylinders (LOC 2023) and as nearly 7,000 from about 140 groups (a 1986 review); the difference is unexplained. How the recordings are viewed today, as records made under assimilation policy and as sources communities now use to revive songs, is the subject of repatriation scholarship (e.g. https://scalar.oberlincollegelibrary.org/decolonizing-ethnomusicology/repatriation , not read).

6.2 ABORIGINAL AUSTRALIA

Wangga. A public song genre of the Daly region, Northern Territory (Belyuen, Wadeye), sung by a songman with clapsticks and a didjeridu player, at mortuary and circumcision ceremonies and in public performance. A. Marett, L. Barwick, L. Ford, For the Sake of a Song: Wangga Songmen and their Repertories, Sydney University Press, 2013, open access (read, ch. 2). A rhythmic mode is a tempo band combined with a clapstick pattern: mode 1 without sticks; 2 slow even; 3 slow moderate (even, uneven triple); 4 moderate (even, uneven quadruple, triple, quintuple, doubled); 5 fast (even, doubled, uneven quadruple, triple, sextuple). Tempo bands, clapstick bpm (Table 2.5):

repertory	slow	slow moderate	moderate	fast
Barrtjap	58-65		117-120	126-144
Muluk	50-55		110-113	126-140
Mandji	46-48		110-116	130-140
Lambudju	64-69	99-107	110-116	120-125
Walakandha (early)	60-72		112	120-136
Walakandha (post-1986)	55-65			133-142
Ma-yawa			117-125	134-146

Within each repertory the bands are discrete; across repertories slow is clear of moderate, but moderate and fast overlap (Ma-yawa's moderate reaches 125, Lambudju's fast starts at 120; asserted). The bands are relative to a songman's practice, not absolute. The didjeridu supports the voice and defines metre almost as much as the

sticks; in unmeasured sections it marks word boundaries. In the Marri Ngarr Church Lirrga songs, L. Barwick (2003) found four discrete tempo bands and that singers have their own words for them (https://ses.library.usyd.edu.au/handle/2123/13089 ; abstract).

The yidaki. Among the Yolŋu of north-east Arnhem Land the didjeridu is the yidaki. "By law and custom, Yolŋu women do not play yidaki", with ceremonial exceptions, and most Yolŋu want the custom kept; senior Yolŋu interviewed differ on whether outsider women should play. Yidaki Dhäwu, a Yolŋu-led site, https://yidakistory.com/dhawu/yidaki-issues/women-play-didgeridoo . Elsewhere in Australia practice differs and the "taboo" has been overstated as universal. In 2008 the Australian edition of The Daring Book for Girls was criticised for teaching girls to play it, and the publisher apologised (secondary reports only). Many Aboriginal song genres and ceremonies are restricted by gender and initiation; wangga is described here because its singers' families published it.

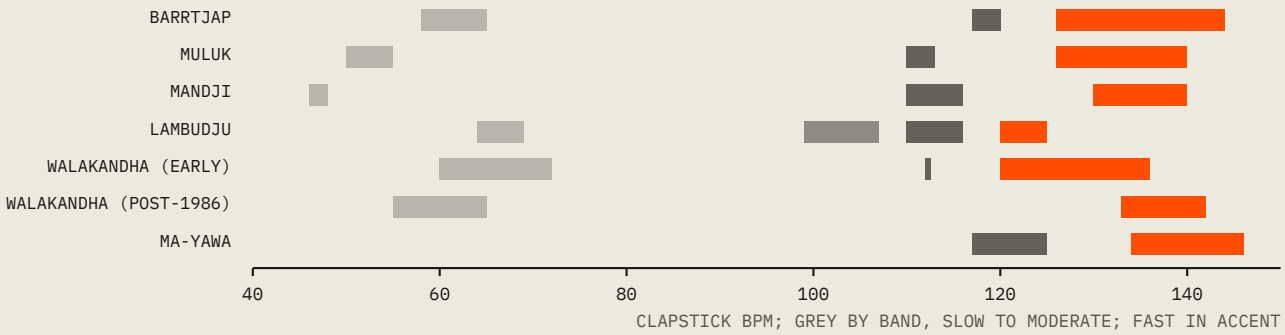


fig. 6: wangga, a public song genre of the Daly region: each repertory keeps its clapstick tempi in distinct bands, and the band is part of the song's mode (Barwick, Marett). Public, published measurements only.

7 / COSMOLOGY

7.1 THE MUSIC OF THE SPHERES

The Pythagorean idea that number orders sound and cosmos alike reaches the Middle Ages through Plato (the sirens on the spindle of necessity, Republic X 617b; the world-soul's ratios, Timaeus 35b-36b) and Boethius, whose De institutione musica (I.2) divides music into mundana (of the spheres and seasons), humana (of body and soul) and instrumentalis (sounding). Kepler gave each planet a melody from its orbital speeds (Harmonices mundi, 1619, Book V). Standard references, not re-read for this note. None of these is a rhythm a drummer plays; they are the frame in which rhythm was read as order.

7.2 THE PERFECTION OF THREE

Notre-Dame polyphony (Paris, about 1170 to 1250) wrote rhythm in six modes, metrical feet on a ternary grid of breves. https://en.wikipedia.org/wiki/Rhythmic_mode (after Apel 1961, Hoppin 1978, Reese 1940; the anonymous De mensurabili musica, about 1260).

mode	foot	breves	grid
1	trochee	2+1	x.x
2	iamb	1+2	xx.
3	dactyl	3+1+2	x..xx.
4	anapaest	1+2+3	xx.x..
5	spondee	3+3	x..x..
6	tribrach	1+1+1	xxx

Every mode fills whole perfections of three (asserted). Modes 2 and 4 are modes 1 and 3 started one note later, not their retrogrades (asserted). Medieval writers linked ternary metre to the Trinity; Reese and Hughes judge that "an explanation made after the event, rather than a cause" (same source).

7.3 THE MEXICA SLIT DRUM

The teponaztli is a hollowed log with an H-shaped cut that leaves two tongues of different length or thickness, two pitches usually a third or fourth apart, struck with rubber-tipped mallets; carved with deities, animals or human forms. Motolinía (Historia de los Indios de la Nueva España, bk 2, ch. 26) says it was played with the upright skin drum huehuetl for dances; the Florentine Codex draws both at a One Flower ceremony. https://en.wikipedia.org/wiki/Teponaztli ; https://aztecglyphs.wired-humanities.org/node/7854 . That victims' blood was at times poured into the drum is reported "according to some sources" (Collier, via the same page; unchecked). That the drums themselves were treated as deities was not found in the sources checked. G. Tomlinson, The Singing of the New World, Cambridge, 2007, is the study to read.

7.4 BALI: SACRED, CEREMONIAL, ENTERTAINMENT

Bali sorts its dances as wali (sacred, inside the temple), bebali (ceremonial) and balih-balihan (entertainment); UNESCO inscribed nine as "Three genres of traditional dance in Bali" in 2015, the trance dance sanghyang dedari among the wali. https://ich.unesco.org/en/RL/three-genres-of-traditional-dance-in-bali-00617 . Kecak, the interlocking male chorus of "cak", grew from the chorus of sanghyang exorcistic trance and was staged as a Ramayana drama in the 1930s; Walter Spies and Wayan Limbak are usually credited, while I Wayan Dibia argues the Balinese were already developing it. https://en.wikipedia.org/wiki/Kecak . The same village art exists in two

7 / COSMOLOGY

categories: a temple rite and a tourist show. Kecak's interlocking parts are not sourced here; Dibia, Kecak: The Vocal Chant of Bali, 1996, is the source.

8 / FOR THE LAB

Ideas that use public, published material, each with what it would honestly claim.

Build.

- Ringing mode (4.1). Lanes or voices as bells; each step plays a row; methods by place notation (plain hunt, Plain Bob, Grandsire later); BOB and SINGLE as performer gestures at lead ends; a truth light that goes out when a row repeats. SQRL-1's eight lanes are Major; RUDE could play rows as stroke orders. Entirely public, and the mathematics is checkable (the script already is).
- Halving stages (4.4). A macro that steps a cycle 96, 48, 24, 12, 6 (or 56 to 7) with a tempo rule the player sets. Name it "after panchari", and say the tempi are ours: the sources give the cycle lengths, not the speeds.
- Jo-ha-kyū macro (5.1). One control that shapes a phrase's tempo in three or five nested parts. The curve is our design; the nesting is Zeami's.
- Komi and call (5.1, volume one 6.1). A silent pre-event of variable length, then a call, then the stroke. The gap is a performance parameter, not a grid value.
- Measured accelerando (3.1). A tempo-automation preset from Jankowsky's numbers (68 to 131 bpm, a dip, 395). A curve from a measurement, cited as such.
- One section may accelerate (3.2). A song-level rule: tempo change allowed only in a flagged section, after the Mevlevi ayin.
- Tempo bands (6.2). A tempo control that snaps to discrete bands rather than sweeping, the wangga observation that tempo is categorical. Uses the published finding, not the songs.
- Rhythmic modes (7.2). Six ternary feet as a generator; public since the 13th century.
- Three-gesture grammar (4.2). A horn model driven by long, broken and rapid-short gestures in fixed orders. Public and printed; build it as an envelope grammar, and do not market a synth preset as the liturgy.

An entrainment experiment we could run honestly. Within-subject, preregistered. Stimuli: one recorded frame drum at 2 Hz (where entrainment peaks), 4.24 Hz (Hove's rate) and 8 Hz (inside Neher's range), each isochronous and jittered (Hove's SD 6.7 ms against 16.5 ms), 8 min each, counterbalanced. Measure EEG phase locking at the stimulus rate (inter-trial coherence), theta power, and a standard altered-states questionnaire. Claim only what is measured: tracking, band power, self-report. Call it a listening study, not trance, since no rite, instruction or belief is present, and Rouget and Hove both say those are what matter. A consumer EEG headset limits it to frontal-temporal channels; say so.

Do not build. Each of these uses restricted material or turns a rite into a product.

- Orisha and orixá toques as presets (2.1, 2.2): the batá oru seco, Candomblé alujá or adarrum, labelled for the deity. Toque names address gods in living religions; "possession" presets are out.
- Gnawa colour suites (2.3) as presets or a "trance by colour" mode.
- Sámi drum figures (1.3) as interface art, or a "divination" randomiser in their image.
- Native American Church songs or water-drum patterns, powwow honour songs, Densmore recordings as samples (6.1).
- Yidaki or wangga samples, or any "Aboriginal" preset (6.2). The recordings belong to songmen's families; Yolŋu law governs who plays the yidaki.
- Tibetan ritual scores or a "skull drum" chöd voice (3.3). Tantric material, transmitted with initiation.
- Okina as a preset (5.1).
- "Shamanic theta trance" marketing for any drum mode. Section 1.1 shows the evidence does not support the claim.

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