

edo variations

book one

2021

book two

2022–2023

composed & mixed by Lucilla

book one

theme
12edo
13edo – lullaby
14edo – funeral march
15edo – blues
16edo – nocturne
17edo – medieval dance
18edo – passacaglia
19edo – gigue
20edo – siciliana
21edo – balkan dance
22edo – etude
23edo – gamelan fantasia
24edo – fugue

book two

theme
12edo
scherzo – 17edo
anime opening theme – 22edo
raindrop prelude – 15edo
march – 20edo
gymnopédie – 13edo
chaos prelude – 18edo
cinematic suite – 23edo
ballad – 16edo
gavotte – 21edo
lament – 14edo
lively dance – 19edo
medley – 24edo

liner notes

book two

the edo variations are based on a simple premise: one main theme, appearing in each of a number of short pieces, each in a different number of equally spaced notes per octave, other than the usual twelve.

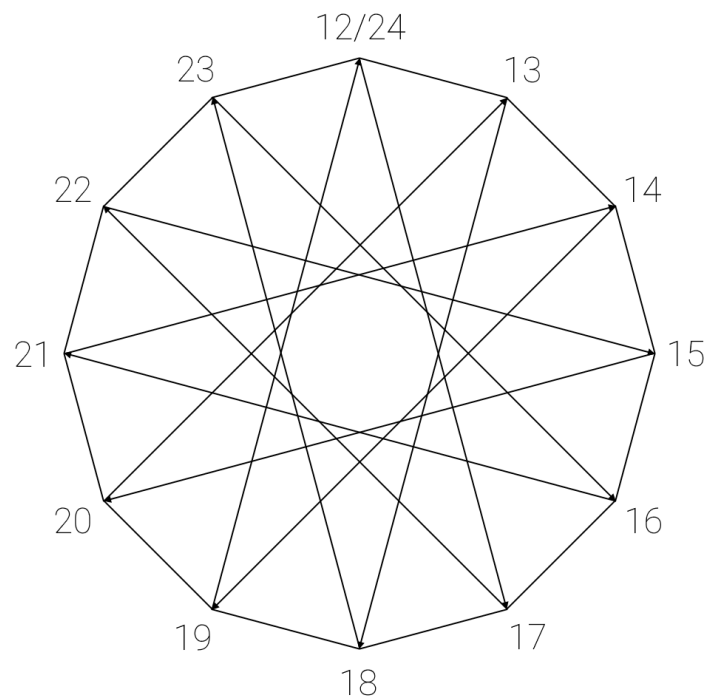
this idea first came to me in 2021, when i composed book one of the edo variations. a collection of pieces to the theme of twinkle twinkle little star, one each in all equal divisions of the octave from 12 to 24, with each piece having one more note per octave than the previous. i had set several goals for myself: each piece should be in a style that i feel matched its edo, it should not have a trivial translation into any other edo without losing some nuance, and it should use each of the edo's notes at least once.

over a year later, in late 2022, i decided to return to this idea and give it a new life with book two. this time, the main theme is l'homme armé, a medieval song notable for being remarkably popular as a theme for composers of that time to set their own works to.

many things stayed the same between the two books, including many of the same goals, and the same range of edos. generally, however, book two aims to be more developed than its predecessor, each piece being generally longer and with more distinct personality compared to the first book. additionally, the new variations need to match the feel of their edo in a style as distinct as possible from the corresponding variation in book one, and each piece must include all of its edo's notes in a non-trivial way.

perhaps the largest difference concerns the ordering of the pieces. in the first book, the edos from 12 to 24 occurred in ascending order. in contrast, book two uses an ordering where the number of notes from one edo to the next either increases by five or, if that were to put it outside the range, decreases by seven instead. this ordering is the only other possible cyclic ordering that contains all the edos in this range, analogical to using the circle of fifths rather than the chromatic circle to traverse all the ordinary twelve notes.

strengthening the parallel even further, it also has a more apparent harmonic significance: traversing this circle of edos has the effect of gradually sharpening the perfect fifth from 12edo, all the way until 18edo's extremely sharp fifth, switching there to its very flat fifth and continuing to sharpen it again, eventually returning to our starting point. thus, neighboring edos in the cycle are harmonically related, rather than melodically.



book two begins with a presentation of the main theme tuned to ji, much like book one. the tuning is a simple five-limit scale, with no notes differing by commas. the zeroth variation, in 12edo, immediately follows, and sets the mood of the collection without drawing too much attention to itself. it is the only one not categorized as belonging to a particular genre, being the shortest and most bland of all the pieces in the set.

after this twofold introduction, the journey begins proper.

17edo

VAR 1: SCHERZO

FIFTH: $4/7 < 10/17 < 3/5$

the microtonal cycle starts with 17edo this time around. with its slightly wide fifths, harshly sharp major intervals and flat minor ones, and thirds very distant from $5/4$ and $6/5$, this edo felt like a good match for something spicy and cunning – a scherzo.

most of the piece consists of a climb up the entire 17edo circle of fifths – a nod to blackwood's 17edo etude. but even after the theme's last note, it goes on, an entire coda with its own lyrical melody in a scale full of neutral notes, and a mysterious apex that so badly wishes it was an A, but it only manages to reach an A-half-flat instead. while every piece must contain all the edo's notes at least once, in this case, this A-half-flat is included exactly once.

22edo

VAR 2: ANIME OPENING THEME

FIFTH: $4/7 < 13/22 < 3/5$

22edo is very expressive, almost too much so. with all the possibilities it was hard for me to decide on just one style. but eventually, curiosity led me to try mimicking an anime theme song.

making the most out of 22edo's rich harmonies, i touch on as many of its aspects as i can incorporate: its beautiful untempered tuning of the 5-limit, its lush variety of flavors of thirds, its flourishing seventh chords. it wonderfully fits both major and minor alike.

finally, the last instance of the main theme is accompanied by gleaming 11-limit consonances from a descending porcupine scale, and the very final chords culminate with the lovely $11/8$. no better approach than to keep the best for last.

15edo

VAR 3: RAINDROP PRELUDE

FIFTH: $9/15 = 3/5$

with 15edo, we reach both a multiple of five and one of my favorite small edos overall. it seems 15edo has the perfect combination of familiar and unfamiliar elements – the sweet spot of distance from 12.

i took inspiration from chopin's raindrop prelude and wrote a variation in a similar style and structure, but adapted to the capabilities of 15. in stark contrast to the variation from the first book, which was a lively and aggressive twelve-bar blues, this one is a slow, calm trek through 15's harmonic soundscape.

chord progressions that instantly traverse the pentagon of fifths in one direction or another can be found throughout. the final section, which switches the time signature from 4/4 to 5/4, also includes passages in 15's wonderful decatonic scale, which has exactly one consonant triad on every note.

20edo

VAR 4: MARCH
FIFTH: $12/20 = 3/5$

20 is another multiple of five. although sharing many properties with the 15edo that precedes it, 20edo is certainly different in plenty of ways. like 17, it completely lacks 5-limit intervals, offering only supermajor, neutral, and subminor flavors instead – but it makes up in melody for what it lacks in harmony.

a minor key and upbeat rhythm were fitting for the harsh chord qualities, so writing 20edo's variation in the style of a march seemed appropriate. i filled the piece with plenty of things impossible in 12 – some shared with other multiples of 5, others not. the return from the key of g-half-sharp up to A is once again a climb up the decatonic scale, with alternating major and minor triads, with perhaps a little too much inspiration from sevish's enterprise.

13edo

VAR 5: GYMNOPÉDIE

FIFTH: $7/13 < 4/7 < 3/5 < 8/13$

as unlucky of a number 13 may be, 13edo is more usable than it might seem at first. even though it has no perfect fifth, there are still plenty of other consonant intervals – with 4:5:9 being a simple good-sounding triad. the melodic proximity to 12edo helps, but doesn't power miracles, as even the familiar diatonic and whole-tone scales are both warped into something in between the two.

modeling this variation after erik satie's gymnopédies helped to weaken some of the harmonic awkwardness, and worked well with the main theme. the ending unexpectedly moving to E-flat serves as a smooth transition to the next variation, 18edo.

18edo

VAR 6: CHAOS PRELUDE

FIFTH: $10/18 < 4/7 < 3/5 < 11/18$

this might very well be the most unlucky small edo out there. 18edo is a parade of dissonances, only retaining a spark of familiarity due to its large overlap with 12, though this overlap only encompasses atonal, periodic scales. nevertheless, it's possible to make music with 18 notes – even if harsh.

similar to 15edo, 18edo also has had its variation modeled after an existing piece. in this case, it was the third of wyschnegradsky's 24edo preludes – the bittersweet way it handles faux fifths and fourths worked extremely well for 18edo's lack of a perfect fifth. many elements of the structure were retained from the original, although with novel chords and melodies. for the middle section, i additionally have messiaen's vingt regards to thank.

23 edo

VAR 7: CINEMATIC SUITE

FIFTH: 13/23 < 4/7 < 3/5 < 14/23

this variation is without a doubt one of the highlights of the cycle, and not without justification. 23 is probably the most unique small edo. it fails to approximate any of 3, 5, 7, or 11 well, although it does approximate their sums and differences remarkably. moreover, its primality means it contains no sub-edos within itself.

however, 23 is by no means a lost cause: quite the opposite, actually. 23 is the indigo child of edos, a nearly endless mine of microtonal beauty. to me, 23 is like a portal to a parallel universe, one where music is not based on ji but still works beautifully somehow. 23 is certainly far more difficult to tame than many other simpler edos, but putting in the effort lets me create music that can make me see stars and rainbows.

i concluded that a piece in one style just cannot possibly be enough to contain what 23 can offer, so i instead wrote a suite of four short movements. they have no clearly identifiable genre, but the entirety is reminiscent of a soundtrack to a short film, hence the name "cinematic suite."

the first part, "exposition," starts by gently establishing harmonies in this parallel universe, and introducing a leitmotif, before slowly vanishing after a mavila comma pump. it alone already contains all the 23 notes. the second part, "mouvement," depicts a more energetic scene, and begins exposing the wealth of mos scales. it also contains all the 23 notes once again.

we then arrive at "finale," which could perhaps play as the credits roll. the majority of this movement is in a 9-note mos scale, but there are also brief mentions of some pentatonic mos scales, including pelog – an homage to the first book. finally, out of nowhere, a theme from earlier in the cycle reappears, and makes the suite take a turn to an unexpected ending. "finale" does not contain all 23 notes a third time, but only two are missing – E-sharp and A-flat – both of which are included in the last part, "coda." a furious sequence of back-and-forth oscillation in a beautiful 8-note mos scale, with wonderfully bittersweet chords.

16edo

VAR 8: BALLAD
FIFTH: $9/16 < 4/7 < 3/5 < 10/16$

to contrast with the musical turmoil of the preceding variation, 16edo calms down and takes a simpler approach. in stark opposition to the neo-romantic, slightly atonal nocturne in the first book, this time 16 notes are the setting to a parody of a piano arrangement of a pop song.

in accordance with its genre, nearly the entire piece is in a 6-note mos scale, with an occasional seventh note sprinkled on top. it also almost constantly cycles through a four-chord loop. a short bridge contains all the remaining 9 notes.

21edo

VAR 9: GAVOTTE
FIFTH: $12/21 = 4/7$

with 21edo, we surface back out of the harmonic underworld, as acceptable perfect fifths become available again. 21 even supports full 5-limit harmony, although in a very warped way. for this reason i decided to mimic classical music and set the main theme to a gavotte. notable moments are unbroken cycles of seven fifths, as well as a fifth created from a stack of harmonic sevenths.

14edo

VAR 10: LAMENT
FIFTH: $8/14 = 4/7$

14 is in a few ways to 21 as 20 is to 15. it is also a multiple of seven, but a much harsher one, dominated by thirds and sixths pretending to be major and minor, but actually slicing intervals in half. a bitter piece seemed to be the only thing that would fit such a bitter tuning. the cycle of seven fifths makes another appearance here as well.

19edo

VAR 11: LIVELY DANCE

FIFTH: $4/7 < 11/19 < 3/5$

the cycle is nearly complete. we have arrived at an edo very close to home. 19 is the next smallest meantone tuning after 12, making it share almost all harmonic properties characteristic of most music surrounding us.

nevertheless, 19 is full of its own unique traits that set it apart, and make it anything but boring. being a prime edo, every interval can form a full circle, in stark contrast to the highly composite 12. it can also build a perfect twelfth from stacking major thirds, and split a perfect fourth into two equal halves. to me, 19 has a well-behaved familiar side and a mysterious dark side, and this variation aims to explore both.

at first, the music unfolds into an innocent sounding folk dance in the lydian mode on A. the dance is structured like a song, with a recurring “chorus” separated by “verses,” briefly modulating to related keys: F-sharp minor and E. the second one features the middle section of the main theme, briefly playfully swapping out the major intervals of lydian for supermajor ones, before finally introducing the main theme proper: uniquely out of order.

the dance goes on, continuing down a path along the 19edo circle of fifths. just as the first variation, in 17edo, climbed up the entire circle, so does this one, near the end of the cycle, climb down. the harmonic landscape is much wilder and more chaotic on the other side of this rainbow, featuring many of 19edo’s darker properties. the apex involves one straight from blackwood’s works: the ability to stack four minor seconds to reach a perfect fourth.

but even after reaching the end, it isn’t over yet. the entire dance has another perspective to show – its mirror image. the result of a miraculous discovery, that a piece composed in one direction ended up sounding even more amazing when played in reverse. it feels like more than just rewinding – looking in the mirror reveals hidden messages of beauty that were not there before, even a new face of the dance’s main motif.

24edo

VAR 12: MEDLEY

FIFTH: $4/7 < 14/24 < 3/5$

having traveled all the way around the globe of edos, we finally arrive back where we started – except everything has changed while we were away. the familiar size of perfect fifth is still there, but the number of notes has doubled, and with it, the number of possibilities. we are in 24edo, quarter tones, twice twelve.

being just a doubling of the standard notes, 24 is mostly familiar: half of all the notes are already well known, while the other half can easily be conceptualized. as a result, it tends to be dismissed as uninteresting. but even the tuning of the finale of this set of variations has plenty to explore.

similar to 23, this final piece, meant to encompass a little bit of everything we've seen on our journey so far, is divided into four parts. the first part, "prologue," is set in a distinctly 24-ish scale: a mode of the Greek enharmonic genus. it presents the main theme, with its notes shifted to match the mode.

the second part is the titular "medley." similar to the ending of a musical, it is made up of small pieces of all the variations that came before it, except that all are now quantized to the quarter-tone grid. it feels a lot like rewinding the cassette tape: we are tracing our steps backwards through the cycle, seeing chaos everywhere. former comma pumps no longer working, regular scales becoming irregular. much like in 23, the medley contains all 24 notes on its own.

"epilogue," the third part, follows. after briefly reintroducing the enharmonic genus, it continues restating the main theme: first in a 9-note mos generated by half-fourths, then in a 7-note mos of neutral thirds, all the while building more and more tension. finally, a staircase of intervals takes us all the way back to the contrapuntal segment of 12edo, played backwards. after filling in the last missing notes of another set of 24, it explodes in a great collapse.

the world is desolate and lifeless after the cataclysm... but among all the silence, one faint ji melody survives. "cadence." the very same melody we met near the beginning, which by then was too short to reach its peak, has finally found itself. we have reached the end. there is no more to hear. redemption.

liner notes

book one

the original edo variations, retroactively renamed to “book one,” were composed in a much more light-hearted tone than book two. the very idea was initially a joke, and the music itself was filled with comical moments – with even the original title being a joke. additionally, at around half the total length, it is undoubtedly dwarfed by book two not only in style, but also in size.

nevertheless, even if it no longer stands up to standards, it bears significance as the ultimate origin of its sequel, and a milestone that led me somewhere. below, then, are excerpts of the original notes to book one.

much like in the sequel, in book one i set out to match the equal divisions of the octave from 12 to 24 with short pieces, to the theme of twinkle twinkle little star. each piece was to fit its edo uniquely, and contain all of its edo’s notes at least once. unlike in book two, however, the order in book one was simply ascending in the number of notes.

13edo: *traditional harmony doesn’t really work in this edo, but a basic consonance to get us started is 4:5:9(:11). in accordance with these properties, i decided to style the 13edo variation as a lullaby. the slow tempo and soft notes put emphasis on the harmonies that are available, and distract from the sometimes awkward melodic leaps in the theme.*

14edo: *due to the bitter sound of the subminor intervals, and the spicyness of the supermajor ones and the tritone, i went with a funeral march aesthetic. the bass oscillates between a perfect fifth and subminor sixth, while the melody imitates a music box timbre with its grace notes.*

15edo: *for this edo, i wrote a twelve-bar blues. the blue notes lend themselves extremely well to the 240 cent “major seconds”, especially on notes like g and c. aside from that, the energetic and lively feeling of blues itself superbly reflects my opinions on 15edo.*

16edo: *i decided to [...] write this variation in the style of a john field nocturne. this let me make extensive use of the diminished seventh chords, as well as patch up holes in the melody with some graceful chromatic runs of fast notes, which eventually led to an entire section consisting entirely of chromatic runs unrelated to the melody. [...] my favorite part is in the reprise section, when an F-sharp in the original melody is expanded into a diminished seventh arpeggio and then resolves with a very graceful step to E. that 75 cent step is just spot on.*

17edo: *because of [the lack of 5/4], combined with the good 3/2 and the fact that its perfect fifths are sharper than just, creating narrower leading tones, it's only natural to put this variation in a (neo-)medieval style. but rather than stop there, i wanted to make it a little more interesting and actually split up the two different obvious ways in which 17edo can be used: the introduction and reprise sections are in a neo-medieval style, while the middle and ending sections, which modulate to the dominant key, are instead in a scale full of neutral intervals, and contain softer fleeting notes instead of the hard and stoic notes seen elsewhere.*

18edo: *9/8 and 7/6 plus a sharp leading tone made me mentally fill in the blanks to make the harmonic minor scale; using triple time let me divide the familiar 3\18 chromatically into two or three parts; and the theme just so happened to align perfectly with a repeating descending bass as long as it modulates at the right moments. verdict: passacaglia. [...] it wasn't easy, but eventually, i did it. i made something somewhat musical using probably the edo equivalent of locrian.*

19edo: *to contrast the bitter and dissonant 18edo passacaglia that immediately precedes, i judged a fast-paced dance to be most appropriate here, so i went with a gigue with a classic aabb structure. [...] the b section includes some usage of half-fourths as a melodic interval as well as a particularly alien, but very plausible, modulation from E to D-flat. overall, this variation is a good refresher after 18edo and an energetic start to the second half of the work.*

20edo: *for this variation i picked a siciliana form. this is also the variation where i most shamelessly ripped off easley blackwood. part of the main theme of the 20edo microtonal etude can be heard in the reprise section, while the ostinato-like pattern in the left hand, alternating between a minor triad and the "5edo chord", is taken from the 15edo guitar suite. the ending features an andalusian cadence, but with a twist, containing neutral triads instead of major ones on the seventh and sixth degrees.*

21edo: *unconventional time signatures have entered the game along with 21edo, whose variation is in 7/8 and mimics a balkan dance. [...] the ending section of this variation is completely disconnected from the rest: it appears after a pause, is in a slower tempo, quieter, in a higher register, and doesn't even contain the theme or any of the other characteristics. instead, it's a pastiche of the common, and very cliché, circle progression.*

22edo: *in stark contrast to the 7/8 madness that preceded it, 22edo's variation is rhythmically and structurally very simple, and its time signature is no other than the ordinary 4/4 (which had actually last been heard in the 15edo variation, and even then it was combined with swing). it's in the style of an etude, and most of its complexity comes from crazy altered chords that could perhaps best be described as "hyper jazz".*

23edo: *23edo's variation is almost certainly the one that required the most work, but which also provided the most satisfaction once complete. it's extremely musical and beautiful in a way that seems to just cross out ji entirely and write its own thing over it. it's not like 18, where all the notes just sounded harsh and i had to settle for a moderately musical compromise. 23 truly opens a gateway to completely new ways of making music that sound genuinely good. [...] 23edo's variation easily has the most variety, maybe even too much for some tastes, especially when paired with an edo as alien as 23. but i think this much variety is more than justified, considering how powerful and expressive 23 is.*

24edo: *what better way to round off this series than with a fugue in four voices on the main theme? as the individual voices enter, at first glance the fugue sounds like 12edo. but the moment the final fourth voice starts playing the theme, all four voices modulate at once to the other set of 12edo. for a while, the fugue just keeps switching between two exclusive sets of 12 that are both contained in 24, and it's not until much later, after several repetitions of the main theme in its principal form, inversion, stacked on itself and in countless other ways, the two sets of 12 begin mixing with each other: first, by gliding across a semitone; then, as a passing tone that arches back to its starting note; finally by dividing the perfect fourth and by resolving the tritone into a perfect fifth. the coda also moves the final minor subdominant down an additional quarter tone to resolve it even more smoothly.*

appendix

NOTATION & TUNING

both books are notated using kite giedraitis's ups and downs notation for edos, using the "melodic" variant. the essential idea is notating the fifth chain FCGDAEB by using the edo's nearest $3/2$ as the notational fifth, with sharps and flats extending the chain. meanwhile, ups and downs always represent one edo step. since the details are more complicated, however, below is a table outlining the meaning of the notation for every edo that appears in the books.

edo	scheme	fifth size	sharp size	enharmonics
12	diatonic	7	+1	d2
13	subset of 26 (diatonic)	7.5	+0.5	d ³ 2
14	multiple of 7	8	0	A1, v ² M2
15	multiple of 5	9	+3	m2, v ³ M2
16	antidiatonic	9	+1	d ² 2
17	diatonic	10	+2	d ² 3
18	subset of 36 (diatonic)	10.5	+1.5	d2, v ³ m2
19	diatonic	11	+1	d ² 2
20	multiple of 5	12	+4	m2, v ⁴ M2
21	multiple of 7	12	0	A1, v ³ M2
22	diatonic	13	+3	vm2, v ³ A1
23	antidiatonic	13	+1	d ³ 2
24	diatonic	14	+2	d2

three sections throughout the books are tuned to ji. the tunings are as follows:

book one, theme: 1:1, 9:8, 5:4, 4:3, 3:2, 5:3, 15:8

book two, theme: 1:1, 9:8, 6:5, 5:4, 4:3, 45:32, 3:2, 8:5, 27:16, 9:5, 15:8

book two, cadence: 1:1, 9:8, 5:4, 4:3, 3:2, 14:9, 5:3, 16:9, 15:8

book two, 24 used the following sound effects:

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