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TEN-THOUSAND VIEWS OF MOUNT TORO

A dissertation submitted in partial satisfaction
of the requirements for the degree of

DOCTOR OF MUSICAL ARTS

In

MUSIC COMPOSITION

By

Jonathan B. Myers

June 2022

The Dissertation of Jonathan B. Myers is
approved:

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Vice Provost and Dean of Graduate Studies

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Dissertation Abstract

Ten-Thousand Views of Mount Toro

By Jonathan B. Myers

This essay presents a discussion of *Ten-Thousand Views of Mount Toro*, a procedurally generated set of variations of an artificial idiom featuring a trio of synthetic instrumental "performers." Harmonically, this composition draws upon the *harmonic space* lattice representation of intervallic relationships in order to explore cyclic sequences of just intoned pitch sets, or modes. Temporally, at the macro level, the piece follows a finely calibrated, gradually expanding tempo curve; at the micro level, the rhythms are non-metric, instead relying upon various stochastic procedures and hierarchically coordinated organizational systems. The "instruments"—both in their synthesis and morphological logics—are designed so as to heighten a tension between certain familiar attributes of acoustic instrumental performance practice and the artificiality inherent to any such synthesized forms. In its presentation, this piece is ephemeral in two senses: each instance is only available to be heard one time, and once all instances have been heard, the piece will cease to exist as a corporeal, audible presence in the world.

As a way of contextualizing the particular idiosyncrasies of this composition, I propose a model of the current dominant paradigm of musical experience as bounded by certain historically contingent limitations inherent to ensemble instrumental performance practice, limitations which themselves have been reinforced by the technological and cultural attributes of the twentieth century recording industry. There are thus five common features of typical "musical artifacts" that circulate amongst human beings: each such artifact emanates music that is 1)

bounded by a fixed, immutable set of pitches; 2) aligned with an underlying periodic

pulse structure; 3) is in all instances a verbatim repetition of itself; 4) has an

unending lifespan; and 5) plays a role in a monetary transaction, and is thus "valued"

accordingly. *Ten-Thousand Views of Mount Toro* runs counter to these five

boundaries, serving as an example of an alternative model of musical experience

more befitting the political, social, and technological opportunities of the third

millennia.

Acknowledgements

I would like to thank my committee members for the contributions they have made both toward my development as a composer and researcher in general as well as toward this project in particular: I am grateful to Larry Polansky and David Dunn for mentoring me during the first half of my time in Santa Cruz and for allowing me to steal so many of their fecund ideas; to Michelle Lou whose practical insights, unvarnished opinions, and multi-faceted compositional example have been important to me throughout the dissertation process; and to Dard Neuman for keeping the candle of music burning throughout the darkest times of the pandemic and for placing trust in me as a researcher and collaborator. I would also like to acknowledge the important influence that Professor Amy Beal has had on my historical sensibility and performance practice, especially during the first portion of my time in Santa Cruz.

I owe a great debt to the staff of the Music Department at UC Santa Cruz who have made my work immeasurably easier throughout rather trying times, especially Scott Makson, Alice Gallup, and Susan Guatieri.

Thanks also to the peers I was lucky to know during my time at UC Santa Cruz who helped me in countless ways large and small: Jay Arms, Brian Baumbusch, Lisa Beebe, Marguerite Brown, Sam Cushman, Kira Dralle, Ed Garcia, Zach Hejny, Lucas Helland, Madison Heying, Nelsen Hutchison, David Kant, Melodie Michel, Pablo Rubio-Vargas, Assaf Shatil, Andrew Smith, Greg Sullo, Brock Stuessi, and Mustafa Walker.

Discussion

If you wish to play, then you must first

> seek out a quiet chamber,
> A studio with a distant view,
> Or upper room;
> Or some secluded nook
> 'mong rocks and trees,
> or craggy mountain-top
> By water's edge …

Let the weather be clear and calm, a gentle breeze, a moonlit night. Light some incense, and sit in silent meditation. Empty the mind of outward thoughts. Poise Breath and Blood in Perfect Harmony. Your Soul may now commune with the Divine, and enter into that mysterious Union with the Way.

'As the ancients said, true music-lovers have always been few. If there is no one able to share your music's true delight, then sit alone, and

> Serenade the breeze and moonlight,
> Hymn the ancient pines
> And weather-worn rocks;
> Let wild monkeys and venerable cranes
> Hear your song[1]

The spheric experience is a high-frequency, omnidirectional complex of events and their relatedness. Since it is concerned with the most economical relatedness, we can also speak of it as a geodesic spherical experience. This is where the importance of chords comes in. A chord is abstract, yet tensive. A chord has pull: we would probably not think about the connections unless there was some pull between them. The function of the chords is to relate. The event is the *vertex*. The reaction is the *chord*, the pulling away. And the resultant is the inadvertent definition of the nothingness of the *areal and volumetric spaces*. The sequence is: Events; chords; no-events. No-events=novents. Areas do not create themselves; as with celestial constellations, they are incidental to the lines between the events. The faces are the bounding of nothingness. Areas and volumes are incidental resultants to finding the connections between events of experience.[2]

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[1] Cao Xueqin and Gao E, *The Story of the Stone, Volume IV: 'The Debt of Tears'*, tr. John Minford (London: Penguin Books, 1982), 154.
[2] R. Buckminster Fuller and E.J. Applewhite, *Synergetics: Explorations in the Geometry of Thinking* (New York: Macmillan, 1975), 656.

Creation of a *thing*, and creation plus full understanding of a *correct idea* of the thing, *are very often parts of one and the same indivisible process* and cannot be separated without bringing the process to a stop. The process itself is not guided by a well-defined programme, and cannot be guided by such a programme, for it contains the conditions for the realization of all possible programmes. It is guided rather by a vague urge, by a 'passion'…. The passion gives rise to specific behaviour which in turn creates the circumstances and the ideas necessary for analysing and explaining the process, for making it 'rational'.[3]

Throughout the majority of the years 2020 and 2021, I found myself in possession of a rare luxury: a place to go outside of my home. On most days of this long, quiet abyss, I made my way up the hill to the Digital Arts Research Center (DARC) on the campus of the University of California at Santa Cruz, wherein I was permitted the use of a small windowless third-story office within which to pursue my "research." While the nature of my work over these many months vacillated between a series of topics and methodologies before settling finally into the project outlined in this text, a stable pattern could be observed in my once or twice daily ruminous walks about the empty campus.

From a perch at the top of the fire escape by which I made my usual exit from the DARC, to take one of these walks, facing south by south-west, one is confronted with a particular vista. Directly beyond the music center, which sits at the bottom of this vista's reference frame, lies the Great Meadow, a large tumbling Steinbeckian expanse of grass and chaparral—filling out a gradient from green to gold, depending on the current severity of drought—that descends down toward the town of Santa Cruz, enclosed on either side by forested stands of Redwood and Douglas Fir. From this angle, the town is largely obscured, excepting the rooftops of coastal estates and

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[3] Paul Feyerabend, *Against Method*, third edition (London: Verso, 1993), 17.

landmarks along the coast: the boardwalk, wharf, lighthouses and harbor. Beyond the shore, on a clear day, one can see the full expanse of the Monterey Bay, glistening down below, thirty-five miles straight across to the towns of Monterey, Seaside, and Pacific Grove, the lights of which are visible at night.

In the rainy season, when the sky is thick with clouds, or in 'June gloom', when marine fog creeps ashore, the bay appears to taper off into nothingness, if it can even be seen at all. But on a clear day, the Santa Lucia mountain range rises up out of the horizon beyond and above the bay. From this vantage point, Mount Toro appears to be the second highest point along the ridgeline, a rounded peak whose shape, like a constellation, takes on the form of its namesake. Depending on the humidity, the transition from bay to mountain reflects a wide gamut of color shades and degrees of differentiability: at times, one might observe a hard cut from icy-blue to vernal greens, or a clean gradation from azure to violet, or a foggy haze where bay and mountain seem to fuse, as if colluding in some mysterious optical ploy. Above the ridgeline, the sky opens up, painted with a never-ending carousel of forms: cloud, moon, sun, and glorious blue backdrop.[4]

From such a viewing platform, the geographic area one looks upon is always the same. But when seen over the course of days, weeks, months, and years, such a vista is revealed to be an elastic, ever-morphing, non-repetitive play of temporal color-forms, highly dependent on time-of-day, seasonality, and weather. Amidst all of these shifting colors and gestalts, the shape of the ridgeline, with Mount Toro at its center, is an immutable fact, cutting the reference frame roughly in half, unyielding in its formal consistency over time.

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[4] Or sickly deathknell orange backdrop, as on the 9th day of September, 2020.

Each viewing is its own unique temporal experience in which the observer's eye saccades about the reference frame, taking in all of its particularities, measuring out each element against all others, and forming a particular image-sensation. This is an ephemeral experience, not to be repeated, except in memory. But each viewing is also part of a much larger temporal form, the combined matrix of all past viewings. The comprehension of this larger temporal form is deepened with each subsequent viewing and vice versa: subsequent viewings are made more meaningful when measured against remembrances of past viewings. The Santa Lucia ridgeline serves a stabilizing function that binds together this many-instanced temporal experience, and it is through this stability that the depth of experience afforded by subsequent viewings is made possible.

Ten-Thousand Views of Mount Toro is a composition consisting of ten-thousand unique instances of an artificial musical idiom featuring a trio of synthetic instrumental "performers." Each instance of the piece is ephemeral, intended only to be heard one time. As such, it can only be accessed at a particular website, https://tenthousandviews.com, wherein all instances are presented in order. Each time someone visits the site and begins listening to a variation, a process is set in motion in which a later variation is generated, and the current variation is destroyed. Any subsequent visitor to the site is presented with the next variation in the queue. As of this writing, on March 13, 2022, the first ninety-five variations have already been "performed," and the website will continue to operate until the remaining nine-thousand nine-hundred and five variations have been played, at

which time this volume will serve as the composition's sole form of documentation. A short text is available on the website that serves as a "program note":

> A warning, please take note, ye scoundrels! This website is a portal to an ephemeral temporal form, a 'musical composition' written as a trick, perhaps, by some fetid imp, with a limited number of unique 'views' -- a mere 10,000 instances, each an expression of the artificial idiom formally 'notated' in the code that serves as its 'score'.
>
> Each 'vista' is unique, each blessed to exist for just one auspicious encounter with a lucky soul -- a friendly listener, I pray! Once heard, each is destroyed, never to be heard again. So if you are inclined to listen, listen well. Be advised that each 'viewing' lasts somewhere between one and two thirds of an hour. Best not to know for sure, lest ye grind your teeth staring off at the clock waiting for an 'ending'.
>
> I must also warn you, poor devils, that the harmonic activity herein contained is of a strong pungency not usually on offer in such an overflowing grandiosity! Microtonal, yes, and free-floating from pitch-shape to pitch-shape in harmonic space. One might even accuse this activity of being 'out of tune', hah hah hah! (As if wine were grapes gone rotten!) Better to say that the pitch collections create sensations which a person can perceive as unique and learn to associate with other such sensations, building up an associative network of harmonic experience much more finely grained and diverse than the networks generated from exposure to the fixed-pitch systems of the so-called 'instrumental age' ...
>
> But I've said too much already, and music does have a way of speaking for itself, after all, oblivious of all this prattle.
>
> Jon Myers
> Santa Cruz, CA, Dec. '21

In lieu of a "notated score," the scope of the compositional work involved in carrying this piece through to its final web-based presentational form spans a series of stages of algorithmically specified instructions expressed in a number of different programming languages that run partly on a cloud-based Linux server, and partly in a listener's web browser. The bulk of the code, written in Python, generates the specifications for musical events in a particular variation according to a complex interconnected network of rule-based systems, stochastic generators, statistical feedback mechanisms and sundry other formally encapsulated ideas, arranged in

such a manner so as to systematically articulate certain music-theoretical and aesthetic speculative propositions. These specifications describe all of a particular variation's musical events: starting times, amplitude envelopes, durations, frequencies, pan positions, timbral attributes, etc. Once they are generated, these event specifications are interpreted by a non-realtime SuperCollider patch in which I have designated the sonic characteristics of each artificial instrument via physical modeling and modular-synthesis-esque digital signal processing techniques. This patch synthesizes and saves all of the events in a variation as a 48 khz, 16 bit .wav audio file. The web app through which the piece is accessed and that serves these audio files to end users and sets in motion the generation of subsequent variations is written in JavaScript, HTML, and CSS code.

The musical idiom specified in these code-bases is intended to serve as a perceptual stepping-stone away from what I would suggest is the current dominant cultural paradigm of musical experience—a self-reinforcing network of ideas, practices, and technologies that is bounded by certain 1) music-theoretical systems, 2) graphical and metaphorical language representations, 3) culturally induced perceptual habits, 4) corpora of fixed-media audio recordings, media that contain these audio recordings, and notated scores, 5) embodied rituals and performance practices, 6) inherited musical instrumentation, 7) hardware and software, 8) and a systemic profit motive and market-orientation that guides the development and spread of each of these elements via various institutions, organizations, and corporations. By taking advantage of (relatively) recent technological and theoretical innovations, I have attempted, in this piece, to create a corpora of music whose

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organizing principles, method of distribution, and auratic identity run counter to some of the boundaries of this dominant paradigm.

This project is not meant strictly as a *critique* of the current dominant paradigm so much as a way of demonstrating its boundaries, and providing a counterexample, for this paradigm is so uniformly entrenched throughout the twenty-first century music-culture that in the eyes of many musical experts and connoisseurs—and indeed, the "public"—its boundaries may appear to encompass the entirety of the musical experiential universe. How better to dislodge such a cognitive limitation than by way of an example, (or in this case, an avalanche of examples)?

The dominant paradigm can be understood as, essentially, an outgrowth of the exigencies of traditional acoustic instrumental musical practice. Even though electronic musical instrumentation and recording technologies have existed for more than a century, the dominant musical artifacts that these technologies have enabled (and that manage to permeate into the cultural marketplace) continue to exist within the same paradigmatic limitations inherent to instrumental music.[5] The boundary

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[5] If one sought to invent a parable that would elucidate how it is that groundbreaking technologies with the potential to disrupt a dominant paradigm, when introduced into a marketplace, are quickly subsumed within the boundaries of that very same paradigm, one would fail to come up with a tale as apt as the release of what remains the highest-selling "classical music" recording of all time: Wendy Carlos' *Switched on Bach*. This one simple musical gesture, of interpreting and recording a set of Baroque era musical scores (from the corpus of J. S. Bach), on a Moog synthesizer that incorporated an interface modeled on a Baroque instrumental technical innovation (the twelve-note keyboard layout), has had the effect of forever linking the keyboard—and its concomitant twelve-tone equal-tempered scale—to the concept of the synthesizer in the popular imagination. Wendy Carlos, *Switched on Bach*, recorded 1967, East Side Digital 81602, 2001, CD.

Don Buchla, synthesizer pioneer, elaborates on this issue of the keyboard-centric nature of the culturally-constructed conception of the synthesizer, and of "electronic music" generally: "No, I think you have to go a little further back and say what does electronic music mean? The term bothers me a little bit, even now. To me it meant simply the source of sound was electronic rather than vibrating strings, membranes, and columns of wind. And to me, that meant it was a potentially new source, and therefore instruments based on it would probably

lines of ensemble instrumental musical experience that I am suggesting have been rendered non-boundaries by technological innovation, are 1) a fixed, immutable gamut of pitches, and 2) an underlying periodic temporal grid by which events are synchronized or coordinated. In different ways, these two factors each limit the scope of our perceptual experiential sphere.

Music that uses the twelve-tone equal tempered scale (12-EDO)—or, for that matter, *any* fixed-pitch tuning system, whether it be the various keyboard temperaments of Andreas Werkmeister,[6] the "monophonic fabric" of Harry Partch,[7] the "*Well-Tuned Piano"* scale of La Monte Young,[8] the Huygens-Fokker 31-EDO scale,[9] or any of the 4800 other "known" tuning systems listed in the international Scala database[10] of scales/tuning systems—is inherently limited both in terms of the possible instantaneous pitch collections, i.e. "chords," as well as the harmonic motion between these collections, i.e. "modulation." In the mid twentieth century, the composer Lou Harrison envisioned such a music, in which notes were not bounded

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be new and different. I saw no reason to borrow from a keyboard which is a device invented to throw hammers at strings, later on operating switches for electronic organs, and so on. But I didn't particularly want to borrow the keyboard to control. . . . I tried once to put a keyboard on my system … and I found myself overwhelmed by the psychological aspect of looking at this very familiar twelve tone structure, and wanting to do music that was very much against what I was conditioned to do. . . . The tying of the keyboard, the wedding of the keyboard, with the synthesizer was a disaster for a creative composer who doesn't want to do twelve-tone melodic, and doesn't want to imitate violins and saxophones and so on and so forth, who wants new kinds of dynamics, and networks attached to his sound." Quoted in Trevor Pinch and Franc Trocco, "The Social Construction of the Early Electronic Music Synthesizer," *Icon*, vol. 4 (1998): 18.

[6] Andreas Werckmeister, *Musicalische Temperatur*, tr. Rudolf Rasch (Utrecht: The Diapason Press, 1983).

[7] Harry Partch, *Genesis of a Music; an Account of a Creative Work, its Roots and Its Fulfillments*, Second edition, enlarged (New York: Da Capo Press, 1974):

[8] Kyle Gann, "La Monte Young's *The Well-Tuned Piano*," *Perspectives of New Music* 31, no. 1 (1993): 134-162.

[9] Adriaan Fokker, "Equal Temperament and the Thirty-One-Keyed Organ," *The Scientific Monthly* 81, no. 4 (1955): 161-166.

[10] See www.huygens-fokker.org/docs/scalesdir.txt for a summary list of the over 4,800 "known" scales.

by any fixed pitch-set, in a series of "Free Style" pieces for acoustic instruments:

Simfony in Free Style (1955), *At the Tomb of Charles Ives* (1963), and *Arion's Leap*

(1974). These pieces are notated in traditional staff notation with the inclusion of

ratios in between successive pitches, requiring performers to tune on-the-fly from

note to note as they work their way through the piece: a level of performance

virtuosity that is heroic, to say the least. Harrison matter-of-factly explains the

possibility of this kind of tuning format thusly:

> After only a brief study of intervals it becomes clear that there are two ways of composing with them: (1) arranging them into a fixed mode, or gamut, and then composing within that structure. This is Strict Style, and is the vastly predominant world method. However, another way is possible—(2) to freely assemble, or compose with whatever intervals one feels that he needs as he goes along. This is Free Style, and I used this method first in my *Simfony in Free Style*.[11]

This format of music, presumably, is quite difficult (if not impossible) to

perform accurately in a purely acoustic setting, especially for long-duration pieces

containing many chains of such modulations. Since the time of Harrison's

composition of these "Free Style" pieces, the ability to create and sonically realize

music with such flexible modulation between all-manner of rationally describable

tunings with perfect accuracy has been made possible via computer music synthesis.

In a 1987 article, Larry Polansky discussed some possible avenues of exploration for

these kinds of "dynamic tunings," noting that the new possibilities opened up by

technological advances had the potential to cast certain contemporary tuning

practices in a "historical" light:

> It is now practical, however, to use each tuning class—dynamic, static, or paratactic—when and if we want, for reasons more musically interesting, and more directly involved with compositional and musical intent than the primarily mechanical and practical reasons of the past. For example, the reasons for the genesis of twelve-tone equal temperament may no longer be

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[11] Lou Harrison, *Music Primer* (New York: Edition Peters, 1971): 6-7.

relevant—making that system more useful for consideration as an experimental and/or historical tuning, like Just intonations.[12]

Thirty-five years on, the situation regarding the dominance of fixed-pitch tuning systems in the dominant cultural paradigm remains largely unchanged, and not for a lack of technical possibility.

The second boundary limitation—the presence of a fixed underlying temporal grid—is a limitation that certainly does not cover all extant performance practice, as there are many kinds of acoustic music (including much that is improvised) that include "free time" rhythmic activity. And yet I think it is safe to say that musics that obey some kind of meter or pulse-structure make up the majority of extant repeatable, transmittable music. That is, compositions that are shared amongst practitioners, both that are conveyed orally and by way of some technology such as notation, by the very nature of these methods of transmission, require a pulse or metric structure: in notation, in order for sequences to be realized consistently, rhythms must be coded for in some way that breaks them down according to some human-interpretable 'atomic' unit; in oral traditions, pulse-structures enable practitioners to easily memorize compositions.

For listening to music, however, pulse-structures are by no means a necessity. Musics that have a pulse-structure, especially those in which there is no ambiguity as to where the dominant pulse is or, in the case of metered music, where the "down beat" is, enforce upon the listener a framing structure that limits the listener's freedom to engage with music according to their own personal internal temporal framing schemes. This situation is analogous to being shackled to a post

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[12] Larry Polansky, "Paratactical Tuning: An Agenda for the Use of Computers in Experimental Intonation," *Computer Music Journal* 11, no. 1 (1987): 66.

while viewing a sculpture, forced into a single two-dimensional observational frame, rather than being free to walk around and observe it from all manner of different angles, forming a three-dimensional sensation.

I am aware, of course, of many counterexamples to both of these acoustic instrumental paradigmatic limitations, but I would argue that these boundaries, while not drawing a circle around all extant musical practice, do in fact undergird the episteme in which music is cognized, discussed, and enacted. Further, in identifying this dominant paradigm, and brandishing my composition in contrast to it, I am engaging in a rhetorical strategy the goal of which is to establish a conceptual frame through which a *variety* of different musics may be articulated, this piece being just one possible example. The process by which I arrived at this piece—and that I am only now "justifying," after the fact—is a process not unlike the *counterinductive* strategy outlined in Paul Feyerabend's *Against Method,*[13] which explains how novel scientific theoretical frameworks are typically conceived long before there is sufficient evidence or an active program of research to "prove" a new theory.

In Feyerabend's reading, Galileo Galilei's technological invention, the telescope, which provided the "proof" upon which he relied in updating and spreading word of Copernicus' Heliocentric model of the solar system—assertions for which he was eventually found to be "vehemently suspect of heresy" by the Inquisition—was at that time in such an unrefined state so as to produce misleading and non-conclusive evidence. It was only later, after other astronomers had been swayed by Galilei's rhetorical efforts to engage with his "research program" and refine the technologies and theoretical frameworks involved that the corresponding evidence

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[13] Paul Feyerabend, *Against Method*.

could be ascertained so as to "prove" the matter once and for all. Fortunately, unlike in the hard sciences, music-theoretical speculation need not rely upon "proof" in order for its premises to be manifestly articulated as a "research program" in the world: this is the role that compositions play.

Since the advent of recording technologies around the turn of the last century, and the accompanying "culture industry"[14] infrastructure that sprung up in order to commodify the artifacts enabled by these technologies, the dominant paradigm outlined above has been further reinforced and codified according to processes that follow necessarily from certain features of this 20th century industry. First, these artifacts were once[15] bought and sold, and thus conceptually understood not according to "aesthetic value" but by "commodity value." Second, each time these products are encountered, they emit a music that is exactly the same, verbatim, down to the last sonic detail. In effect, this music is designed not to be listened to, but to be *re-listened to*, in what amounts to a form of indoctrination via nostalgia-inducing mnemonic signals that are temporally scattered across time.[16] The necessity that these products be suitable for repeated consumption has exerted an

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[14] Max Horkheimer and Theodor W. Adorno, "The Culture Industry: Enlightenment as Mass Deception," in *Dialectic of Enlightenment: Philosophical Fragments*, ed. Gunzelin Schmid Noerr, tr. Edmund Jephcott (Stanford, CA: Stanford University Press, 2002).

[15] I use the past tense here as a recognition that the era in which musical recordings could still truthfully be described as physical commodities ended definitively in the late 1990s with the advent of peer-to-peer file-sharing software such as Napster and Limewire, and the later decentralized BitTorrent protocol. Those artists and record labels that continue to purvey new "releases" engage in a nostalgia-induced twentieth-century fetishism.

[16]This process can be understood in terms of what befell various prisoners of the United States Military at Abu Ghraib, Guantanamo Bay, and other CIA blacksites throughout the world during the "war on terror" who were subjected, as part of a protocol of "no touch torture," to long durations of endlessly repeated exposure to fixed-media recordings of American popular music at loud volume, a method that was believed to act much more efficiently than traditional, physical methods of torture. Susanne G. Cusick, "Music as Torture / Music as Weapon," *Transcultural Music Review*, 10 (2006).

incalculable influence on the kinds of music they contain, an influence that continues to snowball the longer this process goes on.

Lastly, these artifacts, especially once they are digitized and made publicly available, suspended in the "cloud," last forever, never seeming to cede an inch of cultural territory to the musical innovations of subsequent generations: there is no "sunset clause" for recorded media. Like most people, I have taken great pleasure throughout my life in experiencing recordings from decades past, and I certainly understand that this "grand corpus" of all recorded media is something of a treasure trove of unqualified cultural and historical import, so it is with some trepidation that I hammer this point home: but there is just something eerie and ahistorical about the un-ending lifespan of these works and their ability to project into the future that, in my view, entraps the current generation (of listeners) in the cultural stew of these bygone eras, as if we are being haunted, coaxed into a sleepy nostalgia from which we might well never awaken.

The theoretical systems (metrical, tuning, harmonic), notational forms, and metaphorical language that we have inherited to describe and comprehend of musical structures were developed during historical eras in which the two instrumentally dependent constraints were active, and reinforced during a century in which the three "culture industry" dependent constraints were active. Thus, the mental constructs obtained from a "traditional" music education or through cultural osmosis only allow for conceiving of musical structures that it is possible to engrave in notation or to transmit orally and propagate "live" with acoustic instruments (or some admixture of the two). In order to conceive of and manifest a music that does not align with these constraints, it is necessary to make use of or invent alternative

theoretical propositions, graphical representations, (synthetic) instrumentation,

schema, formulae, metaphors, organizational principles, and methods of distribution.

There has long existed a venerable tradition of composers interrogating the

cultural, technological, and philosophical structures that underlie the contemporary

musical practices of the eras in which they find themselves, and performing custom

interventions in order to manifest unique alternative visions. The counterinductive

process by which these interventions are manifested in the world—that is, as

compositions—is guided by a kind of "passion"[17] that is necessarily intuitive and

"unjustifiable," at least in the contemporary terms. Arnold Schoenberg described this

necessity for conviction, for trusting this "passion" in this way:

> One must be convinced of the infallibility of one's own fantasy and one must
> believe in one's own intuition. Nevertheless, the desire for a conscious
> control of the new means and forms will arise in every artist's mind, and he
> will wish to know consciously the laws and rules which govern the forms
> which he has conceived "as in a dream." Strongly convincing as this dream
> may have been, the conviction that these new sounds obey the laws of
> nature and our manner of thinking … forces the composer along the road of
> exploration.[18]

In the introduction to *New Musical Resources*, Henry Cowell describes this

sort of passion as instinctual:

> My interest in the theory underlying new materials came about at first through
> wishing to explain to myself, as well as to others, why certain materials I felt
> impelled to use in composition, and which I instinctively felt to be legitimate,
> have genuine scientific and logical foundation. I therefore made an
> investigation into the laws of acoustics as applied to musical materials. Some
> of the results of the investigation convinced me that although my music itself
> preceded the knowledge of its theoretical explanation, there had been
> enough unconscious perception so that the means used were not only in
> accordance with acoustical law, but are perhaps the best way of
> amalgamating sounds formerly considered discords . . .[19]

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[17] Feyerabend, 17.
[18] Arnold Schoenberg, "Composition with Twelve Tones (I)," in *Style and Idea: Selected Writings*, ed. Leonard Stein (1941; Berkeley: University of California Press, 1975), 218.
[19] Henry Cowell, *New Musical Resources*, third edition (Cambridge, UK: Cambridge University Press, 1996): xv.

Anthony Braxton, in *Tri-axium Writings*, challenged the entire conceptual

apparatus that surrounds creative musical activities—not just the work itself, but the

journalism, scholarship, pedagogy, and theoretical discourse—in order to perform a

sort of corrective against what he observed as an entrenched wilful

misunderstanding of creativity (especially black creativity) with real-world

consequences. In so doing, he carved out an alternative conceptual space in which

to pursue his creative musical work:

> The challenge of erecting a positive basis for understanding creative music must necessarily involve a complete examination of every area of creative music - regardless of form or style. We must move to seek out a more human understanding of this subject that is free of petty accusations or racist doctrine, and the time to do it is now - not later. The act of writing this book has helped me to see how deeply I disagree with the present reality of commentary about creativity - and its related information continuum. Because the dynamic misinformation that has been generated in music commentary is not separate from what has transpired in the composite guilt of our society; that is - the misinformation presently attempting to solidify our relationship with creative invention also effects [sic] our composite relationship with fundamental information (or as this period of time would have it 'alternative fundamental information') - and this is what worries me. …
>
> For to really attempt understanding the reality of creativity is to transcend the particulars of a given focus and instead reinvestigate the dynamics of composite earth information. As such the thrust of these writings are as concerned about the vibrational and philosophical implications of a given information focus (interpretation) as the particulars of its related music. Because the reality of creativity is not limited to only how a given phenomenon works but also involves the meta-reality context from which that phenomenon takes it [sic] laws. This is what concerns me, and this is what my writing is directed towards examining.[20]

In a letter written in the early 1980s, composer Maryanne Amacher

expressed the potential of a newly developed sound dissemination technology, and

explained her life-long commitment to a practice of sonic investigation unbounded by

the contemporary technological and cultural practice limitations:

> Since 1967, all of my music <u>has</u> <u>been</u> <u>prepared</u> for the kind of reproduction these new media now make possible. This happened because what interested me in sound was to explore the many areas of threshold sensitivity

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[20] Ibid., iii - iv.

I began to <u>recognize</u> <u>consciously</u> while doing my work. My discoveries led further and further into areas of sound and structure, impossible to reproduce on "records," or on magnetic tape, unless I "played" the tapes.

Totally compelled to give attention to these discoveries about mind, perception, and the physical nature of sound, rather than to accommodate ideas to MUSICAL or RECORDING FORMATS, I went ahead and developed these sound worlds, even though there were only limited ways at the time - performances and installations - to communicate them. I decided not to let <u>thought</u> or <u>investigations</u> be dominated by constraints of what I knew to be nearly terminal technologies. What has resulted is really a "new music," where many "ways of hearing" and "being with sound" can exist - experienced up to now only by audiences attending performances/ installations I've created. It is now possible to reproduce this work on digital discs.[21]

This critical orientation is also typified in the work of Harry Partch, who explained that in order to maintain a vital music-culture, it is necessary for practitioners to continually engage in this kind of comprehensive cross-examination:

In poetry and in many other forms of creative expression investigation may take an entirely intellectual and metaphysical path, but in music, because of the very nature of the art, it must also take a *physical* path. A phalanx of good pianists, good teachers, good composers, and "good" music no more creates a spirit of investigation and a vital age in music than good grades in school create a spirit of investigation and a body of thinking citizens. To promote a youthful vitality in music we must have students who will question every idea and related physical object that they encounter. They must question the corpus of knowledge, traditions, and usages that give us a piano, for example—the very fact of a piano; they must question the tones of its keys, question the music on its rack, and, above all, they must question, constantly and eternally, what might be called the philosophies behind device, the philosophies that are really responsible for these things.[22]

In Partch's case, this deconstruction of the contemporary situation led to a life-long compositional labor that included theoretical systemization; instrument design and construction; recruiting, training, rehearsing, performing, and recording with members of his ensembles; conceiving of and notating pieces; and writing and publishing his grand discursive tome*, Genesis of a Music*. All of these disparate activities ultimately seem aimed at giving rise to an epistemic change, one that could

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[21] Maryanne Amacher, "Letter to Wies Smals and Josine van Droffelaar," in *Selected Writings and Interviews*, ed. Amy Cimini and Bill Dietz (Brooklyn: Blank Forms Editions, 2020): 256.
[22] Partch, xv-xvi.

only be enabled through an introduction (by the maestro himself) of novel music

technologies designed to articulate his speculative idiosyncratic music-theoretical

universe:

> Equal Temperament is a current habit, as is also the scope for modulation which it allows. Composers can "think" only in Equal Temperament for just one reason: because it is all they have got to think in. Music systems are made valid—and workable—by significant music, as these pages have so frequently sought to remind us. But to produce significant music in Just Intonation we must have instruments, and instruments are no small problem.[23]

Instruments *were* no small problem, but no longer: we live in the era beyond

traditional technology, the computational age, in which all manner of abstract thought

can be logically encoded and transmogrified into perceptually actuated forms, like

incantations whispered into the wind, but true. I am of course talking about

programming, the medium which, over the past six years, I have studied and come

increasingly to rely upon in order to translate ideas into works of art. At first, I saw

this way of manifesting ideas as a means to end: a method for arriving at some kind

of music, whether it be synthesized directly or arrived at through a series of

intercessors, i.e. the generation of MIDI messages transmitted to a disklavier or

analog synthesizer; or the rendering of a notated score to be realized acoustically by

musicians. Perhaps this utilitarian view of coding is what is meant by the

academician's construct, "computer-assisted composition?" The computer as a

walking stick, to lean upon whilst you hobble along, and not a flying machine?

Increasingly though, I have come to see this activity of programming as the

actual site of thought, the creative locus in which compositional ideas are contained

and enacted, a method for accumulating and "thinking through" one's ideas. From

this viewpoint, the code itself *is*, for lack of a better term, the "piece," while the music

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[23] Partch, 194.

that it generates is just a possible realization of the "piece." I experienced this identity-shifting thought during a period of creative work in which I was primarily invested in the practice of encoding instructions symbolically as notation to be realized acoustically by (human) instrumental performers. Since, over the last six years, I have been composing (for the most part) with stochastic procedures, I would find myself, in the late-stages of composing, in an odd sort of holding pattern involving an endless cycle of generation and evaluation: my code would generate a synthesized rendition of the composition which I would listen to and judge. If I were to find it wanting, I would re-run the program some five, ten, twenty, one-hundred times, perhaps tweaking some subtle variable or another in between auditions, listening and rendering judgements with each iteration, hoping, eventually, to stumble upon an "ideal" version, as if a) such an "ideal" were even possible and b) I would be even be capable of recognizing it, and c) my sense of judgment would somehow remain stable over the course of auditing dozens of pieces. It doesn't take very long to realize that this process can lead one down the path to madness:

Imagine searching for a needle in a freshly-cut, fragrant stack of hay, except you've never actually seen or felt a needle before. You've just imagined what a needle might be like, and you are convinced that it would be an excellent thing to possess and to share. Each time you reach into the pile and assess another handful, you find each strand to be quite pleasing in its own unique way, but none of them seem to strike you as a needle, and, oddly, more and more hay keeps getting piled on top, and you become less and less sure of your abilities to discern a needle from the rest, but no matter, because any old strand will do, right? "Was that prickly strand of hay I discovered in my ninth handful actually a needle after all? I can appreciate

the shape of this strand of hay, and the color of this other one, but are either of them a needle? Maybe I should just go back to that first strand that caught my eye, but where has it gone, I can't find it amidst all this hay!" Over the course of this search, you become more and more accustomed to the hay so as to lose your ability to tell one strand from another, and so much time passes in this muggy heat that the stench of rot sets in, and the flies descend. Before long, the whole business of searching becomes such an ordeal that you just arbitrarily grab a strand of hay, without any longer being able to appreciate it for its virtues, and head off to town to display your wares, but all the way there you can't stop thinking about the giant stack of hay piled back there in the barn, and all of the needles that must be buried in there!

The shift that obviates this maddening last stage is a conceptual move away from the traditional understanding of a "piece of music" as a unique, individual, idealized form and toward an understanding of a "piece of music" as a possibility space of forms. What is important in this sort of medium is the shape of the possibility space itself: how each particular form articulates that space in its own way, and how each form contrasts with every other form. Over the course of many iterations, lines of actualization are traced all across the possibility space allowing the shape of the full volumetric form to be filled in, as in the thread installations of Chiharu Shiota.[24]

The formal context of this piece is indebted to the structural framework James Tenney first described in *Meta/Hodos,*[25] which allows for the specification of a nested

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[24] Chiharu Shiota, *The Key in the Hand* (Berlin: Distanz, 2015).
[25] James Tenney, "Meta Hodos," in *From Scratch: Writings in Music Theory*, ed. Larry Polansky et al. (Urbana, Chicago, and Springfield, IL: University of Illinois Press, 2015), 13–96.

hierarchy of musical elements at various different perceptual levels. As in many of

Tenney's compositions, at each of these perceptual levels, musical parameters are

controlled by various stochastic procedures, allowing for a formally coherent musical

texture.

This is a way of composing that embraces stochastic methods—so-called

"chance operations"—as a means of articulating musical ideas that are *abstracted*

away from the traditional compositional focus on the *particular*. To some degree, this

understanding echoes the well-known rhetorical strategy employed by John Cage in

explaining the use of such methods in his compositional work, as a way of

circumventing his own "ego":

> However, chance operations are not mysterious sources of 'the right
> answers.' They are a means of locating a single one among a multiplicity of
> answers, and, at the same time, of freeing the ego from its taste and
> memory, its concern for profit and power, of silencing the ego so that the rest
> of the world has a chance to enter the ego's own experience.[26]

I take seriously this sentiment that there is no "right answer," and that out of a

multiplicity of possible answers, all options are equally valid, though I am not as

certain of the notion that employing such a procedure somehow removes the volition,

musical-conceptual apparatus, and "taste" of the composer from the causal chain by

which this music has come about. In fact, I would lean toward an opposing

interpretation: it seems more likely to me that in the use of so-called "intuitive"

methods—in "smoking-jacket" music,[27] in which composers tune-in to some internal

auditory hallucination and attempt to capture it in markings on the page, as well as in

"free" and not-so-free improvisatory practices—one's "ego" is overruled by something

like a cultural mirror, in which perceptual habits and idiomatic knowledge developed

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[26] John Cage, *Empty Words* (Middletown, CT: Wesleyan University Press, 1979), 5.
[27] Larry Polansky, "Cocks Crow, Dogs Bark: New Compositional Intentions," *Leonardo Music Journal* 7 (1997): 61.

through training or osmosis are reflected back out in musical form. It would seem that only through *abstraction*—as articulated in my case via stochastic methods—can one enable the "ego" to take on a more intentional role in the act of musical creation. Ultimately though, the discourse around the notion of "intuition" is cursed, and this dichotomization tends toward the reductive: there is both "abstraction" and "intuition" involved in any creative musical act.

For me, this sort of composing via abstraction is ultimately an analytical process, a way of formally specifying musical ideas and structures invented or "borrowed" from my personal history, including experiences learning and playing a variety of different musical idioms. The process of specifying such an abstract musical idea in code is a clarifying experience. It can't be faked: the results that the computer renders will clarify whether or not an idea has been understood thoroughly enough to be formally specified. This method can also be generative of heuristic experiences: if I have been successful in encapsulating a network of musical ideas in code, then I will have quite a lot to learn from listening to the resultant music. I will be able to take pleasure in this music not in the role of "prophet,"[28] but as a "friendly experiencer."[29] In this way, there is intrinsic value for me in carrying out the compositional act that is something akin to learning a new instrument, reading a book, or walking in the woods. Thus, the experience need not be validated by any external evaluative authority. By this I mean, even if very few besides myself ever participate in (the hearing of) this piece—a likely scenario!—the task of listening to it

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[28] Jacques Attali, *Noise: The Political Economy of Music*, tr. Brian Massumi (Minneapolis: University of Minnesota Press, 1985), 12: "The musician, like music, is ambiguous. He plays a double game. He is simultaneously *musicus* and *cantor*, reproducer and prophet."
[29] Anthony Braxton, "Keynote Address at the Guelph Jazz Festival, 2007, Macdonald Stewart Art Centre, Guelph, Ontario, Canada," *Critical Studies in Improvisation* 4 no.1 (2008), 5.

myself in the coming years will represent a fulfillment of my goals: listening is the second stage of a single analytical process, as in the life's work that serves as the central narrative throughline in Georges Perec's *Life A User's Manual*.[30]

The novel, which is set all throughout an apartment building in Paris at the moment of the protagonist's death, describes the elaborate plan that one Mr. Bartlebooth, a wealthy British man, devised for himself in his youth as a meaningful way of spending both his wealth and his remaining years. After taking painting lessons and making all the necessary preparations over the course of ten years, he embarked with a manservant on a twenty-year journey all around the world, the goal of which was to paint watercolor portraits of five hundred different sea-ports at a rate of roughly one every two weeks. Upon completion, each seascape was shipped back to a craftsperson living in the apartment building in Paris, who attached the paintings to slabs of wood and cut them into devilishly tricky jigsaw puzzles. After returning from his long journey, Mr. Bartlebooth then set off on a second twenty-year task of solving each of these puzzles one by one. After completing each puzzle, his craftsperson re-bound the paper, removed it from the slab of wood, and shipped it off to the port where it was originally painted, ultimately to be placed in a detergent solution exactly twenty years after the date of its original painting, which had the effect of dissolving the colors leaving only a blank sheet, which was then returned to Bartlebooth: a fifty-year endeavor with no lasting corporeal evidence. (This is the art equivalent of committing murder with an icicle: the perfect crime).

In pursuing this kind of work, I am guided by a metaphor that I think has resonance for a few generations of American composers, namely, that I am seeding

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[30] Georges Perec, *Life A User's Manual*, tr. David Bellos (Boston: D. R. Godine, 1987).

a forest rather than designing a garden.[31] The results are bound to be wild and untamed, and this is a virtue: this is what makes the work "alive." In this sort of process, carried out over the course of ten-thousand iterations, there are bound to be many unremarkable moments and unremarkable iterations. By the same token, there will also be some coincidental moments in which unqualified beauty shines through. This is a form of balance: if you witnessed a rainbow every day, would you even notice it?

Admittedly, there is an aspect of all of this "playing at God" that tends toward the megalomaniacal and the sybaritic. Composing itself has traditionally been a largely solitary act, but in an ideal world, a solitary act that takes place within a larger community of artists and performers with opportunities for a genuine exchange of ideas and sharing of experiences and in which individuals learn from and help one another. My work in composing this piece has not taken place within the context of such a community, at least not a *synchronous* one. Furthermore, in this piece's particular mode of production—synthesized, without any human performers—and method of dissemination—hosted on a custom website, without appearing in any concert or "live stream" nor on any of the technologically *au courant* social media or streaming platforms—it is as if the piece has been constructed within an

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[31] Larry Polansky explained it this way in a lecture at Ostrava Days, 2011: "As James Tenney might say, the idea is to make a forest, but one doesn't put trees in a forest one by one. We design the process that makes forests. That's a much more beautiful, more interesting thing to do. Perhaps when you do that, maybe your forest is overrun with elms, and you don't want that. You don't start pulling out each elm, you go back to look at wherever elms came from in the process, and you look at the whole thing. You make another forest. Maybe then you have too many spruces, or gophers. You can't care where the individual trees are, but about the totality of wildlife in that forest. It's not so much the ecology, as, in my way of thinking, the heterology." Larry Polansky, "Two Talks by Larry Polansky" in *Ostrava Days 2011 Report* (Ostrava, Czech Republic: Ostrava Center for New Music, 2012), 106.

impenetrable sphere that serves partly as a defense-mechanism, but also as a
necessary outgrowth of the time and place of its origin.

I did not intend to inhabit the life of a hermit when I set out westward from
New York in July of 2016, driving across the continent to begin a doctoral program at
UCSC. At every prior stage of my life, and indeed throughout the first three years of
my stay in Santa Cruz, I had been an active member of various and distinct kinds of
institutional, "amateur," or "professional" musical communities, playing the role, at
different times, of student, performer, organizer, instigator, fund-raiser, usher,
technician, audio engineer, copyist, volunteer, interviewer, sounding-board, publisher,
band-leader, stage manager, disputant, critic, teacher, composer, and, most
importantly, "friendly experiencer." The primary way in which I have participated in,
experienced, and learned about music has been in the playing of instruments in
particular idioms: I grew up playing the drum-set, piano, and electric bass guitar in
various United States styles ("Jazz," popular music, etc.), and sang in choirs and in
"musical theater"; at University, I continued as a drum-set player and studied "Jazz"
guitar, Ghanaian drumming, Carnatic solkattu, the trans-idiomatic music of my
advisor Anthony Braxton; in Sommerville, Berkeley and New York, I played Central
Javanese Gamelan in various community ensembles, studying, in particular, two of
the elaborating instruments, the *gendèr* and the *gambang*; at Mills College, I became
an acolyte of the arts of free improvisation and "experimental" electronic / computer
music, and began to perform as a percussionist in so-called "new music"
performances; in New York and early on in Santa Cruz, I worked up all manner of
permutations and bebop licks on the alto Saxophone and performed with a custom
radio-feedback network; in the last four years I have been learning Hindustani music

on the sitar; and all throughout I have spent the odd afternoon and evening flipping through and sight-reading all manner of European and American sheet music at the piano.

What do all of these instrumental experiences add up to? I'm no virtuoso on any of these instruments, and I have become less and less inclined toward performance as the years go by: what once was an exciting opportunity to "prove my worth" as a musician has come to seem like a well of vanity. And since performance serves, ostensibly, as the telos in our culture for learning an instrument, it begs the question: why am I still so compelled toward learning and playing instruments? Ultimately, for myself at least, I think that gaining fluency on an instrument, especially in an idiomatic context—that is, in a system of music that operates within a certain set of consistent and graspable characteristic forms, methods of performer interplay, structural dependencies, "rules" of variation/elaboration/improvisation, etc.—is an essentially interpretive act, a form of what David Dunn might call a "heuristic analysis." It is, all at once, 1) a means of participating in an experiential discourse that has been morphed by and shared between other musicians, 2) a way to "extend the mind"[32] out into the world by way of technology, 3) a method for assimilating, representing, and "embodying" knowledge-forms that are non-textual, and 4) good clean fun.

Given this life-long commitment to and deep interest in instrumentalism and a history of participating in musical communities, the anti-instrumental, isolationist nature of the compositional endeavor outlined in the text may come across as something of a paradox. Returning to the idea of community, due to a confluence of

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[32] Andy Clark and David Chalmers, "The Extended Mind," *Analysis* 58, no. 1 (1998): 7-19.

uncoordinated circumstances which occured in the middle of 2019, the musical

communities in which I had taken part over the previous years seemed to evaporate

thoroughly, a turn of events that was obviously compounded in March of 2020. This

is the wider context in which I composed *Ten-Thousand Views of Mount Toro*, and

helps, in part, to explain some of the compositional choices I intuitively arrived at

(and only after the fact sought to "justify" according to the five paradigmatic

boundaries discussed above). However, I would proffer that my instrumental practice

and this compositional work ultimately represent a single multifaceted but unified

practice, one in which the notion of community was widened (almost as a coping

mechanism) to include incoming signals with very long delay times. This is a practice

in which technological means are ultimately employed to analyze, understand, think

through, and enact music in dialogue with a community of musicians, or at least in

dialogue with the delayed reflection of ideas and practices of people whose work, by

some accidental stroke of luck, I have had the fortune of being exposed to, if not

through direct contact, than by way of texts, recordings, concerts, scores, and

idioms.

Temporal Structure

Even though the rhythmic events in this piece do not align with any underlying periodic temporal grid, from a structural perspective, the piece is guided by a formally specified tempo curve, the shape of which outlines a gradual expansion, or temporal spiral. In part, this curve is designed to enable a process modeled abstractly after a process seen in a number of Southeast Asian musical traditions, referred to as *irama* in Javanese music, and *thăw* in Thai music. This is a process of "expansion and/or contraction allowing a single piece to assume different lengths, instrumentation, different styles and degrees of improvisation, and consequently, different meanings and ethos."[33]

In a central Javanese gamelan *gendhing* (song) performance, *irama* operates roughly as follows: a group of *saron* (metallophone) players repeat a basic melodic cycle, or *balungan*, aligning to a metric grid laid out by a *kendhang* (drum) player. Other instrumentalists perform elaborating parts accompanying this *balungan* melody in a quasi-improvisational style that also aligns with the *kendhang*'s tempo. At certain idiomatically consistent points in the cyclic pattern, the *kendhang* player can choose to gradually slow down the tempo. When the tempo drops below a certain fuzzy threshold, a temporal expansion occurs in which extra notes fill in gaps directly between the original *balungan* melody, and the *kendhang* and accompanying instrumentalists shift to patterns that are twice as fast and in a different elaborating style.

This process of shifting through successive levels of *irama* is paradoxical in that the primary melodic skeleton continues to slow down or expand while the

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[33] Judith Becker, "A Southeast Asian Musical Process: Thai *Thăw* and Javanese *Irama*," *Ethnomusicology*, (Vol. 24, No. 3: 1980), 454.

surface of the music (and the actual performance style of many of the players) doubles in sudden bursts. I think of this process as belonging to the same family of perceptual illusions as the Shepard Tone[34] or the "*Vertigo* effect"[35]: a shifting of perspective that implies a sort of motion while remaining at rest. In addition to the change in rhythmic speed, when expanding to a "lower" *irama* level, the playing styles of elaborating instrumentalists become increasingly ornate.

This spiraling, expanding musical process is a form I have explored in a number of pieces in the past. I see it as an ideal form for the exploration of any kind of unfamiliar material, in that the listener is continually reacquainted with the same seed elements present from the beginning of the piece. With each return, those elements become more and more saturated, more familiar to the listener, more comprehensible, even though the manner in which they are being elaborated has evolved since the previous rendition. In this piece, the unfamiliar materials are just-intoned pitch collections, and, perhaps more importantly, the transitions —"harmonic motion"—between those pitch collections. In this way, the *irama* spiraling process serves a heuristic function.

An abstract interpretation of this occurs in each version of *Ten-Thousand Views of Mount Toro.* Although it can't be directly perceived from the instantaneous surface rhythm,[36] over the course of a rendition of the piece, the tempo gradually decreases, passing through four different stages of *irama*. These shifts occur each time the tempo is halved, at each tempo "octave." Rather than a melodic skeleton

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[34] Roger N. Shepard, "Circularity in Judgments of Relative Pitch," *The Journal of the Acoustical Society of America*, (Vol. 36, No. 12: 1964), 2346 - 2353.
[35] *Vertigo*, directed by Alfred Hitchcock (Paramount Pictures, 1958).
[36] Not unlike the *lagu*, or hidden "inner melody" in central Javanese Gamelan music. For a detailed account, see Sumarsam, "Inner Melody in Javanese Gamelan Music," *Asian Music*, (Vol. 7, No. 1: 1975), 3-13.

that slowly expands, in *Ten-Thousand Views*, there is a repeating harmonic cycle that gradually expands, expressed through the playing of the three synthetic "instruments." Within an *irama* level—and in the case of certain instrumental elements, throughout the entire piece—the relative temporal density of each instrument gradually decreases. But when an *irama* shift occurs, the elaborating style for each instrument changes in idiosyncratic ways, tending toward higher frequencies, faster rhythms, and more ornate patterning.

The particular shape of the tempo curve used to carry out this process has a great effect on the relative duration spent at each of the four different *irama* levels. If the tempo falls too quickly, the majority of the piece will be spent in *irama* IV, and vice versa, if the tempo falls too slowly, proportionally more time will be spent in *irama* I. Balancing the relative amount of "musical time" spent in each *irama*—the elapsed number of cycles of the repeating harmonic pattern—with the relative amount of "real time" spent in each *irama*—measured in seconds—was my primary constraint in finding a suitable tempo curve.

In order to implement the particular *family* of curves used in this piece—for there is a subtle degree of variability in the curve used for each of the ten-thousand variations—I used the calculus framework developed by Clifton Callender for working with formalized accelerando[37]. Callender's framework borrows, by way of metaphor, the interrelationship seen in Newtonian Mechanics between instantaneous functions that specify distance traveled, *d(t)*, velocity, *v(t)*, and acceleration, *a(t)*:

$$d(t) = \int v(t) = \iint a(t)$$

[37] Clifton Callender, "Formalized Accelerando: An Extension of Rhythmic Techniques in Nancarrow's Acceleration Canons," *Perspectives of New Music*, (Vol. 39, No. 1: 2001), 188-210.

Instead of distance being the underlying term, Callender substitutes beats elapsed, leading to this relationship between instantaneous functions for beats elapsed, *b(t)*, tempo, *mm(t)*, and acceleration, *acc(t)*:

$$b(t) = \int mm(t) = \iint acc(t)$$

I will, for the most part, stick with Callender's nomenclature, although in the case of this piece, the concept of "beats" is meaningless. The relevant consistent unit of "musical time" is the length of the cycle. In my first attempt to find a tempo curve, in the spirit of balance, I searched for and eventually discovered a set of formulas wherein an equal amount of "real time" would be spent at each *irama* level. These equations are as follows, and are represented graphically in Figure 1 for a prototypical piece twenty minutes in duration consisting of a total of ten cycles of musical time, whose tempo shifts through four levels of *irama*.

$$b(t) = z^t ln(z) \qquad mm(t) = z^t \qquad acc(t) = \frac{z^t}{ln(z)}$$

where:
$$z = 0.5$$

Figure 1. Graphs of the acceleration, linear-scale tempo, log-scale tempo, and elapsed cycles for my "initial tempo curve" with equal relative duration in each *irama*.

At first, this tempo curve seemed ideal. But upon implementation in the context of the piece, I realized that the relative amount of "musical time" spent in each irama, as opposed to "real time," was rather unbalanced in a way that prevented the kind of gradual saturation described above. As shown in the *Elapsed Cycles* graph in figure 1 and the table presented in figure 3, for a variation consisting of a total of ten cycles following this tempo curve, more than five cycles—more than

half of the total "musical time"—would occur in *irama* I. Meanwhile, only two thirds of a cycle would occur in *irama* IV. If my intention was to have each pitch collection in the harmonic cycle be elaborated at every level of *irama*, clearly more than a single cycle would have to elapse at each *irama* level.

As a compromise of sorts between balancing the relative amounts of "real time" spent in each *irama* level versus the "musical time" spent in each *irama* level, I settled upon the following set of equations to define the "eventual tempo curve" used in the piece, as displayed in figure 2:

$$b(t) = f z^{t^f} ln(z) t^{f-1} \quad mm(t) = z^{t^f} \quad acc(t) = \frac{\Gamma\left(\frac{1}{f}, -ln(z)t^f\right)}{f(-ln(z))^{\frac{1}{f}}}$$

where:
$$z = 0.5$$
$$f = 0.5$$
$$\Gamma(s, x) = \int_0^\infty x^{s-1} e^{-x} \, \mathrm{d}x$$

As shown in the table in figure 3, this tempo curve enables a situation in which "musical time" is more evenly distributed among the four *irama* levels, with roughly two or three cycles spent at each level. Perceptually, it makes a certain kind of sense to spend a greater amount of "real time" in this last *irama*: as this is the section with the greatest temporal density and the widest variety of musical activity, more time ought to be allotted to explore this wider possibility space. Figure 4 shows how this all plays out for a specific variation of the piece: *No. 62: Brinjal, Sweet Pepper, Waffle*.
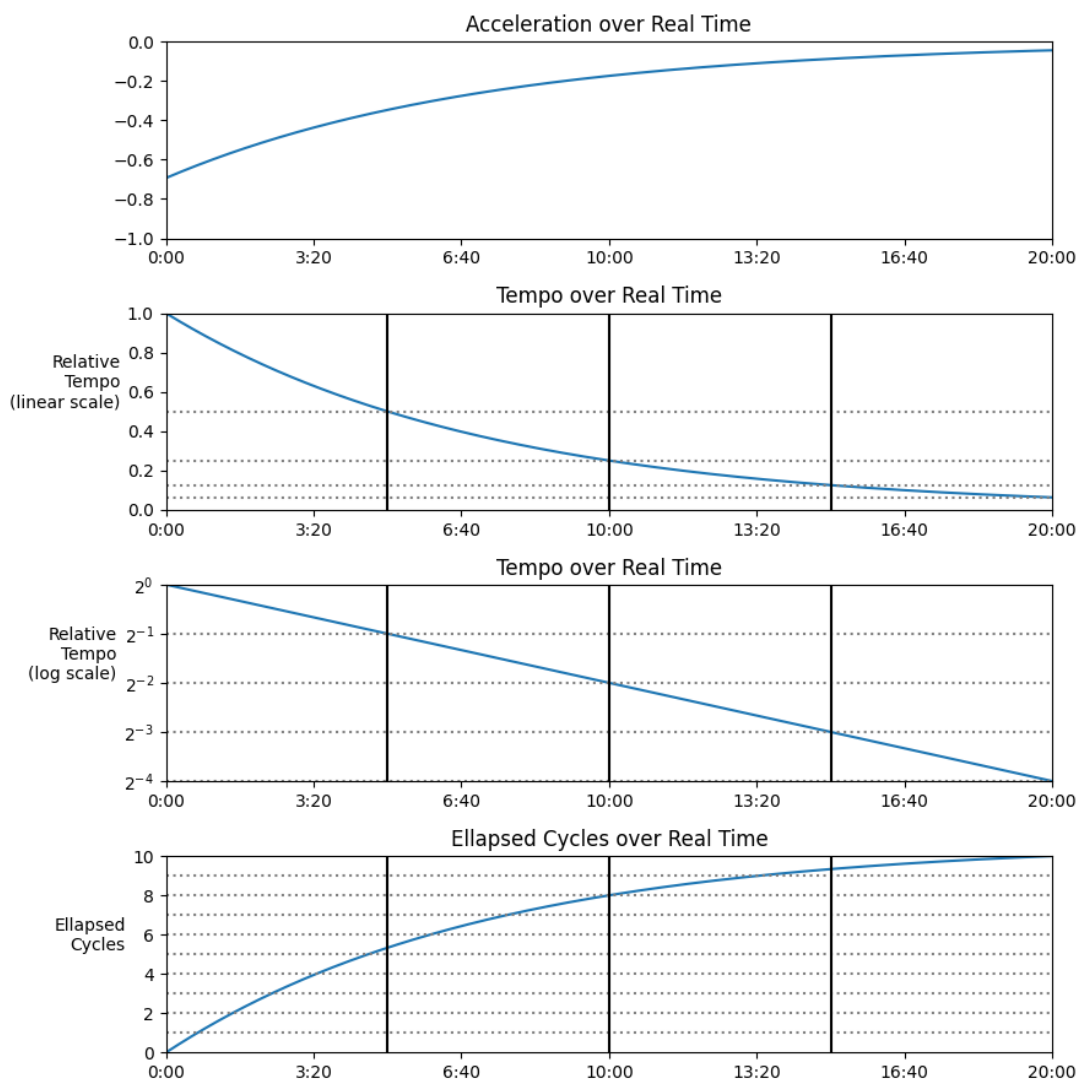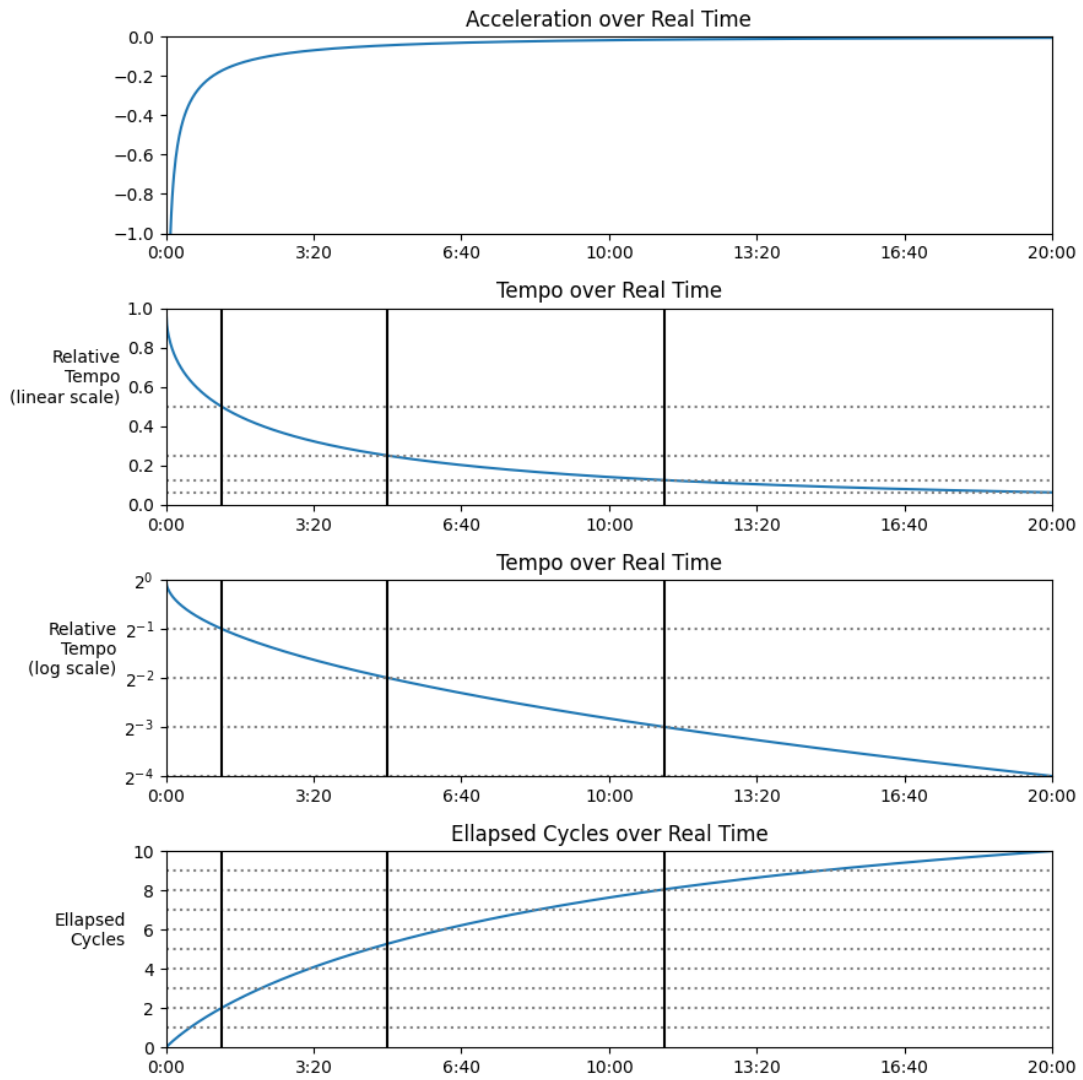
Figure 2. Graphs of the acceleration, linear-scale tempo, log-scale tempo, and elapsed cycles for my "initial tempo curve" with equal relative duration in each *irama*.

	Initial Tempo Curve		Eventual Tempo Curve	
	% of total duration	No. of Cycles	% of total duration	No. of Cycles
Irama I	25	5.33	6	2.01
Irama II	25	2.67	19	3.27
Irama III	25	1.33	31	2.77
Irama IV	25	0.67	44	1.95

Figure 3. Table detailing percentage of total duration and number of elapsed cycles occurring at each level for the two tempo curves displayed in Figure 1 and Figure 2.
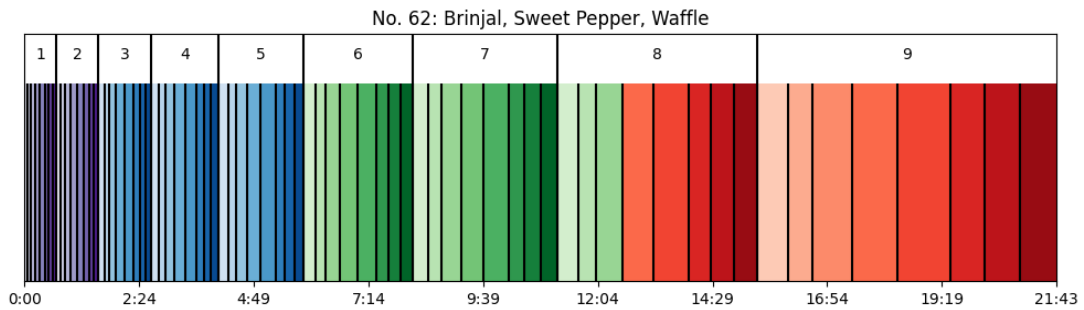

Figure 4. Chart of durations from variation *No. 62: Brinjal, Sweet Pepper, Waffle*, which has a rhythmic cycle made up of eight segments that repeats nine times. Colors are indicative of *irama* level — purple: *irama I*, blue: *irama II*, green: *irama III*, red: *irama IV*.

Harmonic Structure

As stated above, each variation is built upon a cycle which repeats a certain number of times, slowing down throughout the total duration according to a formally specified tempo curve. For a given variation, the cycle is divided into segments, each of which is associated with a particular collection of pitches. These pitch collections are just-intoned; that is, the frequencies of the pitches within any such collection are related to one another by way of whole number ratios. I find it instructive to consider such pitch collections in the context of a multi-dimensional model of pitch relationships known as *harmonic space*.

Successive pitch collections in the piece are related to one-another by a custom-designed method of root motion through *harmonic space*, which is informed by James Tenney's concept of *containment*, and which make use of his method of calculating *harmonic distance.* The zig-zagging pathways that my composition takes through *harmonic space* are cyclic in that they return back exactly to where they started.[38]

In this section, I will first give an overview of the *harmonic space* model, the concept of *containment* and the method of measuring *harmonic distance*. Then, I will outline the procedures used to a) generate a cyclic pattern of root motion in harmonic space, and b) select the pitch collections that form modes above these roots, which

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[38] When devising the code that generates these harmonic-space pathways, I kept in mind, as a metaphor, the Miles Davis composition "Blue In Green" (1959) which made a strong impression upon me during my "real book" inflected youth, for the non-traditional harmonic pathway it takes (while remaining in the traditional Western tonal framework). This composition stuck out to me for resisting the Tin-Pan Alley eight or sixteen bar formulae by returning back to its initial chord after just ten bars, seeming to tumble harmonically over itself and propel ever forward, having arrived sooner than expected, as it were. (There is some dispute over the writing credit for this piece: Bill Evans, the pianist who appears on the original Miles Davis recording, claims to have composed it himself, and is credited as co-composer on some later recordings). See Miles Davis, "Blue in Green," *Kind of Blue*, recorded on March 2, 1959, Columbia CS 8163, 1959.

is modeled largely on the method James Tenney used in two compositions in the mid 1980s.

Harmonic Space

Harmonic Space is a multidimensional lattice-model that has been used since the mid 20th century by composer-theorists such as Adrien Fokker,[39] Ben Johnston,[40] and James Tenney,[41] primarily as a kind of heuristic visual metaphor that aids in the building of intuition about harmonic relationships. In this representation, pitches can be thought of as occupying discrete locations on a multidimensional grid—or lattice—the dimensions of which each represent a different prime component of the space.

Figure 5 displays one such lattice which spans dimensions 2, 3, and 5, with pitches labeled as ratios relative to a fundamental of 1:1. Moving one step in the positive direction along the 2-axis is equivalent to a multiplication by two or a shift up by an octave; moving one step in the negative direction along the 2-axis likewise represents a division by two or a shift down by an octave. A shift up by a perfect fifth—a ratio of 3:2—is represented by a positive step along the 3-axis along with a negative step along the 2-axis. A shift up by a just major third—a ratio of 5:4—is represented by a positive step along the 5-axis and two negative steps along the 2-axis. In this way, any rational pitch relationship can be conveyed so long as the dimensions of the model encompass all of the prime factors of that ratio.

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[39] Adriaan Fokker, "Equal Temperament and the Thirty-One-Keyed Organ," *The Scientific Monthly*, (Vol. 81 No. 4: 1955), 161-166.

[40] Ben Johnston, "Rational Structure in Music," in '*Maximum Clarity' and Other Writings on Music*, (Urbana and Chicago: University of Illinois Press, 2006), 62-76.

[41] James Tenney, "John Cage and the Theory of Harmony," in *From Scratch: Writings in Music Theory*, ed. Larry Polansky et al. (Urbana, Chicago, and Springfield, IL: University of Illinois Press, 2015), 280-304.
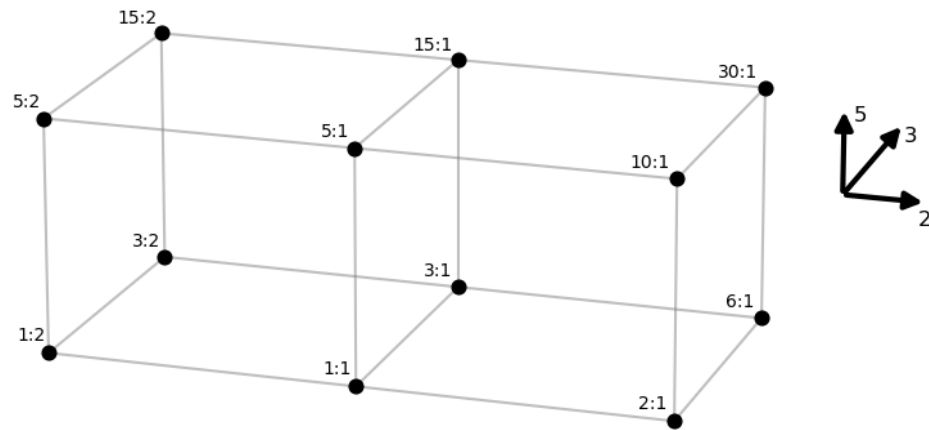
Figure 5. Twelve pitches represented as black dots in a harmonic space lattice with dimensions of 2, 3, and 5.

The decomposition of a ratio into its prime components for representation in *harmonic space* is accomplished by calculating vectors for the exponents of the prime factorization of both sides of the ratio, and subtracting the vector associated with the denominator from the vector associated with the numerator. The result is what I call a *harmonic space vector*:

$$HSV(a,b) = pe(a) - pe(b), \text{ such that } x = \prod_{i=0}^{\infty} k_i^{pe_i(x)}$$

where *k* is the list of prime numbers, *pe(x)* is the list of exponents of the prime factorization of *x*, and *a* and *b* are the numerator and denominator of an integer ratio.

Figure 6 presents three examples of a collection of pitches in a variety of different visual and numeric representations, including via western staff notation, as harmonic space vectors, and on a harmonic space lattice.
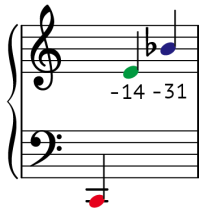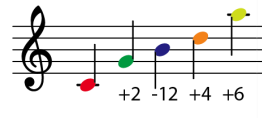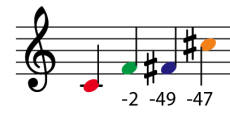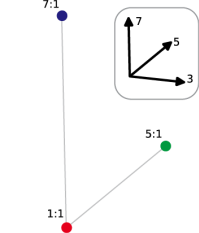
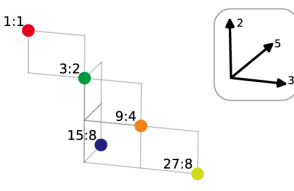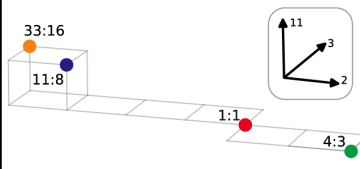|			
Western Notation	*staff notation* −14 −31	*staff notation* +2 -12 +4 +6	*staff notation* -2 -49 -47
Frequency (hz.)	65, 327, 458	262, 393, 491, 590, 884	262, 349, 360, 540
Interval Ratio	1:1, 5:1, 7:1	1:1, 3:2, 15:8, 9:4, 27:8	1:1, 4:3, 11:8, 33:16
Prime Factors / Harmonic Space Vector	$\begin{bmatrix} 3 \\ 5 \\ 7 \end{bmatrix} \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 3 \\ 5 \end{bmatrix} \begin{bmatrix} 0 & -1 & -3 & -2 & -3 \\ 0 & 1 & 1 & 2 & 3 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$	$\begin{bmatrix} 2 \\ 3 \\ 11 \end{bmatrix} \begin{bmatrix} 0 & 2 & -3 & -4 \\ 0 & -1 & 0 & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$
Harmonic Space Lattice	*lattice plot: 7:1, 5, 3 / 5:1, 1:1*	*lattice plot: 1:1, 3:2, 9:4, 15:8, 27:8 / 2, 5, 3*	*lattice plot: 33:16, 11:8, 1:1, 4:3 / 11, 3, 2*

Figure 6. Three collections of pitches represented in staff notation, as a list of frequencies, as a list of interval ratios, as a combination of prime factors and harmonic space vectors, and as plotted in a harmonic space lattice.

In tuning theory texts that make use of the "language of ratios," it is traditional to octave-reduce all intervallic ratios such that they are situated in the octave between 1:1 and 2:1.[42] For example, 17:4 would be reduced to 17:16, 3:7 to 12:7,

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[42] Partch sums up the issue thusly: "Consequently, when an interval is wider than a 2/1, the upper number may be halved or the lower number doubled to bring it within a 2/1. . . . A system of music is determined for one 2/1; the system is then duplicated in every other 2/1, above or below, that is employed. Consequently, symbols—ratios in this exposition—are used to denote the degree of one 2/1, and the symbols are repeated in every 2/1 of the musical gamut. Musicians are accustomed to this idea; the "octave" above or below a given "A" is still "A." The situation here is identical . . . Only the physicists who are not practicing musicians will find this objectionable, since, acoustically, a 2/1 below a given 9/8 should be expressed 9/16 . . . . But such a procedure would mean that every one of the approximately seven 2/1's of the common musical gamut would have a set of symbols of its own, and when forty-three degrees—ratios—in a single 2/1 are involved the number of total symbols would be unwieldy." Partch, *Genesis of a Music*, 79.

and etc. This can also be applied to harmonic space lattices. Figure 7 shows this approach, which is useful for representing complex multi-dimensional intervallic relationships within the limitations of a three-dimensional visual rendering, as reducing the pitch collection to a single octave obviates the need for a 2-dimension altogether. I will adopt this practice as well in visualizations and discussions of the harmonic procedures employed in this piece.
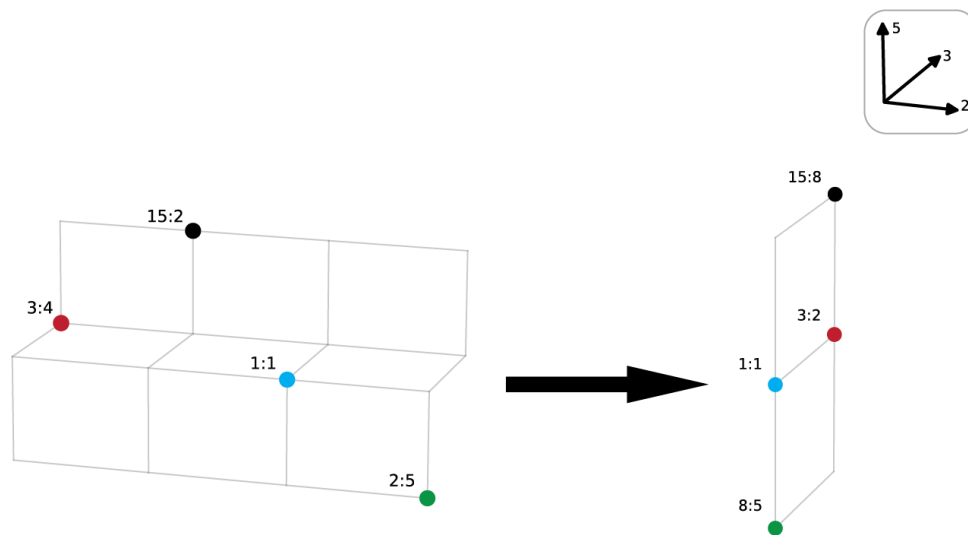
Figure 7. A collection of pitches represented in standard (left) and octave-generalized (right) harmonic space.

Containment

Music theorists have proposed various methods for assigning a kind of weighting or directionality to the relationship between the two pitches in a given interval, a way of deciding which one is considered the "tonic" or "root" with respect

Johnston also explains this in greater detail in another essay in the same volume, "Rational Structure in Music", 70: "By custom, all ratios are "octaved" in this manner to bring their value between 1/1 and 2/1. This has the practical effect of transposing all ratios by octave into the span of a single octave, bounded by 1/1 and 2/1. Thus all ratios are customarily expressed as improper fractions smaller than 2/1. This greatly simplifies the formation of linear scales, since the only further step is to sort out the ratios into ascending order of magnitude." Ben Johnston, "Aesthetic Theory; Philosophical Background for Mathematical Theory; Musical Background for Application of Mathematical Theory," in '*Maximum Clarity' and Other Writings on Music*, ed. Bob Gilmore (Urbana and Chicago: University of Illinois Press, 2006), 7.

to the other. This is, of course, a subjective affair, dependent on the listener's

background, the idiomatic context in which the question is being asked, and, for

composers, the desired type of perceptual effect one is intending to enable.

Depending on the particular theorist, this general family of conceptions has gone by

names such as *interval root*[43]*, polarization*[44]*,* and *magnetism.*[45] For the purposes of

this composition, I make use of the concept and terminology suggested by James

Tenney, *containment*, the perceptual intuition for which he sums up thusly:

> Harmonic space is not symmetrical. It clearly has an up and down. In each dimension, in fact, except between the octaves, there's an asymmetry, which is what leads to roots and tonics. And moving to the left along that three-to-two dimension is a very different manner from moving to the right. It's as if one is uphill and the other is downhill….Those downhill progressions are the ones that *sound*, I guess, because they really present new information. When you move uphill you're moving into a region which you're already expressing with the harmonic series, which is already present. But when you move downhill, you're always moving into an area that contains where you've been. The harmonic structure could move down a major third. And that, to my ear, is only a little less powerful than down a fifth. That's a strong harmonic progression….It's always like from 3:2 to 1:1, and 5:4 to 1:1, or from 1:1 Down to 4:3—moving in the subharmonic direction. There is a power in that direction.[46]

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[43]"Numerous experiments have convinced me that the feeling that one tone of an interval has more importance than the other is just as innate as the ability to judge intervals exactly—everyone hears the lower tone of a fifth as the principal tone; the ear cannot be persuaded to attribute primary importance to the upper tone. Yet I have never found in any treatise the statement that intervals have roots—a curious circumstance, since this fact is of primary significance for the hearing and evaluation of harmonic intervals, and since its acoustical basis is so easily established." Paul Hindemith, *The Craft of Musical Composition; Book 1: Theory*, Fourth Edition, tr. Arthur Mendel (Maintz: Schott, 1970), 68. I too believe that, for some intervals, there is likely to be a clear, simple acoustical basis for the subconscious assigning of relative importance to the two pitches. However, the approach that Hindemith proposes by way of an explanation for this phenomena—a scheme that incorporates combination tones and the so-called "rules" of tonal harmony—is difficult to follow, with all of its hemming and hawing, caveats, and feints toward "musical practice."
[44] Clarence Barlow and Henning Lohner, "Two Essays on Theory," *Computer Music Journal* 11, no. 1 (Spring 1987): 45. Polarization is shown in this article to be a byproduct—the signed component—of Barlow's formula for "harmonity."
[45] Harry Partch, *Genesis of a Music*, 182.
[46] Brian Belet and James Tenney, "An Interview with James Tenney," *Perspectives of New Music* 25, no. 1/2 (1987): 462.

This notion of being presented with "new information" or moving to an area "which is already present," can be understood by considering that audible pitches are made up of harmonic series aggregates. Given a pitch A and a pitch B whose fundamental aligns with one of the partials of A, all of B's partials align with those present in A. (see Figure 8) Therefore, we can say that A *contains B* if the fundamental frequency of B is a multiple of the fundamental frequency of A. Motion from A to B presents no new information to a listener—all of B's partials are already included in A—while motion from B to A provides new information in the form of the partials in harmonic series A that are below the fundamental frequency of B.
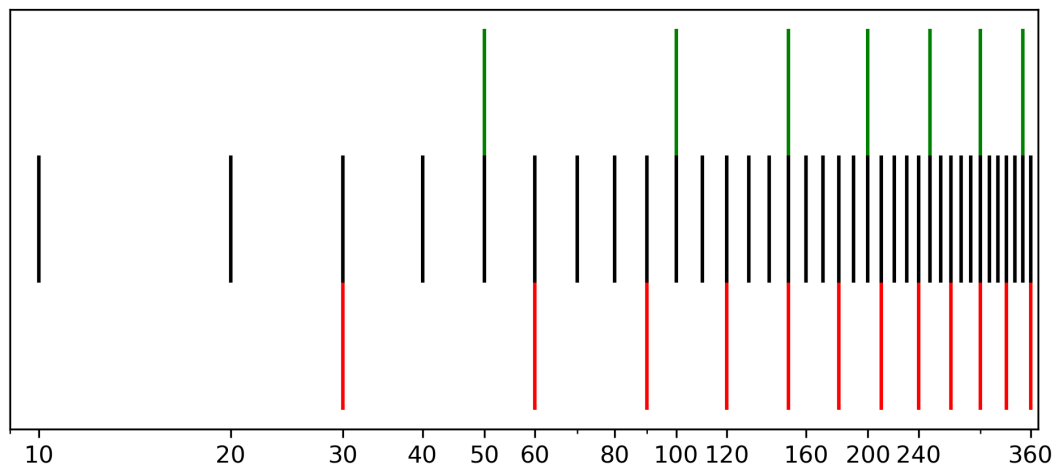
Figure 8. Harmonic series with fundamentals at 10 hz. (black), 30 hz. (red), and 50 hz. (green). All of the red and green partials align with partials in the black harmonic series; a *tone* with a frequency at 10 hz is thus said to *contain* tones at 30 hz, 50 hz, and any other frequency aligned with one of its partials.

For the purposes of this piece, since I am working with an octave-generalized model of harmonic space, I have chosen to extend this definition of *containment* to be consistent across all octaves. If any lower octave of pitch A contains pitch B, then A also contains B:

41

$$\text{if } \left(\frac{f(A)}{f(B)} = \frac{2^y}{x} \right) \text{ then } A \text{ contains } B.$$

where *A* and *B* are pitches, *f(C)* is the fundamental frequency of *C*, and *x* and *y* are positive integers.

This formulation of containment maps intuitively to the harmonic space model: "downhill" motion is akin to taking a step in the negative direction along any axis; "uphill" motion, a positive step. In addition to its ability to assign prominence within intervallic relationships, *containment* can be used to assess the structure of pitch collections in harmonic space, especially those that are ambiguous—that don't cleanly align with a shared harmonic series whose fundamental is one of the members of the pitch collection. This kind of structural analysis of harmonic space pitch sets is used in the generation of melody for the plucked string instrument (see below).

Harmonic Distance

Before detailing the procedure used to generate harmonic cycles, I must first discuss one other important innovation of James Tenney's: the *harmonic distance* (HD) function, a formal measure that is intended to record the relative "degree of consonance" or "harmonic relatedness" of an interval. It makes some intuitive sense that the nearer two points in *harmonic space* are to one another, the more harmonically related they ought to be. That is, intervals that span one step along a given axis—say, 3:1—ought to be twice as related as those which span two steps—say, 9:1. In other words, 9:1 could be said to span twice the HD as 3:1. This is a straightforward enough idea, though an issue arises in deciding how to scale

distance in one dimension against distance in another dimension. Tenney's formula for elegantly solves this through the use of logarithms, as follows:

$$HD(a, b) = \log_2(ab)$$

where *a* and *b* are relatively prime integers.[47]

This deceptively simple function might be better understood by way of an example. Take the ratio of 5:3, the just major sixth. Starting from 1:1, 5:3 can be arrived at by moving one step in the 5-dimension and one step in the 3-dimension. In order to scale these incommensurate steps, we can take their logarithm: $\log_2(5)$ = 2.32, and $\log_2(3)$ = 1.58. Steps in the 5-dimension, then, can be said to be (2.32 / 1.58), or ~1.5 times *wider* than steps in the 3-dimension. From there, we can simply add up the steps. Due to a basic additive property of logarithms—$\log(a)$ + $\log(b)$ = $\log(ab)$—it is generally simpler to just take the logarithm of their product: $\log_2(5\text{x}3)$ = $\log_2(15)$ = 3.9.

The HD function generates a different result, however, depending on which octave equivalent of an interval is being measured: *HD*(3, 2) = 2.58; *HD*(3, 4) = 3.58. This is clearly not ideal for situations—like the composition of this piece—in which octave equivalence is assumed. For this purpose, Tenney also proposed a slightly modified extension of this measure, the *octave-generalized harmonic distance*, in which all powers of two in a ratio are completely eliminated:

$$GD(a, b) = HD(a'b') = \log_2(a'b')$$

where:

---

[47] James Tenney, "The Structure of Harmonic Series Aggregates," in *From Scratch: Writings in Music Theory*, ed. Larry Polansky et al. (Urbana, Chicago, and Springfield, IL: University of Illinois Press, 2015) 258.

$$a' = \frac{a}{2^{m_a}}, \text{ and } b' = \frac{b}{2^{m_b}}$$

With maximal integer values of m_a and m_b such that *a'* and *b'* remain integers.[48]

This *octave-generalized* version of *harmonic distance* is the one used in this work.

Mode and Root Motion Procedures

As stated above, the algorithms I used for generating root motion and selecting pitch collections are based on procedures James Tenney developed for *Changes: Sixty-Four Studies for Six Harps* (1985)[49] and *Water on the Mountain…Fire in Heaven* (1985)[50]. (Specifically, my root motion procedure makes use of Tenney's concepts of *containment* and *harmonic distance*, while the pitch collection generation procedure is a direct implementation of some specific rules from Tenney's compositional method). In those pieces, Tenney used a seventy-two tone equal tempered scale (72-EDO) formed from the combined scales of six instruments each tuned to the standard twelve tone equal temperament (12-EDO) and offset from one-another by one sixth of a semitone. This scale allows for approximations of most of the important just pitches up to the 11-limit with much more accuracy than the 12-EDO scale.

These pieces consist of a series of phrases—or *clangs* to use Tenney's terminology—made up of notes selected from a pool of pitches constituting a mode. Each of these modes has up to seven pitches, one of which serves as a "root" or

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[48] Ibid., 263.

[49] James Tenney, "About *Changes: Sixty-Four Studies for Six Harps*," in *From Scratch: Writings in Music Theory*, ed. Larry Polansky et al. (Urbana, Chicago, and Springfield, IL: University of Illinois Press, 2015), 327.

[50] Giacomo Fiore, "Tuning Theory and Practice in James Tenney's Works for Guitar," *Music Theory Spectrum* 40 no. 2 (Fall 2018), 338-356.

"tonic" with respect to the others. In my piece, an algorithm specifies the modes and root motion iteratively: first it generates a mode above a starting root, then uses this mode to decide upon the harmonic motion that leads to the next root, before building a mode above that root, and so on until the desired number of modes has been generated—anywhere between 12 and 22 for a given variation. The ending root is then tested against the starting root, and if the proportion between their frequencies are found to be within a small divergence limit, the process completes. Otherwise, the mode generation algorithm starts from scratch, and repeats until it finds a progression that satisfies this condition of returning very near to its original root.

Motion from root to root consists of a step in a 3 x 5 x 7 harmonic space lattice, always in the negative direction. That is, each subsequent root *contains* the previous root. The allowable ratios for this root motion, then, are 4:3, 8:5, or 8:7. In order to choose between the three possible root motion steps, my algorithm takes into account the sum of *harmonic distances* between the trial roots and all of the pitches in the previous mode. Trial roots that have a lower value for combined *harmonic distance*—those that are "nearer" in *harmonic space*—are weighted more highly.

As stated above, my process for generating this progression of root motion aims to, for a given number of total steps, return exactly to its starting place. As any student of tuning theory will know, however, such a clean round-trip through harmonic space that lands exactly where it started without retracing its former steps in reverse is an impossibility: you will always wind up at a root frequency that is slightly-off from the initial root frequency by some small divergence. These divergences, or at least the well-known ones, have been referred to in the tuning

45

theory literature as "commas." Historically, tuning theorists have alighted upon various different kinds of temperaments in an attempt to map simple-ratio related pitch collections to fixed-pitch instruments in a way that minimizes these "commas" while allowing for harmonic modulation. This is accomplished by widening or narrowing the various just ratios—sometimes by as much as ~15 cents!—such that they are ultimately *approximations* of just ratios.

Anyone reading this text will of course know that the most well-known of these temperaments, 12-EDO, is ubiquitous in many music cultures throughout the modern world. It is difficult to convey this difference to anyone who has never heard an alternative, but compared to tuning systems employing just ratios, this temperament tends to generate a dull, flat affect that robs harmonic activity of its full potential for expressive splendor. It also only approximates a small portion of the possible just ratios that can be perceived. As such, the pitch collections—the "verticalities"—heard in my composition are fully just and un-tempered. But in order to overcome the inevitable "comma" when a cycle comes back around to its beginning, instead of tempering the ratios of individual pitch collections, I spread this tempering across time.

For example, Figure 9 displays the root motion for variation *No. 82, Coffee Mocha, Runner Bean, Garden Asparagus, Unshu Mikan*, which has a cycle of sixteen pitch collections, and therefore, sixteen root-motion steps. The ratios and harmonic space vectors of these sixteen steps are as follows:

1	2	3	4	5	6	7	8
4:3	4:3	4:3	8:5	4:3	8:7	8:7	4:3
[-1 0 0]	[-1 0 0]	[-1 0 0]	[0 -1 0]	[-1 0 0]	[0 0 -1]	[0 0 -1]	[-1 0 0]

9	10	11	12	13	14	15	16	Total
8:5	8:5	4:3	4:3	8:7	8:5	4:3	4:3	$2^{32}{:}3^9 5^4 7^3$
[0 -1 0]	[0 -1 0]	[-1 0 0]	[-1 0 0]	[0 0 -1]	[0 -1 0]	[-1 0 0]	[-1 0 0]	[-9 -4 -3]

The ratio from the starting point to the end of this cycle comes out to ~1.0179, a divergence of 30.67 cents. Rather than having this divergence sound between the last pitch collection and the recurrence of the first pitch collection—a pseudo 'wolf interval'—this divergence is divided into sixteen equal parts of 1.92 cents (30.67 cents / 16), and iteratively offsets each step. These divergences of ~2 cents each are unlikely to be noticed, especially when compared with the divergences from just ratios of ~15 cents that listeners are asked to accept every time they hear tonal harmony in 12-EDO.
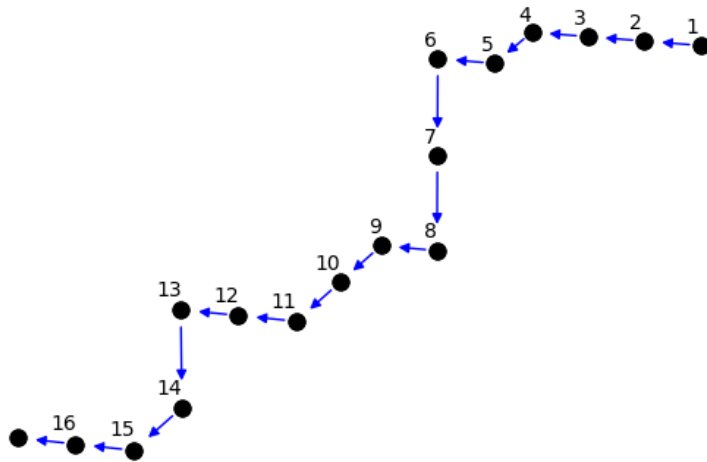

Figure 9. Root motion for harmonic cycle contained in variation *No. 82, Coffee Mocha, Runner Bean, Garden Asparagus, Unshu Mikan*, represented on a 3 x 5 x 7 harmonic space lattice.

In Tenney's pieces, each mode is generated via a process that echoes various scale-selection procedures developed and documented in the history of tuning theory, building up from the root through a series of stacked thirds: prime, third, fifth, seventh, ninth, eleventh, and thirteenth, with each third above the prime having a number of different possible ratios up to the 11-limit—that is, ratios that occupy a *harmonic space lattice* with dimensions 3 x 5 x 7 x 11. In order to select from these options, Tenney devised a set of rules, or constraints, that guided a stochastic selection procedure. In his case, certain of those rules were dependent on the position of the mode with respect to an entire sequence—in particular, the first, penultimate, and final mode in a sequence. As my progressions are cyclic, these location-specific rules don't really translate, but I adopted the other rules, as follows:

> 3) the various "thirds" between adjacent degrees may vary in size only within specified ranges: from a minimum of [9:8] to a maximum of [9:7] between prime and third or third and fifth, a minimum of [7:6] and a maximum of [4:3] between adjacent degrees above the fifth;
>
> 4) no "mistuned fifths" are allowed between non-adjacent degrees (as between the third and seventh, fifth and ninth, and so on)—i.e. any such interval must either be precisely equal to [3:2] or differ from it by an interval greater than [36:35] (a "quarter-tone");
>
> 5) no octaves (either exact or "mistuned") are allowed between those non-adjacent degrees which share a common pc, or approximate that condition too closely (as between the third and the ninth or eleventh, the fifth and the eleventh or thirteenth)—i.e. No "seventh" larger than [1.92] is allowed, and no "ninth" smaller than [1.04]. Thus, any interval between non-adjacent degrees must differ from an octave by at least [1.04] (two-thirds of a semitone);
>
> 6) if the third = [6:5], the fifth must equal [3:2]—thus disallowing both the "flat" and "raised" fifths when the third is of the ordinary minor form;
>
> 7) the raised fifth—[25:16]—is only allowed when the third = [5:4].[51]

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[51] James Tenney, "About *Changes: Sixty-Four Studies for Six Harps*," 340.

In testing this procedure, I initially allowed for ratios up to the 13-limit—ratios

derived from prime numbers 3, 5, 7, 11, and 13—but ultimately decided that the

modes this led to were too "dissonant," for lack of a better word, so as to be

distracting from the musicality of the piece,[52] and so I kept my possible ratios within

the 11-limit. I also experimented with various different limits for the maximum

allowable number of *harmonic space* steps a trial pitch may be away from the

fundamental, ultimately deciding upon a limit of four steps. These constraints allows

for the following possible ratios for each scale degree:

> Thirds: 7:6, 75:64, 6:5, 11:9, 5:4, 9:7
> Fifths: 7:5, 45:32, 3:2, 25:16
> Sevenths: 7:4, 9:5, 11:6, 15:8
> Ninths: 21:20, 135:128, 77:72, 16:15, 15:14, 35:32, 12:11, 9:8, 75:64, 7:6
> Elevenths: 21:16, 11:8, 45:32, 7:5
> Thirteenths: 77:48, 8:5, 105:64, 18:11, 5:3, 27:16, 55:32, 12:7

In tandem with the constraints listed above, the mode selection procedure is

carried out one pitch at a time, building up from the root through each stacked third.

In the stochastic selection of each successive pitch, my algorithm aims to choose

ratios that are near to one-another in harmonic space, in order to form what Tenney

refers to as "relatively compact sets."[53] This is accomplished for each potential ratio

by taking the combinatorial *HD*—the sum of the *HD*s between the potential ratio and

all of the previously selected ratios. The inverse of these sums are then used as a

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[52] "The number 13 provides an augmented triad sound, either a minor sixth added to a major triad, or a major seventh added to a minor triad. These are poignant combinations. This observation, combined with the traditional ominous meaning of the number 13, leads me to associate the meaning with death, or at least with the emotions commonly associated with the possibility of death. . . . To meditate on death is to begin to accept its inevitability, its supreme importance, and its relevance to daily living. As one of the most important life experiences it ought to occupy a correspondingly large place in the values of each person, and not simply as an overwhelming dread." Ben Johnston, "Regarding La Monte Young" in *Maximum Clarity and Other Writings on Music*, ed. Bob Gilmore (Urbana and Chicago: University of Illinois Press, 2006): 256-257.
[53] Tenney, "About Changes," pg. 71.

set of probabilities for the weighted random selection of the next ratio. In other words, trial ratios with relatively low combinatorial sums—those that are more harmonically related to the previously selected mode components— are weighted more highly than ratios with relatively high combinatorial sums.

The general idea here is that the modes end up containing pitches that are all relatively close to one-another in harmonic space, but due to its stochastic nature, this selection process avoids leading to the same exact maximally compact mode each time. Instead, this process leads to a large variety of different modes, some of which contain pitches that are relatively remote from one-another, even though in general these modes tend toward harmonic nearness.

Except for the case of the first mode to be generated, for each subsequent mode, the probabilistic weighting also takes into account the nearness of trial ratios to the pitches in the *previous* mode. This harmonic relatedness of pitches in subsequent modes—in addition to the relatedness within a given mode—allows for harmonically coherent transitions, often-times with notes shared between subsequent modes. For melodic lines in the plucked string instrument that flow over these transitions, and tone-complexes from the soft metallophone instrument that linger beyond these transitions, this enables a coherent, "musical," sensation of harmonic motion. Figure 10 displays a 3 x 5 x 7 slice of the mode transitions for *No. 82, Coffee Mocha, Runner Bean, Garden Asparagus, Unshu Mikan*.
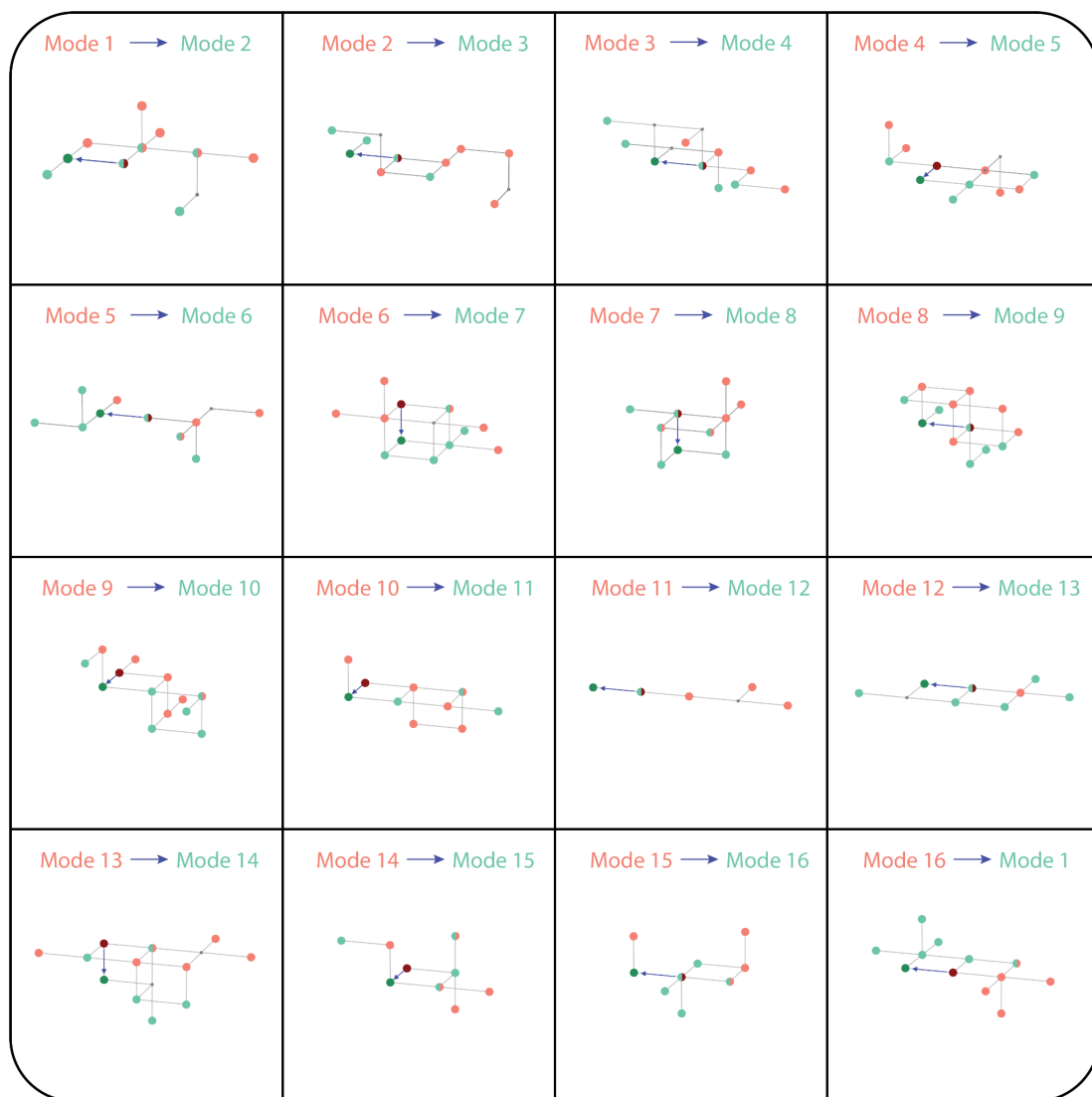
Figure 10. *Harmonic Space* representation—a 3x5x7 slice of the total 3x5x7x11 space—of all sixteen mode transitions for variation *No. 82, Coffee Mocha, Runner Bean, Garden Asparagus, Unshu Mikan*. Previous mode pitches are in salmon; next mode pitches are in light green. The root of the previous mode is dark red, and the root of the next mode is dark green. Pitches that are half one color and half another color are members of both modes. The blue arrow indicates motion from root to root. All modes have seven pitches, but some of them are outside of this 3D slice, offset by a step in the 11-dimension, and thus not visible here.

　　With the generation of a mode for a particular harmonic cycle segment, two alternative modes are also created for that segment. Each of these alternatives has a root that is *contained* by the root of the subsequent mode, but otherwise the rest of its pitches are selected according to the same stochastic method weighted toward

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relatively compact harmonic sets. These alternatives have a very low probability of appearing in the piece, something like 5%. Over the course of 10,000 iterations, that means that alternatives may appear in ~500 of the variations. If they do appear at all, it is very likely that they would only appear toward the very end of the piece, when the "real time" duration of each harmonic cycle element is potentially longer than 40 seconds. In these cases, alternatives may be interspersed between instances of the "real" mode, enabling the late-piece entrance of somewhat unexpected harmonic motion: unexpected due to a lack of saturation, though still a harmonic motion that is relatively near in harmonic space to its surroundings, and therefore consistent with the harmonic logic of the rest of the proceedings.

While the details by which these harmonic generative procedures are carried out may appear byzantine, they ultimately aim to solve a relatively simple puzzle: how to generate many instances of harmonic progressions that follow an internally consistent logic which articulate certain theoretical ideas, namely, the *harmonic space* representation and the notion of *containment*.

Were harmony a science, I might argue that the fact that the articulation of these theoretical ideas "works" in such a sensorially captivating manner means that there is some "truth" to these theoretical ideas, and that the piece serves as "proof" of this truth. But harmony is not a science, and music offers "proof" of nothing.[54]

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[54] With this statement I am responding in a general sense to the ways in which (western) music theory seems to be taught and spoken about by musicians, as if it is based on some sort of verifiable research program, as in chemistry or physics. It is difficult not to bristle and cringe whenever anyone speaks about music theory in such absolutes: "these are the rules of harmony," "a dominant seventh chord is 'unstable' and needs to be resolved in this particular manner," "interval z is more 'consonant' than interval y," etc., rather than "this is a somewhat arbitrary set of ideas and conventions that for historically mediated cultural and technological reasons we have inherited, for better or for worse, and if you are so inclined, you should be free, as a thoughtful member of the society, to come to your own conclusions about these conventions and develop your own methods for constructing and understanding music in a manner befitting your particular creative impulses."

What music can do—and what I would suggest that the harmony in this piece has the potential to do—is serve a heuristic function in expanding the scope and sophistication of a listener's *sensorial interpretive apparatus*, what Tenney might call one's "subjective set."[55] This is an expansion that relates to—pardon the cliché—one's "depth of feeling," "emotional sensitivity," and "sense of wonder."

Instrumentation

In *Ten-Thousand Views of Mount Toro*, the harmonic and temporal structures described above are articulated by three synthetic instruments, each of which—to varying degrees—resemble aspects of traditional acoustic instrumental practice while exhibiting *artificiality*. By *artificiality*, I don't mean artificial intelligence. Instead, I mean a kind of self-awareness and integrity of representation embedded in the character of these synthetic instruments.

The goal for many engineers and artists in designing and creating music with synthesized instruments is to convincingly imitate the acoustical reality and performance practice of a particular instrument with which the listener is familiar, and to perhaps enhance this illusion by simulating the instrument's diffusion through an acoustic space via some form of reverberation. When this kind of sonic simulation is created in the speech domain, in order to convincingly mimic a particular person's voice, it is called a "deep fake," and considered a duplicitous act. And yet this sort of simulation is standard practice in the world of "music production."

It was important then, for me, in designing the idiomatic musical activities and digital signal processing that define these instruments that their artificiality be clearly

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[55] James Tenney, "Meta Hodos," 51.

communicated, worn almost as a badge of honor. Ideally, these would be illusions that announce themselves as such. They bear certain resemblances to instruments listeners may be familiar with, but are flexible and uncanny enough to play upon one's expectations, drawing awareness to the undeniable fact of their artificiality. This is a digital artform, after all, not a simulation of an acoustic artform. Rather than being hidden, this artificiality is one of many strange particularities at play in this piece that a listener might be led to ponder upon while listening. By situating artificiality as a virtue, I am also implicitly trying to devalue the traditional emphasis in the Western canon on "organicism."

Since the harmonic and rhythmic aspects of this music are likely to be somewhat alien with respect to the heuristically engrained expectations of most listeners—myself included—it seemed important that there be some degree of familiarity to the timbres and event contours of the instruments themselves. This way, the instruments may be cognitively identified and taken as vehicles for the exploration of the artificial idiom, as opposed to a situation in which all aspects of the piece, from timbres, to rhythms, harmonies, and temporal structure are equally unfamiliar, and therefore mutually incomprehensible.

One way in which this artificiality is expressed is in the uncoordinated nature of the low-level rhythmic activities of these instruments, and, for that matter, of the harmonic overlays that fall out of these activities. While all three instruments observe and outline the skeletal harmonic framework of the piece, the actual events are completely uncoordinated. Any time the two "pitched" instruments seem to align in some particularly poignant harmonic way, this is a coincidence. Not a completely arbitrary coincidence, but a coincidence in the context of a generative system whose

goal is to allow for the possibility of such poignant coincidences. This lack of coordination ensures that the poignancy of such moments is all the *more* poignant due to its un-scripted way of coming about.

What I have aspired to in the design of these instruments, ultimately, is a delicate balance between familiarity and artificiality. By describing the nature of each of these instruments in detail in this section, I hope to articulate how these goals were expressed throughout the many small-scale compositional decisions that went into the creation of such a large-scale generative work.

Percussion

The percussion in this piece is both the most abstract of the three synthetic instruments and the simplest in terms of synthesis. It also is the instrument which least resembles the timbres of any particular acoustic instrument. As a percussionist myself, and someone who has performed a good deal of "contemporary music" written for percussionists, it is often assumed that there is a category of percussion instruments that are "non-pitched," and much leeway is given to performers in selecting the particular bell, tom, woodblock, etc., as they see fit. Of course, most of these instruments certainly do have a pitch, and the selection of the particular pitch, especially in pieces where harmonic relationships among other instruments are carefully specified, has a great effect on how those intended harmonic relationships are heard. The percussion in *Ten-Thousand Views of Mount Toro* takes the prospect of "non-pitched percussion" literally, by only including sounds consisting of broadband noise.

These sounds are discrete bursts of pink noise, each of which is filtered to stay within a certain frequency bandwidth, dynamically controlled by an amplitude envelope, and diffused to a particular panning location in the stereo field. Sonically, it bears some resemblance to a technique that I like to use on day one of teaching modular synthesis to electronic music students—a simple technique which generates non-simple results and is meant pedagogically to reveal to students the power of modularity and to disavow them of the reductive cultural narrative that these devices are merely glorified keyboards with timbre-adjustment controls. (It is probably not a coincidence that I was preparing to teach such a course at the same time that I designed this instrument).

The technique is to send a noise source through a low-pass filter into an envelope follower, with its threshold knob adjusted such that it sends out trigger signals that constitute a "random" rhythm. These triggers are sent to an ADR (attack, decay, release) envelope generator, which in turn controls the dynamics of a VCA (voltage-controlled amplifier) whose sound source is the very same noise which was initially fed into the envelope follower. The output of the VCA is sent to the speakers, which diffuse a stream of sound whose rhythmic and spectral characteristics are comparable to the popping of popcorn kernels. (See the flowchart in figure 11). Adjusting the knob which controls the low-pass filter frequency affects both the temporal density as well as the frequency band of the resulting stream of pops: these parameters are, in a sense, tied together. While the actual algorithms generating the rhythms, temporal density, and frequency bands of the percussion instrument in my composition are quite different from this modular synthesis technique, the central

idea of correlations tying together these different parameters that carve out particular

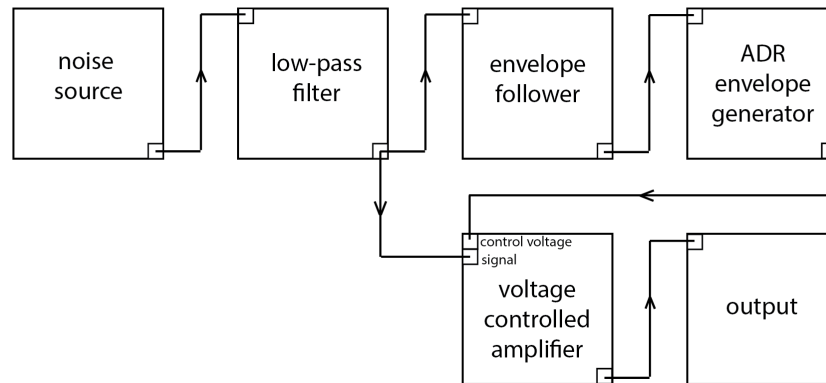regions of sonic activity is evident in both procedures.

Figure 11. Flow chart of simple modular synthesis patch resulting in sounds comparable to popcorn popping, an indirect influence on the percussion instrument.

There are, of course, many different flavors of "random" rhythms—what I

would call "non-metric temporality," rhythms that do not align with any underlying

periodic temporal grid—and many different approaches to generating such rhythmic

sequences—or for that matter generating *any* kind of sequence![56] The method I have

come to rely upon in recent years has the advantage of allowing one to specify a

degree of "non-periodicity," and therefore to explore a variety of rhythmic states

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[56] There is a certain composer friend of mine who, when seeking a chance operation, refuses to use algorithmically specified pseudo-random number generators such as would be built-in to most programming languages. Instead, this composer only uses numbers drawn from https://www.random.org, which takes atmospheric weather data as its noise source, leading to numbers that are "truly random," according to their website. Some would argue that the atmosphere is a chaotic system, ultimately deterministic and therefore not "truly random," unlike, for example, a quantum system. In any case, this composer believed that the weather data provided random numbers that "sounded better." Other composers have been known to flip coins, toss stalks of yarrow, repurpose all manner of scientific datum and "found mathematical objects," or lock themselves away for extended periods of time in complete darkness, allowing their hands to unconsciously scrawl forms on sheets of paper to be interpreted ex post facto or to enable their tourette syndrome outbursts to be captured by microphones and processed by various schema and machinery. Superstition reigns supreme when it comes to the generation of form. My particular disease/predilection for using formulae and rational systems enumerated vast numbers of times for the generation of form is no less superstitious. All of these methods represent a grasping for something solid to stand upon amid an ocean of abstraction.

ranging from periodic to knobbly, and everywhere in between. The generative

method I use is a variation on an analytical method described in the linguistics

literature, the so-called *normalized pairwise variability index* (*nPVI*), which is used to

quantify the relative proportionality of the durations of consecutive phonemes in a

passage of speech in order to compare spoken languages with one another:

$$nPVI = \frac{100}{m-1} \sum_{k=1}^{m-1} \left| \frac{d_k - d_{k+1}}{(d_k + d_{k+1})/2} \right|$$

where *m* is the number of durational elements in a sequence and d_k is the
duration of the *k*th element.[57]

Rhythmic sequences with low *nPVI* values contain minimal variation in the

durations of successive elements, and could be said to sound relatively periodic.

Those with high *nPVI* values have greater variation in the durations of successive

elements, yet they may still result in rhythmic structures that sound periodic at a

higher perceptual level, namely, if the elements are grouped by twos. For example, a

rhythm made up of elements from two possible durations whose general form is

"long, short, long, short, long, short, etc." would have a relatively high *nCVI* value, but

would still appear to be a quite periodic, exhibiting a consistent repetition of the "long,

short" rhythmic pair. In order to avoid this "higher level" sort of periodicity, I have

devised a variation on this measure that assesses the proportional relationships

between all durational elements in a given sequence combinatorially, the *normalized

combinatorial variability index* (*nCVI*):

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[57] Aniruddh D. Patel, *Music, Language, and the Brain*, (Oxford: Oxford University Press, 2008), 177.

$$nCVI = \frac{100}{N(m)} \sum_{i=1}^{m-1} \sum_{j=i+1}^{m} \left| \frac{d_i - d_j}{(d_i + d_j)/2} \right|$$

where *m* is the number of durational elements in a sequence, *i* and *j* are integers, d_i is the duration of the *i*th element, d_j is the duration of the *j*th element, and *N* is the number of pairs in the sequence. *N(x)* is equal to the number of combinations of *x* elements taken two at a time, independent of the order of elements:

$$N(x) = \frac{x!}{(x-2)!2!}$$

While the *nCVI* function is ultimately an analytical measure, I empoy it in compositions as a generator of durational sequences—or really any kind of sequence of events where it may be desirable to control the degree of self-similarity—via an iterative method that generates and tests random values against desired *nCVI* values, one sequence element at a time, repeating the process until a result is arrived at whose *nCVI* is within a small deviation from the desired value. This process enables a consistency to the character of durational sequences in that the *nCVI* of the first three elements in such a sequence is roughly equal to that of the first four elements, five elements, six elements, etc. all the way up to the full sequence. Figure 12 shows six rhythmic sequences with nCVIs ranging from 0 to 100.
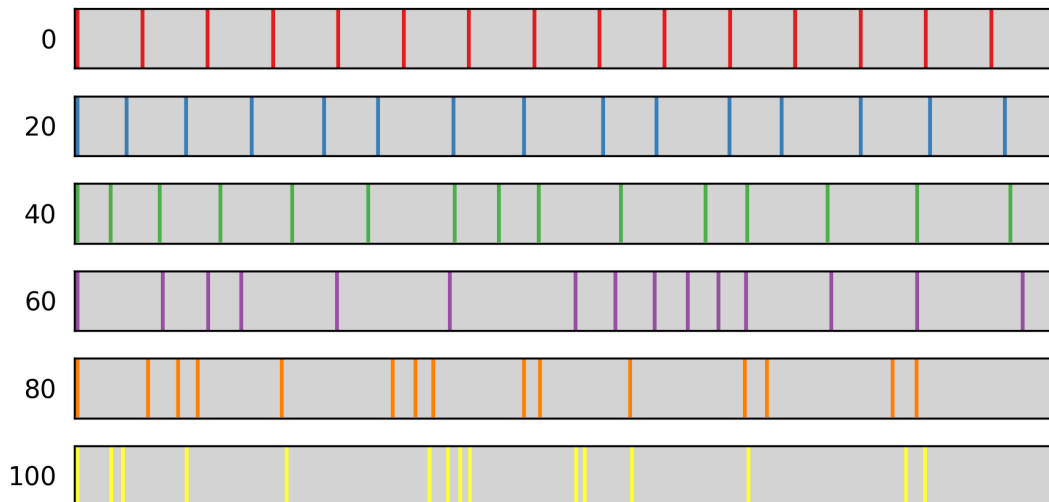
Figure 12. Six rhythmic sequences with nCVI values ranging from 0 to 100.

As I have outlined in previous sections, each variation of *Ten-Thousand Views of Mount Toro* is structurally made up of a harmonic cycle with some fixed number of durational elements all of which repeats a certain number of times while gradually slowing down. Since its spectrum is comprised of broadband noise, the percussion instrument does not articulate the harmonic content of each of these cycle elements, but does temporally align to the same structural frame. Each of these cycle elements has associated with it a set of statistical parameters which control the generation of the percussion instrumental activity within a given cycle element. Each time this cycle element recurs, that same parametric profile is used to generate the subsequent percussion timespan, now stretched out to a longer duration and overlaid with concurrent layers of activity depending on the *irama* level at the time of recurrence.

These parametric profiles are not related to or drawn from the harmonic content of a given cycle element *per se*. Instead, the harmonic content and overall gestalt of percussion instrumental activity are intended to be subconsciously

associated by correlation over the course of the piece due to repeated instances of the cycle element: each time a particular flavor of harmony recurs, it is accompanied by an arbitrarily corresponding flavor of percussion activity. My working assumption is that for a perceptive listener, with each passing cycle, these correspondences become more and more "intuited," such that each recurrence is increasingly satisfying in its adherence to these learned correspondences.[58]

Over the course of a variation of the piece, as the *irama* level proceeds from I to IV, extra layers of percussion activity are overlaid. During *irama* I, for example, only one layer of percussion activity occurs for a given cycle element, in the lowest frequency range and lowest temporal density. During *irama* II, two layers of percussion activity occur, with the second layer being higher and faster than the first. This continues through to *irama* IV, during which time there are four layers of percussion activity—four overlaid "timespans"—occurring simultaneously, as if throughout the course of the performance, a percussionist begins with stoic rhythms on the bass-drum, before adding in faster, but measured, rhythms on a tom, eventually bringing in the snare and ride symbol, comprising a four-limbed full-body Elvin Jonesian[59] dance, an evenly spread frequency/temporal-density environment.

The parameters that feed into the percussion timespan generation function, and which are consistent through each recurrence of a particular cycle element, are as follows:

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[58] I do not think that a listener need necessarily ever be able to point out explicitly how this sort of correspondence plays out in a particular instance, but it is my belief that this kind of subconscious correspondence-forming heuristic activity is at play whenever perceptive listening takes place, and that such correspondences, when seeded into a complex aesthetic form such as this piece, provide a possibility for listeners to experience a depth of meaning beyond the surface level features of a musical composition.

[59] John Coltrane, "Your Lady," *Live At Birdland*, recorded November 18, 1963, Impulse! A-50 1964.

- **"Musical time" temporal density**: The average number of events per "musical time" duration, in divisions of the cycle (as opposed to "real time" in seconds).
- **"Volume"**: A value which sets the total "volume" of the activity in a percussion timespan, conceived as a metaphorical 3d space in which the dimensions are 1) the average amplitude of a percussion event, 2) the average duration of a percussion event, and 3) the average frequency bandwidth of a percussion event.
- **Onset *nCVI***: Controls the generation of the relative periodicity of the inter-onset event durations.
- **"Volume" distribution values:** Sets the relative proportion of the total "volume" spread amongst the three "volume" factors: average amplitude, average duration, and average frequency bandwidth.
- **Global average center frequency**: The average center frequency for the distribution of percussion events. In practice, this is multiplied by the 1.5 ^ (*irama* level - 1), such that for timespans occurring in, say, *irama* III, which would include three layers of percussion activity, if the global center frequency is 200 hz, the center frequency of the *irama* I component would be 200 hz, the center frequency of the *irama* II component would be 300 hz, and the center frequency of the *irama* III component would be 450 hz.
- **Maximum center frequency offset**: The maximum allowable difference between the timespan's average center frequency and a particular percussion event's center frequency.
- **Maximum frequency bandwidth:** The maximum possible frequency bandwidth for all percussion events in a timespan. A frequency bandwidth value of 1/4 octave around a center frequency of 500 hz would result in a pink noise burst with a high-pass filter set at 420 hz and a low-pass filter set at 595 hz.
- **Amplitude *nCVI***: Controls the generation of the relative amplitudes of all percussion events in a timespan.
- **Duration *nCVI***: Controls the generation of the relative durations of all percussion events in a timespan.
- **Frequency bandwidth *nCVI***: Controls the generation of the relative bandwidths of all percussion events in a timespan.
- **Average attack time**: The average amount of time it takes for the envelope generator which controls the amplitude of each percussion event to go from 0 to its full amplitude level.
- **Maximum average attack bandwidth**: The maximum value that an attack time for a particular percussion event can vary from the average attack time, in log2 space.
- **Starting pan center**: The starting center pan value for given timespan. Over the course of the time span, the center pan value gradually transitions from a start position to an end position. Each percussion event in the timespan diverges by some amount from the center value at that given moment in the timespan.
- **Ending pan center**: The ending center pan value for a given timespan.
- **Maximum pan bandwidth**: The maximum allowable divergence from the momentary pan center for a particular percussion event.
- **Rest proportion**: The relative proportion of the total duration of a timespan which is spent in silence, during which there are no percussion events.

- **Rest spread**: Controls the relative number of rests in a timespan. A higher value specifies that the total rest duration will be split into more periods (each of which are shorter), while a lower value specifies a lower number of rests (each of which are longer).
- **Rest *nCVI***: Controls the generation of the relative durations of all rests in a timespan.

In terms of the actual order of events for the creation of the percussion in this piece, first, using one of two methods, a list of values whose length matches the total number of cycle elements is made for each of the above parameters. The first of these methods is the very same *nCVI* function described above: even though it was designed originally to generate rhythmic sequence duration values, the *nCVI* function is also useful for generating any list of values in which it is desirable to control the degree of proportional self-similarity among the list elements.

The other method involves an algorithm developed by James Tenney, and later dubbed "the dissonant counterpoint algorithm" by Larry Polansky, Alex Barnett, and Michael Winter.[60] The DC-alg is a statistical feedback method for creating sequences from a pool of choices which enables a stochastic and therefore "unpredictable" process in the selection of individual elements while ensuring balance among all pool members over the long term.[61] I make use of this algorithm for those parameters that span a linear space, such as the various pan position parameters: as they span from -1 to 1, there isn't any appropriate way of mapping values generated by the *nCVI* function. This is accomplished by first generating a list of linearly spaced values from -1 to 1, and then selecting a sequence from those values using the DC-alg.

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[60] Robert Wannamaker, *The Music of James Tenney: Volume 1, Contexts and Paradigms*, (Urbana: University of Illinois Press, 2021), 239.
[61] Polansky, Larry, Alex Barnett, and Michael Winter, "A Few More Words about James Tenney: Dissonant Counterpoint and Statistical Feedback," *Journal of Mathematics and Music* 5, no. 2 (2011): 63-82.

Once these parameters are set, the function that actually generates the

percussion event information is run for each *irama* level in every timespan in the

piece—each cycle element for all cycles. This function saves all relevant event

information for each percussion event to a JSON file which is later interpreted by a

synthesis function in Supercollider that, along with the other instruments in the piece,

generates the resultant audio .wav file. The specification for each percussion event

contains the following information:

- **Real time event start**: The elapsed time, in seconds, from the start of the piece in which this event begins.
- **Real time duration**: The total duration over which the amplitude envelope controlling the dynamics of this event will decay to zero.
- **Event Type**: Either "active", or "rest". Due to the idiosyncrasies of the Supercollider pattern representation, "rests" are included as space-fillers to ensure proper timing of events.
- **Amplitude**: The maximum value for the amplitude envelope that controls the dynamics of the event.
- **Pan**: A value between -1 and 1 that specifies where, from left to right in the stereo field, an event will appear to be located.
- **Attack Time**: The duration of the initial segment of the amplitude envelope, which spans from 0 to the specified amplitude value. The attack time has an outsized impact on the perception of a percussion event.
- **High-pass filter frequency**: The center frequency (in hz.) of a high-pass filter that the pink noise signal is fed through. This serves as the lower frequency limit for the sounding of the event.
- **Low-pass filter frequency**: The center frequency (in hz.) of a low-pass filter that the pink noise signal is fed through. This serves as the upper frequency limit for the sounding of the event.

Figures 13 and 14 display the timing and frequency information for all

percussion events for a particular variation: *No. 98, Blue Daisy, Chinese Broccoli,*

Clam, Deer. Figure 13 shows the "musical time" along the x-axis, making clear how

each flavor of percussion activity for a cycle-element remains consistent throughout

each cycle, while adding on additional layers of activity according to the *irama* level.

Figure 14 shows the "real time" along the x-axis, directly displaying how this activity

stretches out over the course of the piece according to the tempo curve. Figure 15

shows, in detail, all of the percussion events for a particular harmonic cycle segment.
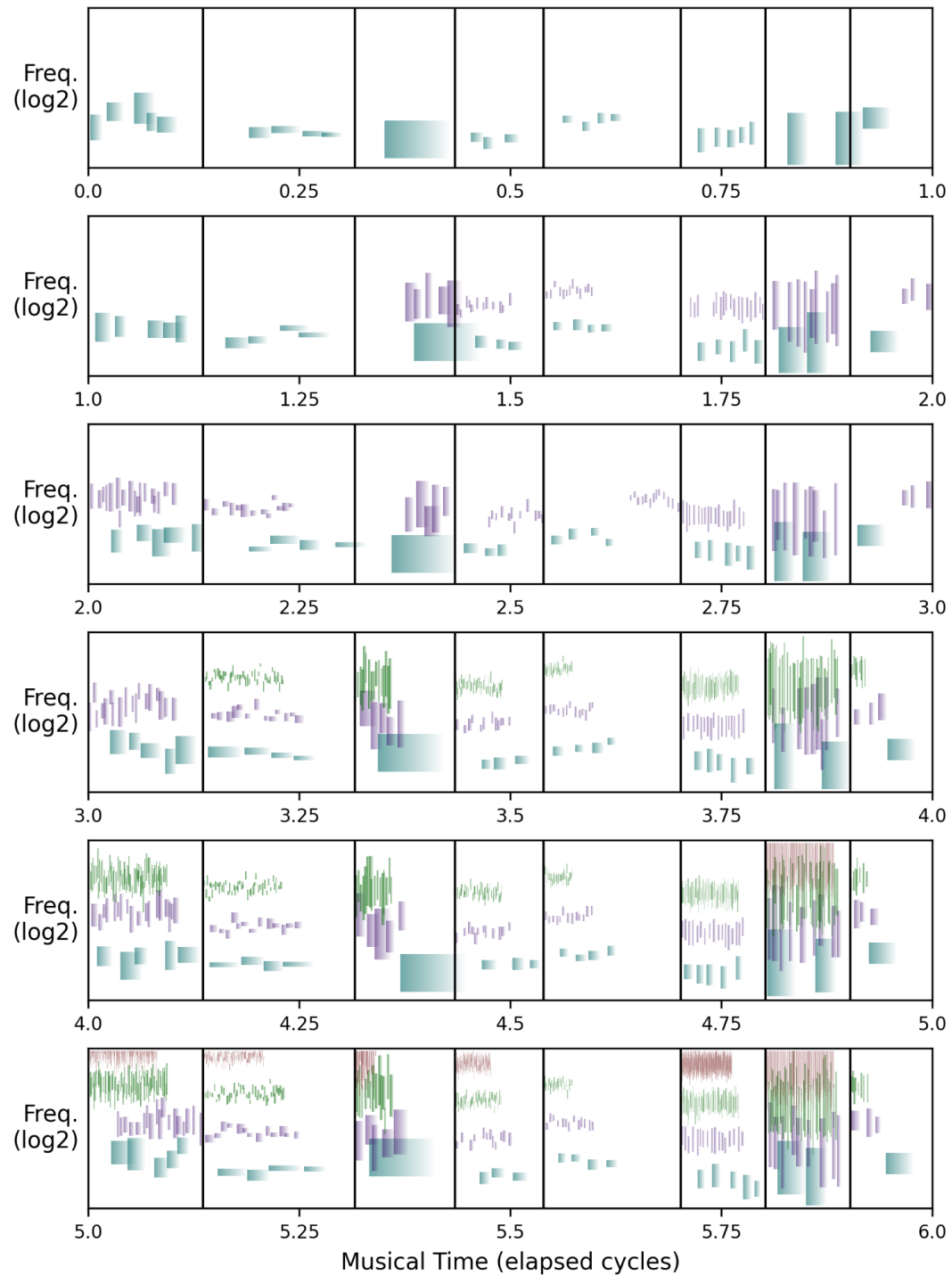
Figure 13. Timing and frequency information for all percussion events in variation *No. 98, Blue Daisy, Chinese Broccoli, Clam, Deer*, with *irama* I events in blue, *irama* II events in purple, *irama* III events in green, and *irama* IV events in red. Musical time (elapsed cycles) is displayed along the x axis. Amplitude is represented by opacity.
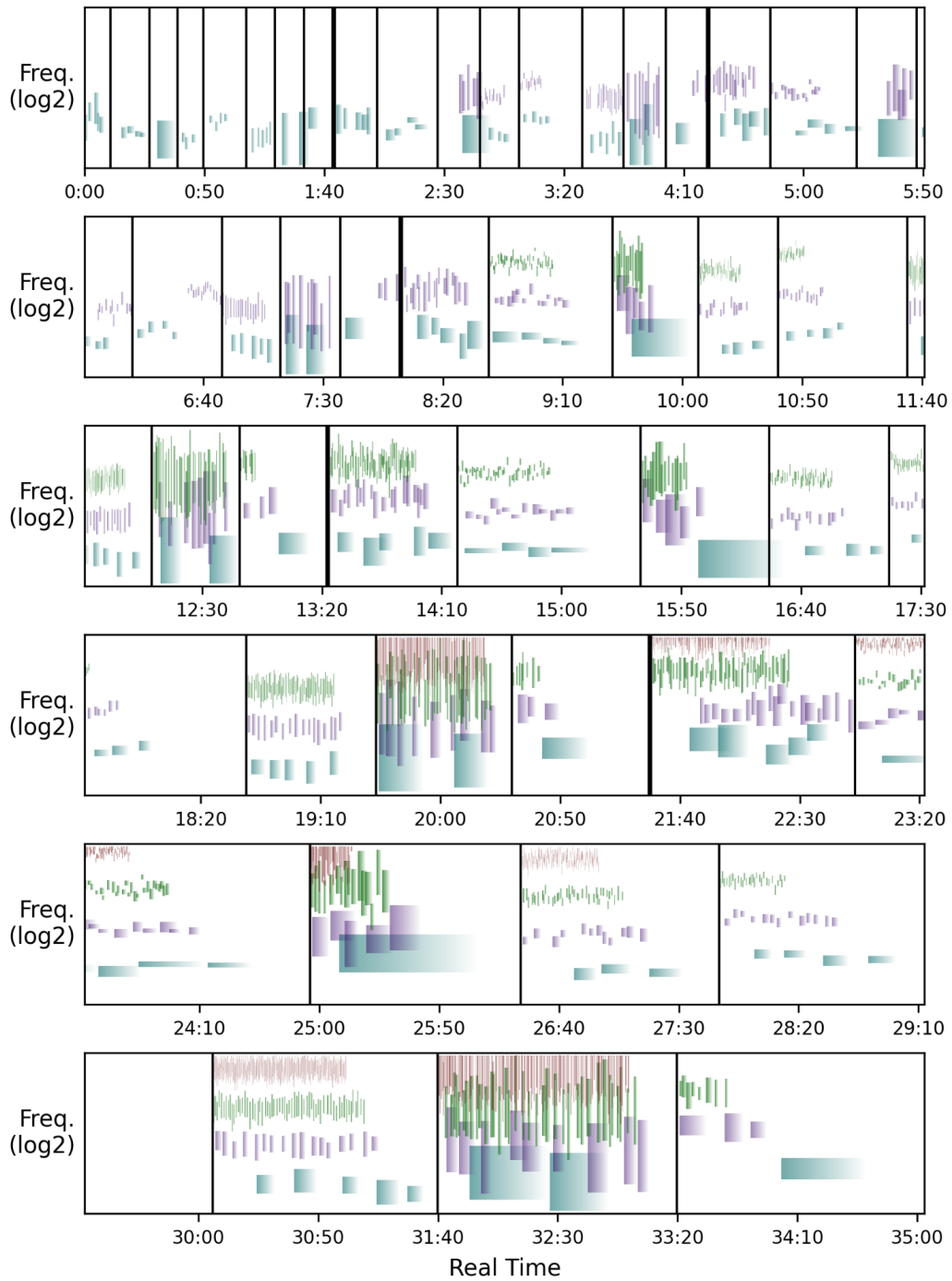
Figure 14. Timing and frequency information for all percussion events in variation *No. 98, Blue Daisy, Chinese Broccoli, Clam, Deer*, with *irama* I events in blue, *irama* II events in purple, *irama* III events in green, and *irama* IV events in red. Real time (minutes and seconds) is displayed along the x axis. Bold vertical division lines indicate a recurrence of the beginning of the cycle. Amplitude is represented by opacity.
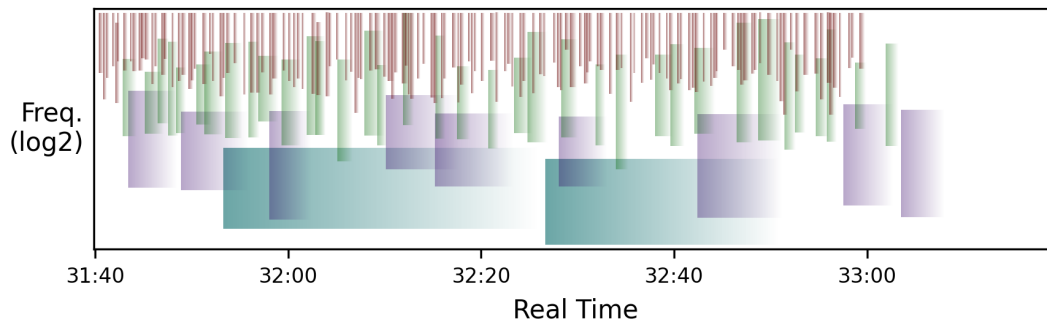
Figure 15. Timing and frequency information for all percussion events in a particular section of variation *No. 98, Blue Daisy, Chinese Broccoli, Clam, Deer*, with *irama* I events in blue, *irama* II events in purple, *irama* III events in green, and *irama* IV events in red. Real time (minutes and seconds) is displayed along the x axis. Amplitude is represented by opacity.

Soft Metallophone

The soft metallophone instrument in this piece is informed by my experience with the central Javanese percussion instrument, the *gendèr*, which I took lessons on from the virtuoso *rebab* player, composer, and Gamelan ensemble leader I.M. Harjito from 2015 - 2016 as a member of Gamelan Kusuma Laras in New York, as well as my (relatively minimal) experience with the Balinese variant duet instrument of the same name: between 2017 - 2019, I learned techniques and pieces from fellow graduate composition student Zachary Hejny. The obvious and superficial connection between the instrument in my piece and these Indonesian instruments has to do with the timbral qualities of the instrumental attacks: both kinds of *gendèr* are metallophones, struck with either a soft felt or hard wood *tabuh* (mallet), and the synthesis patch I use to articulate this instrument makes use of the "klank" Supercollider unit generator, which is meant to simulate the decaying resonant modes of an object such as a metal bar.

The design of my instrument does not attempt to capture the actual musical character of the florid patterning of these instruments as they are performed in their

idiomatic contexts, which, in the case of the central Javanese *gendèr*, is delicately

ornate and stylistically variable from performer to performer.[62] Instead, I have

implemented some very general details that I have observed in *gendèr* performance

practice, and otherwise kept these instruments in mind as a kind of mnemonic in

designing the particularities of my own synthetic instrumental performance practice.

Aside from the timbral correspondences, the feature that I have abstracted

most heavily from *gendèr* performance practice is the variety of decay-times that are

associated with different strokes. Due to the intricate muting techniques idiomatically

used on these Indonesian instruments, some notes are allowed to ring long past the

onset of the next note(s), building up a chord of hanging pitches; some notes are

muted just in time for the following note, creating a legato melodic texture; and other

notes are played while muted, a muffled staccato emenation. Since they are played

with mallets in both hands, there is much interplay involving unison dyadic attacks,

and, in the case of the duet Balinese *gendèr*, up to four-pitch unison attacks and

patterned overlapping interplay between sets of dyads.

In central Javanese *gendèr* performance, these intricate held-sustain effects

occur in the context of a music that stays within a restricted set of five[63] or so pitches.

In such a limited pitchset, all of the notes seem to "fit in" at any given moment, so

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[62] Why not try to directly model the musical characteristics of this central Javanese *gendèr* performance practice? First, I would need to study the instrument for many more years in order to gain sufficient experience to even attempt a proper simulation. Second, this performance style is so interactive and dependent on the actions of other instrumentalists in the ensemble, that to model just the *gendèr* alone outside of these contexts would be to truly misunderstand the nature of the musicality involved. Thirdly, this is an instrumental practice that remains, for the most part, within a particular mode for the duration of a composition, and the performance practice is related to *these modes* in particular. To take patterning or ornaments from their original modes and performance idiom and map them on to the strange and varied harmonic and rhythmic world of my piece would seem to me a kind of artistic misuse: culturally insensitive, but also just plain stylistically and aesthetically immature.
[63] These modes might contain five, or six notes, but each standard Javanese *gendèr* instrument only has five pitches, repeated over a few octaves.

there is no clashing when a note sustains for a long duration. In the context of my piece, in which harmonic motion leads to sometimes drastic changes in the pitch-set from moment to moment, this sustaining action becomes a potentially self-defeating effect, in which the clarity of the current pitch-set is in danger of being muddied by notes hanging over from previous harmonies.[64] While my initial inclination was to avoid the possibility of long tones sustaining beyond harmonic transitions altogether, I ultimately discovered through experimentation that, when used sparingly, the contrast between a set of gradually fading tones from a previous harmony and the new tones in a subsequent harmony—especially when these harmonies occupy different locations in the stereo field—presents the harmonic transition itself in a way that is *more* observable. Since this otherwise momentary transition is, in a way, spread out across some duration, it is available to be observed throughout an extended period of contemplation.

Furthermore, this effect of pitches sustaining long past a harmonic change, and of a single instrument occupying multiple locations in the stereo field at a given time—locations that may themselves be focused to a single point or smeared across some span—aligns with this piece's aforementioned virtue of artificiality. The timbre

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[64] This kind of muddied harmonic transition was, for me, a disappointing aspect of the otherwise compelling premiere and subsequent commercial release of James Tenney's *Changes: Sixty-Four Studies for Six Harps*, which I attended in Los Angeles in 2017 (and did some copyist work in cleaning up the score for performance). The ensemble of harpists in this performance, as a means of simplifying their heroic task in preparing this non-idiomatic over three hour long performance, decided not to recognize the notated durations of individual notes, allowing all notes to fully decay, unimpeded except for when a string needed to be re-plucked or in cases where a pedal change to a currently vibrating string would create a "buzzing" effect. The decay time of notes in the middle and upper harp registers is short enough that this did not cause much of a noticeable problem, but for strings in the lower register, which vibrate for quite a long duration, this led to a rather muddy affair with a loss of all discernable harmonic content, especially in passages with dense temporal density in the low register.
Nicholas Deyoe, *James Tenney: Changes - 64 Studies for 6 Harps*, recorded 2017, New World Records 80810, 2019, CD.

of this instrument is certainly reminiscent of an acoustic reality, but the stereo-field

presentation and performance style points toward this music's phantasmic character.

Another tip-off to this instrument's artificiality lies in the nature of its

pitch-conglomerates and their internally inconsistent decay times. Every event

played on this instrument consists of a chord made up of between two and seven

pitches, with each pitch having a unique decay time. In a particular chord, these

decay times might be quite similar to one another, and in other cases, quite

divergent. Real instruments typically don't allow for this kind of arbitrarily divergent

decay rate amongst different pitches, and so the timbral overlays that this instrument

creates follow quite an "unnatural" spectral envelope, even if they appear familiar on

the surface.

Another artificially seeded aspect of this instrument's performance practice is

the presence of near-verbatim phrase repetition,[65] each occurrence of which irrupts

out from the wash of ever-shifting non-periodic rhythmic overlays formed by all three

instruments. When a repetition appears—a totem of sorts—it casts a temporal

shadow over the proceedings, recontextualizing the momentary flow around the solid

fact of this newfound perceptual measuring stick. The probability of phrase repetition

and the maximum number of total possible repetitions of a given phrase both

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[65] This kind of off-kilter repetition scheme serves as this piece's most blatant nod to the music of Morton Feldman, with whose painfully austere music I was obsessed from the years 2013 - 2017, and only with great difficulty was I able to finally wean myself away from trying to mimic, instead turning inward, for better or worse, toward my own idiosyncratic generative methodology. This sort of hierarchically nested repetition schema is typified in Feldman's solo piano piece, *Triadic Memories*. *Why Patterns?* is another Feldman piece that explores these kinds of repetition schemes in the context of three uncoordinated (not temporally synchronized) instruments—similar to the uncoordinated overlays in *Ten-Thousand Views of Mount Toro*. (I organized and played in a series of performances of *Why Patterns?* in 2017). Morton Feldman, *Triadic Memories* (Vienna: Universal Edition, 1981). Morton Feldman, *Why Patterns?* (Vienna: Universal Edition, 1978).

increase throughout the course of a piece, like so much uncanny detritus floating in what was once an otherwise undifferentiable ocean.

The musical material for this instrument is generated hierarchically, from the top down. First, the total duration of the piece is split into four sections, one for each *irama* level. Even though the tempo curve function described above provides exact timings for transitions between *irama* levels, in deciding on the transition timings *for this instrument*, I elected to adopt a subtle aspect of central Javanese gamelan idiomatic practice: when *irama* changes occur, each elaborating instrumentalist in a gamelan chooses their own particular moment amidst a slowing tempo-curve to "double" their rhythmic activity, such that the transition ends up being a "fuzzy," non-mechanical, heterogenous transition. In order to capture this beautiful inexactitude—or at least an artificial abstraction of this beautiful inexactitude—my program allows for the *irama* transitions for this instrument to occur at times that are stochastically offset from the exact timings given by the tempo-curve. In practice, this means that this instrument may shift to a subsequent *irama* level from ~10 seconds before to ~10 seconds after the other instruments shift.

Once the total duration of the piece is split into these four parts, one by one, each part is filled with the rhythmic components of a sequence of phrases. The number of phrases in each part is decided by dividing each part's total duration by an average phrase duration value which increases for each subsequent *irama* level according to the following function: $avgPhraseDur(i) = 2 \wedge ((i + 3) / 4)$.

An *nCVI* generator function is then used to create the durations of each individual phrase. For subsequent *irama* levels, the *nCVI* value increases—*irama* I, *nCVI* = 20; *irama* II, *nCVI* = 30, *irama* III, *nCVI* = 40; *irama* IV, *nCVI* =50—which

means that there is an increasing degree of variation between the relative durations of phrases as the piece goes on. Also, an increasing proportion of each subsequent *irama* level is spent in silence—*irama* I, rest proportion = 0.1; *irama* II, rest proportion = 0.2; *irama* III, rest proportion = 0.3; *irama* IV, rest proportion = 0.4—such that this instrument gets more and more spacious throughout the course of the piece.

These silent durations are divided into a list of rests, using the same nCVI generative function, and inserted in between particular phrases via a stochastic placement method that ensures that the rests are neither all clumped up together, nor spread out completely evenly. In the context of the three overlaid instruments in the piece, having unpredictable pauses in activity allows for each of the instruments to act, at times, as soloists, as duet members, and as trio-mates, with the relationships between all three instruments ever shifting.

Once the start and end times for all phrases in the piece are established, a list of values is generated—again, by way of the *nCVI* function—and used to set the temporal density and *nCVI* values for each phrase, which in turn are used to generate the rhythmic onset component of all of the events in each phrase. A series of procedures is then carried out in order to assign all of the pitch content for these phrases. The intention behind these pitch procedures is two-fold: 1) each phrase should maintain its own "character" throughout an entire phrase and that "character" should contrast with the phrases before and after it, while 2) articulating and fitting within the underlying skeletal harmonic form. Since the phrase timing boundaries were decided arbitrarily with respect to the skeletal harmonic form, many phrases span the transitions between two (or more!) modes.

For each single-mode phrase—or for each mode within a phrase that spans multiple modes—a sub-mode is selected according to the following procedure:

1. The size of the sub-mode is randomly selected within the range 4 to 7.
2. A weight is assigned to each pitch in the mode—[1st, 3rd, 5th, 7th, 9th, 11th, 13th]—such that the "lower" scale degrees are more likely to be selected, according to the formula: $1 / \phi \text{ ^ } (i/2)$, where ϕ is the golden ratio, and i is the index of the mode element. The normalized weighting comes out to [0.26, 0.21, 0.16, 0.12, 0.1, 0.08, 0.06].
3. The sub-mode is randomly chosen according to this weighting, with no repetition allowed.

In practice, this means that for a sequence of phrases that all share the same mode, each phrase will have its own unique set of pitches selected from that mode, in which the "lower" scale degrees (the ones that are also likely to be nearest in *harmonic space*) are more likely to appear in multiple phrases. This way, the full character of the range of pitches in the mode, as well as their prioritization in terms of harmonic relatedness, is eventually expressed, though not all at once.

The pitch material in a phrase is generated by chaining the outputs of two different DC-alg streams of data—a *chord-size* stream and a *pitch* stream. The octave registration of each pitch is then randomly selected such that the pitch remains within a certain range. I will demonstrate how this plays out for the generation of the lower middle phrase shown in Example 16, Irama 1, phrase 55:

> ***Chord-size* stream**: 3, 4, 5, 4, 3, 5, 2.
> ***Pitch* stream** (in rounded hz. normalized to the lowest octave, 100-200 hz.): 113, 120, 101, 157, 143, 120, 172, 120, 143, 101, 172, 113, 157, 101, 143, 120, 172, 113, 157, 143, 120, 113, 172, 101, 120, 157.
> **Frequency range**: 100 hz. - 690 hz.
>
> Chord one (in green) has 3 notes (as specified in the *chord-size* stream). The next 3 notes in the *pitch* stream are: 113, 120, 101. The randomly selected octaves are: 1, 1, 2. Final chord frequencies: 226, 240, 404

Chord two (in purple) has 4 notes (as specified in the *chord-size* stream). The next 4 notes in the *pitch* stream are: 157, 143, 120, 172. The randomly selected octaves are: 1, 1, 1, 2. Final chord frequencies: 314, 286, 240, 688.

Chord three (in orange) has 5 notes (as specified in the *chord-size* stream). The next 5 notes in the *pitch* stream are: 120, 143, 101, 172, 113. The randomly selected octaves are: 1, 0, 1, 1, 0. Final chord frequencies: 240, 143, 202, 344, 113.

Chord four (in yellow) has 4 notes (as specified in the *chord-size* stream). The next 4 notes in the *pitch* stream are: 157, 101, 143, 120. The randomly selected octaves are: 2, 2, 1, 2. Final chord frequencies: 628, 404, 286, 480.

And so on …
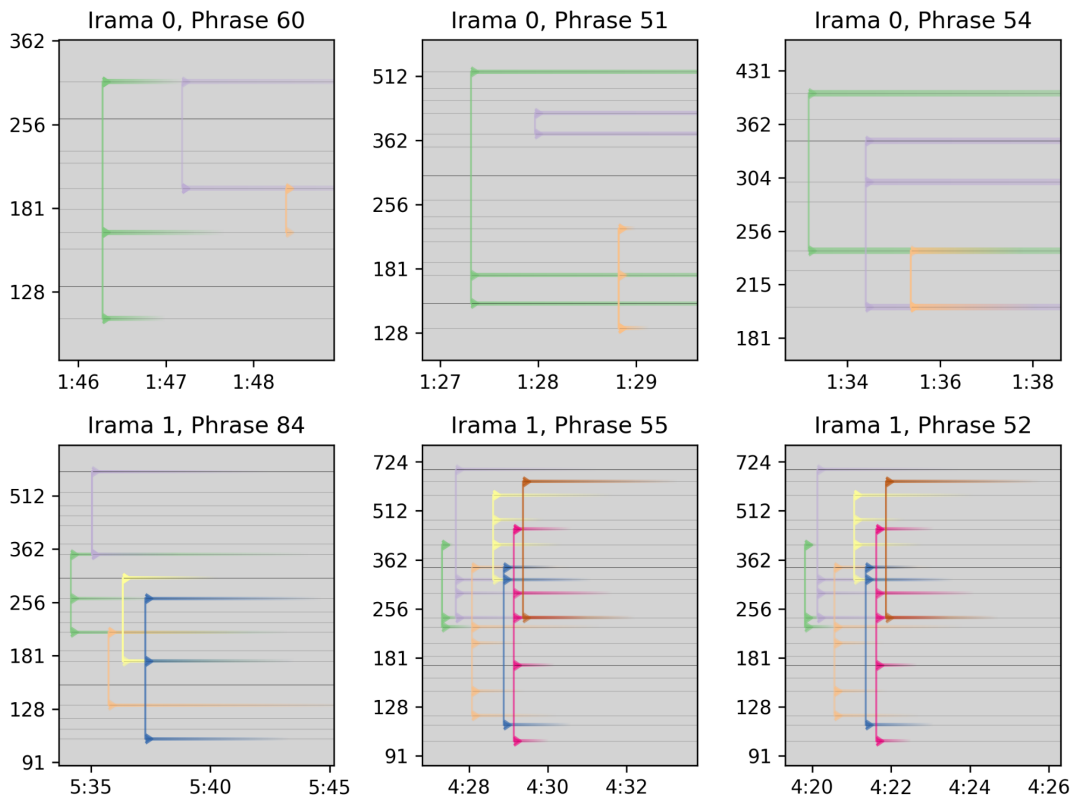
Figure 16. Three typical phrases each in *irama* I and *irama* II. Each new attack is in a different color; the amplitude of each note is represented by opacity, allowing for displaying the relative decay times of each chord, and (within each chord) each note. Mode pitches are displayed as gray horizontal lines; the "root" of the mode is a bold gray horizontal line.
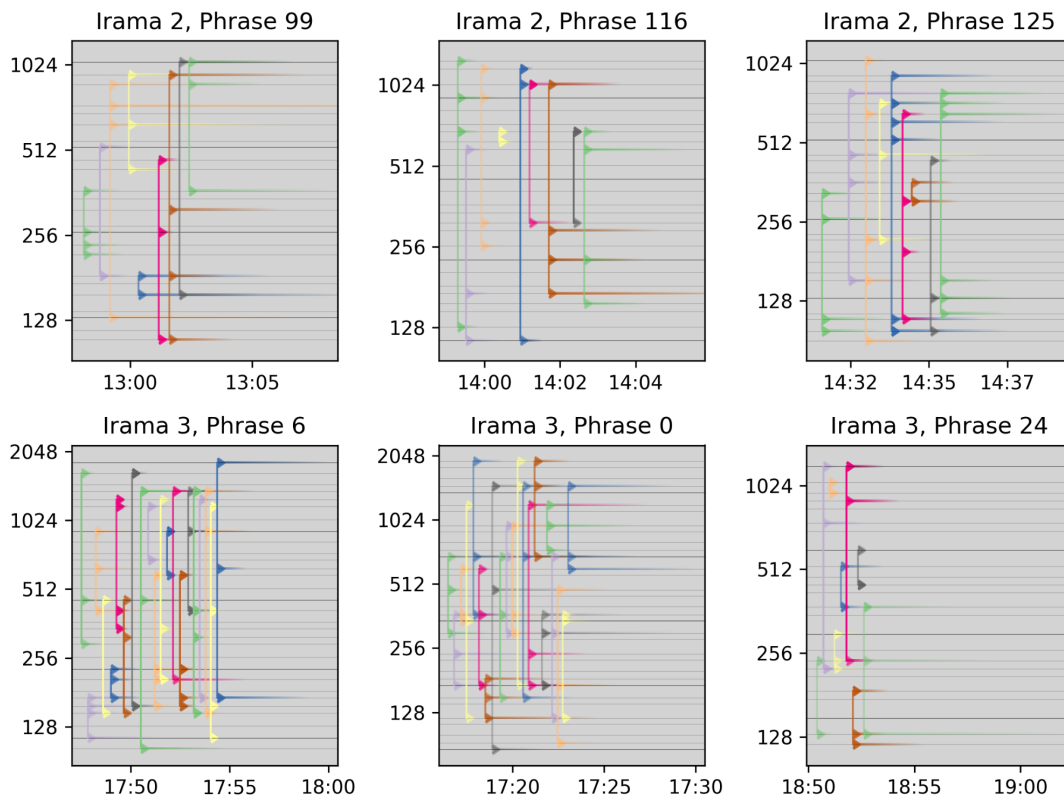
Figure 17. Three typical phrases each in *irama* III and *irama* IV. Each new attack is in a different color; the amplitude of each note is represented by opacity, allowing for displaying the relative decay times of each chord, and (within each chord) each note. Mode pitches are displayed as gray horizontal lines; the "root" of the mode is a bold gray horizontal line.

There are a number of other parametric details for each phrase, and

therefore each chord event within a given phrase, that are also generated by way of

the DC-alg:

- **Average pan position**: average location in the stereo field for events in a phrase.
- **Pan bandwidth**: maximum allowed divergence from average pan.
- **Average transient duration:** average duration of the attack envelope fed into the Klank unit generator; has a large effect on timbral perception.
- **Transient duration bandwidth:** maximum allowed divergence from average transient duration.
- **Transient curve**: the shape of the initial attack envelope.
- **Average decay center**: average decay time for for events in a phrase.
- **Decay bandwidth**: maximum divergence from average decay center.
- **Average Chord Size:** average number of pitches in each chord for a given phrase.

- **Chord size bandwidth:** maximum divergence from average chord size.
- **Average start amplitude**: average amplitude for beginning of a phrase.
- **Average end amplitude**: average amplitude for end of a phrase. (A transition from starting value to ending value plays out over the course of a phrase).
- **Amplitude bandwidth**: maximum divergence from amplitude value for different pitches in a particular chord.
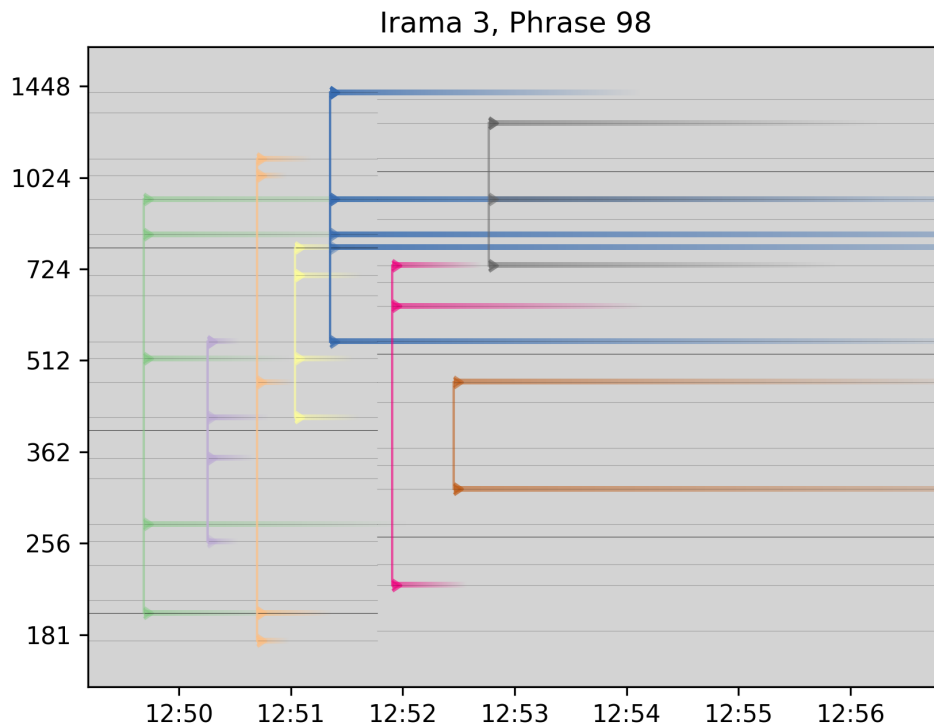
Figure 18. A single phrase that spans across a transition from one mode to another mode. Each new attack is in a different color; the amplitude of each note is represented by opacity, allowing for displaying the relative decay times of each chord, and (within each chord) each note. Mode pitches are displayed as gray horizontal lines; the "root" of the mode is a bold gray horizontal line.

Plucked String

In the same way that the soft metallophone is in some indirect way based on

Indonesian *gendèr* instruments, the plucked string instrument in this piece is

informed by my experiences learning the sitar in the context of Hindustani (north

Indian classical) music over the last four years.[66] As with the soft metallophone, there are a number of obvious timbral and morphological correlates between the sitar and this artificial instrument. For one, the synthesis of this instrument makes use of the "pluck" Supercollider unit generator, an implementation of the Karplus-Strong string synthesis algorithm.[67] This simulated string signal is fed into a bank of "all-pass" filters,[68] whose frequencies are tuned to three octaves of the pitches that make up the current mode. This is not so much a simulation or physical modeling of the action of the sympathetic strings on a sitar as a different means of achieving the same ends: namely, a way of amplifying and extending the decay time of in-mode pitches that are sounded on the "main string," and reinforcing the salience of in-mode pitches during passages (typical of this piece as well as Hindustani performance practice) in which there are a great deal of subtle glissandi between and through the "fixed" pitches.

Unlike the other two instruments, which wander about the stereo field according to various stochastic procedures, the main string of this plucked string instrument is panned to the center. For each phrase, the twenty-one all-pass filters—for the purposes of this discussion, the "sympathetic strings"—are panned to randomly selected positions in the stereo field, creating a stereo image that emanates from the center and reverberates (in a different manner for each subsequent phrase) throughout the entire field.

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[66] I am grateful to Dard Neuman for meeting with me via video-chat on a near-weekly basis throughout the majority of the pandemic and teaching me this instrument to a degree of proficiency past the first few plateaus of learning any instrument, i.e. enough to understand how little I still know.

[67] Kevin Karplus and Alex Strong, "Digital Synthesis of Plucked-String and Drum Timbres," *Computer Music Journal* 7, no. 2 (Summer, 1983): 43-55.

[68] M. R. Schroeder and B. F. Logan, "'Colorless' Artificial Reverberation," *IRE Transactions on Audio*, (1961): 209-214.

While composing this piece, I began working on a research project with Dard Neuman that centers on the development of a software platform for transcribing and notating Hindustani music. As part of this research, I developed a series of different models for representing the idiomatic melodic glissandi contours that occur in that music. Each successive model came closer to an accurate representation. The plucked string instrument in *Ten-Thousand Views of Mount Toro* makes use of the rudimentary first model, which, while not being a particularly flexible or accurate way of representing the subtle aspects of Hindustani musical performance practice, seemed appropriate for use in this piece in which I am attempting (as previously noted) to sustain a tension between acoustic instrumental practice and artificial representations thereof.

This model represents a melodic phrase as a series of pitches that each have a particular duration and wait proportion. After pausing on a pitch for the full wait proportion, the next pitch is arrived at by way of a smooth (half-cosine) interpolation or a series of two such interpolations that pass through a "pivot pitch" one scale degree above the highest of the two connecting pitches. The string is "plucked" at the beginning of each phrase, and (potentially) a number of other times during the phrase that align with the timings of non-pivot pitches; each of these plucks has its own amplitude. Figure 19 displays a typical such phrase with each of these different elements labeled.
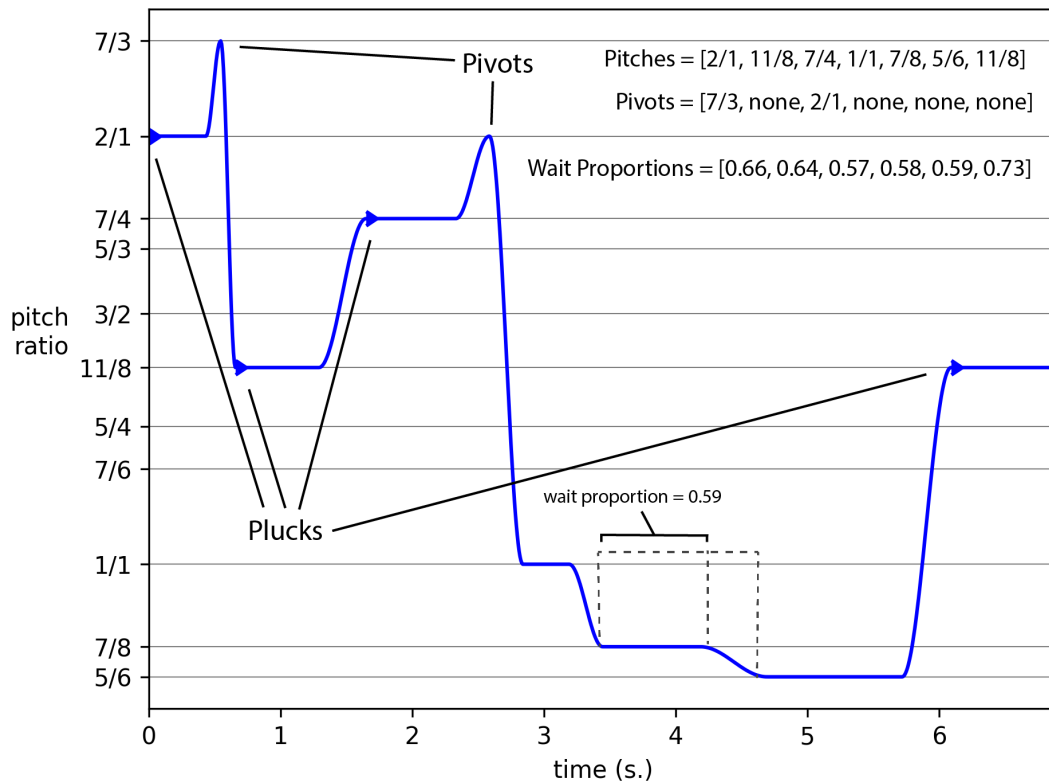
Figure 19. A typical 'plucked string' phrase.

The procedure used for the selection of melodic (non-pivot) pitches takes inspiration—again, abstractly—from the nature of the elaboration of melody in a Hindustani rāg context. There are two features of typical rāg melodic elaboration that I was interested in exploring. The first is that different pitches in a rāg seem to have different degrees of "importance," as evidenced by the fact that certain pitches appear more than others in a way that is statistically consistent across various performances of a particular rāg. The second is that there are characteristic "rules" by which musicians move between the pitches in a given rāg: certain pitches are typically only approached from, say, one scale degree above. To approach that pitch from a scale-degree below would be a sort of faux pas, or would at least signal

ambiguity for a listener trying to ascertain which rāg is being played. In order to generatively implement these two melodic concerns, I used a 7-state Markov chain[69] whose stochastic matrix is informed by the *harmonic space* structure of each particular mode.

A (first-order) Markov chain is a stochastic model useful for generating a sequence from a fixed set of possible states, in which the probabilities of selecting each potential *subsequent* state are reliant only upon the *current* state. These probabilities are generally kept track of in what is known as a stochastic matrix (sometimes called a Markov matrix or transition matrix), a grid of values that correspond to the relative probability of moving from a state labeled on left-side to a state labeled on the top.

In order to generate the probabilities associated with each state transition, I make use of the concept of *containment* described above (in the section on harmonic space). To generate the values for a particular row in the stochastic matrix, which gives the probabilities of moving from that row's state to each of the column states, the first step is to draw a set of 7 values from a dirichlet distribution, which ensures that all selections will sum to 1 without having to normalize. I then sort these values from high to low and assign them to the possible subsequent states in the following order: (1) those states (if any) that are *contained* by the current state, (2) the current state (a repetition), (3) those states (if any) that *contain* the current state, and (4) the rest. Since these are probabilities, and not fixed rules of melodic elaboration, all pitch transitions are possible, and thus in practice this leads to a diverse range of possible melodies that *tend* toward certain kinds of harmonically rational melodic motion. This

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[69] Paul A. Gagniuc, *Markov Chains: From Theory to Implementation and Experimentation* (Hoboken: Wiley, 2017): 61-92.

brings a certain kind of lively musicality to the plucked string lines which were not as compelling in earlier versions of this instrument, in which I had tried to implement either strict rule-based systems or more randomized systems. The Markov chain middle-ground approach I ended up using strikes a balance between these two possible extremes.

As in the soft metallophone instrument, some of the phrases played on this plucked string instrument span across the transitions between two or more modes. In these cases, notes are drawn from successive Markov chains, each associated with their respective modes. In designing these phrases that transition across modes, I was reminded of an anecdote a piano teacher I worked with as a teenager told me about the rehearsal habits of the American virtuoso pianist Bill Evans. As a practice method, Evans would, allegedly, break down a composition into small chunks, each usually two measures long, and loop a particular chunk while improvising, to get increasingly fluid and comfortable soloing through a particular chord transition, before stepping forward to the next two-bar chunk. This kind of fluidity across a chord-change has a way of both articulating and making clear the nature of the chord-change as well as allowing the melodic line to "float above" the segmentation provided by the harmonic structure, thus continuing the forward momentum of the music.

As with the other instruments, the nature of this instrument's elaboration style varies according to the *irama* level at the time of each phrase. At each successive *irama* level, the ambitus (pitch-range) both widens and gets higher. At the beginning of the piece, the ambitus is roughly 100 - 320 hz; by the end it has transitioned to roughly 200 - 1000 hz. The attack ratio, temporal density, average rhythmic nCVI,

and bandwidth of possible damping coefficient values (which affects the timbre of the Karplus-Strong SuperCollider synth) all likewise increase throughout the piece, leading to a situation wherein later in the piece there tend to be longer phrases in which motion between notes is faster, rhythms are less periodic, notes are more likely to be "plucked," and there is greater variability of timbre. Late in the piece, this instrument sometimes ends up playing notes at such a high velocity and covering such a wide frequency range that its spastic glissandi no longer bear resemblance to any "real" acoustic instrumental practice: if at the beginning of the piece this instrument lies in the "uncanny valley," in the case of these frenetic late-stage phrases, the instrument seems to have moved up and out onto the "fjords of absolute implausibility." A friend told me that he "burst out laughing" when confronted with one of these phrases, not so much a detraction as an exclamation point on a piece in which "the mood was bleak but peaceful and beautiful." These sorts of moments are reminders of the (intentional) artificiality of this form, and of the artificiality of the "art endeavor" writ large.

Perhaps it needs not be said, but none of the particular details and schemes by which all of these details are arranged will be apparent to a listener, but all of the particular decisions fuse to grant each instrument a certain perceptible flavor or pathway through a palette of flavors. The conception I have for such an instrument is necessarily vague from the start, and only becomes more refined through the process of programming the idea. In choosing how all of these particulars are

arranged and interconnected, I am ultimately trying to imagine a possibility space containing all of the ways this instrument might act. I think about what might result from a certain limit or stochastic procedure, and according to a certain obsessive impulse, decide if those prospective results would be "appropriate." Generally speaking, no matter how hard I try, this will lead to results that I couldn't possibly have imagined at the outset.

How all of these decisions are actually made is difficult to say, and would probably vary from day to day, but when things are clicking, I know that it is due to a certain sort of blind trust in my own sense of taste—something like Feyereband's "passion"—which in turn is reliant on my current understanding of the matrix sum of all of my past musical experiences. In this way, composing is really a self-analytical process that carries with it a heavy burden of judgment and requires the ability to hold together a great deal of different scales of information in the mind all at once, and for an extended period of time. This is why, I think, there is such a sense of relief when finishing a piece, but also such a sense of loss. On the one hand there is a freedom from the burden of holding all of this information in the mind. On the other hand, there is a feeling of being exiled from the interconnections all of this information had to one's musical experiential past, and therefore a loss of engagement with an understanding of the self and its connection to the world.

Appendix - Titles of the First Thousand Variations

No. 0 - Choko, Pea Eggplant, Bush Tea, Sweet Chestnut, Storax Balsam, Crawling Seals, Bulb Onion. No. 1 - Mexican Lime, Table Beet, Duckwheat, Bok Choy. No. 2 - Indian Potato, Roibos Tea, Maize Oil. No. 3 - Wild Briar, Asparagus, Cocoa, Red Wine, Runner Bean. No. 4 - Rock, Bulgur, Agar. No. 5 - Squaw Huckleberry, Crispbread, Sheep Cheese, Bittergourd, Macaroni, Hazel Nut, Egg. No. 6 - Langouste, Swede, Corn Grits, Vanilla, Susumber, Broccoli Rabe. No. 7 - Flatfish, West Indian Lime, Gandule Bean, Garden Asparagus, Beggar's Buttons. No. 8 - Blackberry Brandy, Yerba Mate, Arrowhead, Jasmine. No. 9 - Musk Okra, Vegetable Juice, Crispbread. No. 10 - Endive, Sheep's Head., Towel Gourd, Rapini, Vegetarian Food, Corn Oil, Fennel Flower. No. 11 - Myrrh, Saskatoon, Rowal. No. 12 - Pan Dulce, Water Apple, Peanut Oil, Ginkgo Nuts, Green Tea. No. 13 - Brackberry Brandy, Bearded Seal, Nutmeg, Duckwheat, Vegetable Pear, Egg, Nut Lettuce. No. 14 - Alpine Sweetvetch, Capsicum, Garden Asparagus, White Turnip, Leavening Agent, Vanilla. No. 15 - Milk Powder, Annual Hibiscus, Swordfish, Langustas. No. 16 - Mexican Lime, Buffalo, Bay-rum Tree, Earth Apple, Semolina, Berry Wine. No. 17 - Rose, Breussels Sprout, Egg, Sage, Mate. No. 18 - Scarlet Runner Bean, Kudanekayi, Butternut, Corn, Vanilla, Muskdana. No. 19 - Basmati Rice, Kaipakka, Jute. No. 20 - Gob, Kanaf, Jicama, Asparagus. No. 21 - Norway Haddock, String Beans, Horchata, Sweet Chestnut, Rutabaga. No. 22 - Larga Seal, Sweetcorn, Soybean Sauce. No. 23 - Soursop, Pea Eggplant, Egg, Rose Wine, Piki Bread, Mustard Spinach. No. 24 - Uchche, Coffee, Roman Coriander, Bitter Buckwheat, Vanilla, Bilberry, Pectin. No. 25 - Satsuma Orange, Red Kidney Bean, Staranise, Feta Cheese. No. 26 - Asparagus, Galu Gasturi, Wood Ear, Chicory, Mandioca. No. 27 - Golden Beet, Fat Hen, Mustard Oil, Sundaikkai, European Chestnut. No. 28 - Dragì©e, Yerba Mate, Bimli, Popcorn. No. 29 - Pepper C. Chinense, Catjang Pea, Anchovy, Gin. No. 30 - Sorghum, Bulgur, Asparagus, Pelecypoda, Feldsalat, Cabbage, Chinese Preserving Melon. No. 31 - Asliwowica, Western Serviceberry, Sunroot, Egg, Mexican Lime, Orxata, Beetroot. No. 32 - Lesser Bulrush, Black Tea, Macaroni, Lavendar. No. 33 - Manioc, Common Pheasant, Vanilla, Stravencchio, Oyster, Flaxseed. No. 34 - Corn Grits, Chocolate Mousse, Prickly Nightshade. No. 35 - Alpine Sweetvetch, Sea Canary, Fennel Flower, Karela, Dead Finish, Icing. No. 36 - Horseradish, Indian Rice, Cocoa Powder, Large Num Num. No. 37 - Korean Chestnut, Egg, Hawaii Nut, Chuckley Pear, Carrageen Moss. No. 38 - Bush Tea, Oyster Mushroom, Edible Burdock, Garden Asparagus, Buttermilk, Muskmallow. No. 39 - Pamplemousse, Capsicum, Bulgur. No. 40 - Plum Wine, Bermuda Arrowroot, India Buckwheat, St John's Bread, Vanilla. No. 41 - Pond Perch, Green Tea, Vine Spinach, Garden Beet, Pole Corn, Chinese Cassia, Milkshake. No. 42 - Nosebleed Plant, River Spinach, Lentils. No. 43 - Fruit Preserve, Chocolate, Cho-cho, Hard Liquor. No. 44 - Nattiq, Cherry Pepper, Brazil Nut, Pizza, Egg, Arabica Coffee. No. 45 - Vanilla, Semolina, Annual Wild Rice, Corn, Round Melon, Mexican Yam Bean, Cottonseed. No. 46 - Crown Daisy, Kaffir Beer, Capsicum Baccatum, Ambrette Seeds, Shaddock, Monkfish. No. 47 - Asparagus, Oat Bread, Wild Eggplant, Jellyfish, Vanilla, Velvetleaf Huckleberry, Hot Chocolate. No. 48 - Mackerel Mint, Coffee Mocha, Sweet Bay, Apple Cider Vinegar, Pak Choy. No. 49 - Persimon, Mì¢che, Fat Hen, Ground Apple. No. 50 - Slivovitz, Egg, Sea Ears, Salmon, Ginkgo Nuts, Cinnamon Vine. No. 51 - Coffee, Groundcherry, Sweet Potato, Parmesan Cheese, India Wheat, Egg, Maize Oil. No. 52 - Musk Seeds, Tallow Goud, Vanilla. No. 53 - Honey, Black Caraway, Roibos Tea, Australian Pea, Salt, Trassi. No. 54 - Asparagus, Broccoli Raab, Greater Burdock. No. 55 - Garden Hyacinth, Satsuma Orange, Cherry Pepper, Beef, Crispbread. No. 56 - Asafoetida, Black Huckleberry, Egg, Garden Mint, Canadian Whisky, Swedish Turnip. No. 57 - Pasta, Tetragon, Spotted Seal, Black Tea, Dandelion, Vanilla, Bamboo Sprouts. No. 58 - Pike, Apple Gourd, Scarlet Bean, Orxata, Peanut Butter, Sugar Corn. No. 59 - Chinese Broccoli, Beggar's Buttons, Batabi, Ginkgo Nuts. No. 60 - Bermuda Arrowroot, Bulgur, Green Buckwheat, Sherry, Abelmosk. No. 61 - Brinjal, Sweet Pepper, Waffle. No. 62 - Knoutberry, Asparagus, Kombu, Bush Tea. No. 63 - Mallard, Egg, Vanilla, Vanilla Grass, Girolle, Breadroot. No. 64 - Anchovy, Fat Hen, Emmentaler, Macaroni Wheat, Dark Tea, Red Beet. No. 65 - Sugar Corn, Strawberry Wine, Black Leather Chiton, Bottlegourd, Sugar. No. 66 - Wood Apple, Huachinango, Burdock, Storax Balsam. No. 67 - Moringa, Acorn, Araru, Cocoa, Egg, Jar Seal, Shuttlecock Fern. No. 68 - King Mackerel, Durum Wheat, Cranesbills, Zambura. No. 69 - Japanese Green, Garden Asparagus, Mat Bean, Turkey Berry, Yerba Mate. No. 70 - Vanilla, Soft Drink, Pomme Blanche, Long Melon, Parsnip, Red Wine. No. 71 - Natto, Popcorn, Goosefoot, Bayberry, Cassic, Ginkgo, Mexican Turnip. No. 72 - Pie Crust, Musk Seeds, Carrageen Moss. No. 73 - Lima Beans, Styrax, Yerba, Abalone Mushrooms. No. 74 - Semolina, Asparagus, Black Cumin. No. 75 - Brazil Nut, Teepsenee, Jambura, Sea Spinach, Egg. No. 76 - Kudanekayi, Water Oats, Ghee, Golden Tile, Malabar Plum, Beet. No. 77 - Musk Okra, Ashgourd, Thorny Burr. No. 78 - Agar, Wapiti, Mate, Vanilla, Greenthread Tea. No. 79 - Aniseed, Armagnac Brandy, Corn Oil, Spiny Lobster, Arrowroot. No. 80 - Diamondleaf Willow, Cocoa Butter, Japanese Mustard Spinach, Red Rice, Pea Eggplant, Scallion, Egg. No. 81 - Coffee Mocha, Runner Bean, Garden Asparagus, Unshu Mikan. No. 82 - Hazelnut, Papaya Brandy, Black Huckleberry, Sweetcorn, Scup. No. 83 - Allheal, Vitellaria, Bulgur, Relish, Vanilla, New Guinea Bean, Swedish Turnip. No. 84 - Plum Brandy, Peanut, Spirulina, Lambsquarters, French Toast, Annual Hibiscus. No. 85 - Fermented Tea, Cherimoya, Black Tea, Hedge Mustard. No. 86 - Bivalvia, Pimento, Egg. No. 87 - Rice, Maranta, Satsuma Mandarin, Finnish Whisky, Pepper C.

Baccatum, Milkshake, Rose. No. 88 - Garden Asparagus, Downy Cherry, Sea Ears, Hemdurgan. No. 89 - Thousand-seal, Cucumber, Green Tea. No. 90 - Maize Oil, Yuca, Field Bean, Table Beet, Parmigiano-reggiano, Sundaikkai. No. 91 - Turnip Cabbage, Pot Marjoram, Netsik, Dumpling, Honey, Filbert. No. 92 - Sheefish, Field Salad, Bamia Moschata, Vanilla. No. 93 - Mexican Oregano, Bread Wheat, Ketchup. No. 94 - Chuckley Pear, Egg, Roman Coriander, Green Tea, Mandarin. No. 95 - Roman Chamomile, Semolina, Cider. No. 96 - Asparagus, Burdock, Cornbread, Cassava, Chinese Kale, Arrack. No. 97 - Susumber, Sockeye Salmon, Uchche, Parsnip, Red Gram, Phoenicean Juniper, Bagel. No. 98 - Blue Daisy, Chinese Broccoli, Clam, Deer. No. 99 - Tartary Buckwheat, Black Raspberry, Dark Tea, Muskmallow. No. 100 - Asparagus, Indian Round Gourd, Vanilla. No. 101 - Pistachio, Milkfish, Champaca, Poire Williams. No. 102 - Yerba Mate, Kumquat, Scrapple, Oregon Yampah, Emmental Cheese, Egg, Brownbeard Rice. No. 103 - Pole Corn, Tomato, Vegetable Juice, Yam, Golden Apple. No. 104 - Broccoli, Palinka, Gob. No. 105 - Buffalo Spinach, Jute, Grass Pea, Valerian, Prawn, Nutmeg Flower. No. 106 - Vanilla, Walleye Pollock, Kugua, Miso, Bulgur, Sacred Garlic Pear, Anise Hyssop. No. 107 - Arabica Coffee, Sheep's Head., Ornamental Okra, Black Chokecherry. No. 108 - Rutabaga, Shoo-shoo Bush, Garden Asparagus, Maize Oil, Sunroot, Common Wheat, Pili Nut. No. 109 - Scallop, Dill, Egg. No. 110 - Pie Crust, Vinho Do Porto, Komatsuna, Rock, Lime, Camphor. No. 111 - Sugar Beet, Yerba, Wild Eggplant. No. 112 - Dragon Bean, Giant Pacific Octopus, Mountain Yam, Ngombo, Storax, Macadamia Nut, Soy Milk. No. 113 - Champak, Sweetcorn, Common Raccoon, Sheep Cheese, Chinese Preserving Melon. No. 114 - Cider, Capsicum Chinese, Stuffing, Egg. No. 115 - Vanilla, Berry, Pummelo, Bulgur, Asparagus, Mate. No. 116 - Hulled Wheat, Blue-bait, Soybean Sauce, Mollusc. No. 117 - Peas, Lovage, Water Morning Glory. No. 118 - Cornbread, Eppaw, Sweet Pepper, Garden Beet, Hulankeeriya. No. 119 - Pasta, Coffee, Schlivowitz, Tree Mushrooms, Muskdana, Liqourice. No. 120 - Cashew Nut, Bonito, Margarine. No. 121 - Hagala, Cook's Cabbage, Jasmine, Avocado Pear, Vanilla, Strawberry Jam, Cardamom. No. 122 - White Turnip, Ku Qiao, Creosote, Kelp, Energy Drink. No. 123 - Edible Burdock, Garden Asparagus, Breadroot Scurf Pea, Skimmed Milk. No. 124 - Dragì©e, Ceriman, Yerba Mate, Maya Nut, Pea Eggplant, Egg. No. 125 - Cocoa, Broadleaf Arrowhead, Corn, Variable Hare, Vanilla, Mat Bean, Nuts. No. 126 - Grapefruit, Port Wine, Palungu, Common Halibut, Rye. No. 127 - Opo Squash, Table Beet, Onion. No. 128 - Garden Asparagus, Yerba Mate, Nigella Seed. No. 129 - Pepper C. Chinense, Bulgur, Tree Fern, Kombu, Winberry, Konyak. No. 130 - Brussels Sprout, Solanum Torvum, Sesbania Flower, Mung, Ambrette Seeds, Balsam Pear, Turnip. No. 131 - Fudge, Vegetable Juice, Popcorn, Tapioca Pearl, Macaroni And Cheese. No. 132 - Black Treacle, Cottonseed, Mushroom, American Butterfish, Bush Tea, Egg. No. 133 - West Indian Lime, Asparagus, Galu Gasturi, Orris. No. 134 - Golden Apple, Roibos Tea, Nuts, European Mountain Ash, Arecaceae. No. 135 - Canada Rice, Square Flipper Seal, Peanut Oil. No. 136 - Cherry Pepper, Melde, Tipsin, West Indian Arrowroot, Vanilla, Fruit Wine. No. 137 - Black Gram, Semolina, Egg, Black Cumin, Indian Baby Pumpkin, Raccoon, Capsicum Baccatum. No. 138 - Mesta, Ginseng, Sage, True Seal, Russian Cheese. No. 139 - Pumpkinseed Sunfish, Celery, Pole Corn, Green Tea, Ear Fungus, Garden Asparagus, Egg. No. 140 - Flaxseed, Kaipakka, Cherry Pepper, Pigeon Pea, Bitter Buckwheat, Spring Onion. No. 141 - Cocktail, Satsuma Orange, Armagnac, Swede, Kai Lan, Happy Major. No. 142 - Potato Bread, Soy Yogurt, Vanilla, Sea Buckthorns. No. 143 - Arabica Coffee, Cinnamon Vine, Sausage. No. 144 - Gelatin Dessert, Asparagus, Kokanee Salmon, Ringed Seal, Spelt. No. 145 - Bush Nut, Yemen Gum, Musk Seeds. No. 146 - Crowndaisy Chrysanthemum, Egg, Sugar Corn, Bengal Quince, Raspberry Brandy. No. 147 - Horchata, Two-needle Piì±on, Semolina, Breussels Sprout. No. 148 - Coffee Mocha, Seerfishes, Prickly Nightshade, Processed Beef, Shellfish, Garden Asparagus. No. 149 - Beetroot, Christophine, Oregon Yampah, Breadnut Tree Seed, Jicama, Rapini. No. 150 - Jabong, Yamamomo, New Zealand Spinach, Prawn, Vanilla, Queensland Nut, Green Bean. No. 151 - Indian Rice, Meringue, Steller Sea Lion, Smoked Fish. No. 152 - Spirit, Edible Burdock, Corn, Egg, Mate, Emmenthal. No. 153 - Wattle, Vegetable Pear, Sesame, Lemon Beebrush, Crab. No. 154 - Capsicum, Common Blueberry, Japanese Mustard Spinach. No. 155 - Asparagus, Greenland Right Whale, Arrowhead, Beer, Saunf. No. 156 - Sweet Potato, Bora, Kalonji, Hibiscus Tea, Sugar Corn, Black Leather Chiton. No. 157 - Quinoa, Coffee, Mustard Oil, Lemon Grass, Gelatin, Enokidake, White Gourd. No. 158 - Turkey Berry, Yellow Zucchini, Piki Bread, Walnut. No. 159 - Jambura, Longfin Tuna, Monster Fruit, Horseradish, Distilled Beverage, Gefilte Fish, Bittergourd. No. 160 - Green Tea, Vanilla, Eppaw. No. 161 - Solanum Torvum, Musk Okra, Bulgur, Leavening Agent, Egg, Asparagus. No. 162 - Durum Wheat, Tinda, Chrysanthemum Greens, Sweet Acacia, Beef. No. 163 - Pepper C. Chinense, Sea Cucumber, Styrax, Duck-potato. No. 164 - Elder, Swede, Sweetcorn. No. 165 - Common Dab, Black Eyed Bean, Dwarf Shadbush, Anise Brandy. No. 166 - Mustard, Cashew Nut, Wheat, Mate, Tangerine, Sandalwood, Bearded Seal. No. 167 - Cherry Pepper, Swiss Cheese Plant, Butter, Soft Drink, Sunchoke, Garden Asparagus. No. 168 - Okro, Vanilla, Pear Squash, Lamb's Quarters, Bok Choy. No. 169 - Semolina, Musk Seeds, Egg, Jowari. No. 170 - Chocolate, Stravencchio, Red Mung Bean, Frog Fish And Sea Devils, Turnip. No. 171 - Chuckley Pear, Black Tea, Fried Potato. No. 172 - Common Pawpaw, Corn Grits, Syrup, Whelk, Garland Chrysanthemum, Tomato, Bermuda Arrowroot. No. 173 - Suzza Melon, Garden Pepper Cress, Leaf Cabbage, Pink Salmon, Mixed Nuts. No. 174 - Muskdana, Roman Coriander, Batabi, Burdock. No. 175 - Xalapa, Black Fungus, Quesadilla, Vanilla, Asparagus, Yerba. No. 176 - Weinbrand Brandy, Japanese Chestnut,

Cottonseed, Grapefruit Peel Oil, Bitter Buckwheat. No. 177 - Sundaikkai, Broccoli Rabe, Eggplant, Rowal. No. 178 - Bergamot, Gean, Wort, Egg, Corn Oil, Biscuit, Haddock. No. 179 - Lamellibranchiata, Schlivowitz, Brazil Nut, Neep. No. 180 - Fruit Preserve, Arabica Coffee, Kugua, Crispbread, Abelmosk. No. 181 - Sunroot, Garden Asparagus, Roquefort Cheese, Runner Bean, Large Indian Breadroot, Bulgur, Cocoa Powder. No. 182 - Greater Burdock, Prickly Nightshade, Purple Laver, Mallard Duck. No. 183 - Jostaberry, Earless Seals, Mandarine. No. 184 - Maize Oil, Old Man's Pepper, Eppaw, Japanese Bunching Onion, Yerba Mate, Egg. No. 185 - Vanilla, Fruit Juice, Water Morning Glory, Paneer. No. 186 - Helianthus, Kakarakaya, Pisco, Oriental Wheat, Margarine Like Spread, Enokidake, Topinambour. No. 187 - Ornamental Okra, Golden Beet, Asparagus. No. 188 - Cobnut, Strawberry, Pimenta, Beggar's Buttons, Apple Cider Vinegar, Grass. No. 189 - Oyster, Solanum Torvum, Pole Corn, Bilberry Wine. No. 190 - Fennel Flower, Cuttlefish, Chickling Vetch, Babaı¤u, Roibos Tea. No. 191 - Batabi, Skunk Currant, Egg. No. 192 - Flaxseed, Hard Wheat, Semolina, Breadroot. No. 193 - Enoki, Storax Balsam, Tasmania Bean, Vanilla, Lamb's Lettuce, Largha Seal, Lambsquarters. No. 194 - Sugar Substitute, Garden Rocket, Corn Grits. No. 195 - Garden Asparagus, Baked Potato, Pasta, Tuica, Wild Eggplant, Wild Boar. No. 196 - Lima Bean, Earth Apple, Chestnut, Neep, Devilfish. No. 197 - Pitanga, Bush Tea, Crawfish, Milkshake, Lappa, Triticale. No. 198 - Annual Hibiscus, Hard Liquor, Asparagus. No. 199 - Thorny Feather Wattle, Agar-agar, Vanilla, Creosote. No. 200 - Corn, Egg, River Spinach. No. 201 - Sugar Beet, Ashgourd, Camembert Cheese, Coffee, Sunchoke, Lemon, Pineapple Guava. No. 202 - Scallion, Cassia, Tyee Salmon, Red Rice. No. 203 - Dandelion, Focaccia, Sweet Chestnut. No. 204 - Leather Chiton, Kudanekayi, Breadnut, Sweetcorn, Long-podded Cowpea. No. 205 - Ear Shells, Bulgur, Blue Sailors, Pembina, Green Tea, Wasabi. No. 206 - Energy Drink, Eucalyptus, Asparagus, Spearmint. No. 207 - Madeira Wine, Egg, Pepper C. Chinense, Muskmallow, Cerasee. No. 208 - Mixed Nuts, Alpine Sweetvetch, Vanilla, Carrot, Pot Pie, Mustard, Nutmeg Flower. No. 209 - Yerba, Spring Salmon, Sweet Pepper. No. 210 - Bilolo, Vanilla, Common Wheat, Trassi, Obedience Plant, Asparagus. No. 211 - Achillea, Macaroni, Egg, Goat Pea. No. 212 - Feldsalat, Golden Beet, Conch, Milk Human, Sugar Corn, Millet Beer. No. 213 - Bottle Gourd, Broccoli Raab, Bulgur. No. 214 - Musk Okra, Boysenberry, Black Tea, Ararao, Chard. No. 215 - Butternut, Vanilla, Golden Spoon, Storax Balsam, Indian Squash, French Toast, European Pollock. No. 216 - Shortening, Coffee Mocha, Pomello. No. 217 - Clawed Lobster, Earth Apple, Black Turtle, Cherry Pepper, Egg. No. 218 - Wild Bachelors Bbuttons, Bourbon Whisky, Ground Apple, Crowndaisy Chrysanthemum, Flour, Garden Asparagus, Cocoa Butter. No. 219 - Pak Choy, Maize Oil, Tomatillo, Korean Castanea, Capsicum Chinese, Ornamental Okra. No. 220 - Swedish Turnip, Mate, Chanterelle, Gelatin Dessert, Ajwain. No. 221 - Tallow Goud, Common Balm, Greenthread Tea. No. 222 - Steller's Sea Lion, Palinka, Semolina, Cetacea, Batabi, Egg, Vanilla. No. 223 - Ceylon Spinach, Bush Tea, Basmati Rice, Prairie Turnip, Asparagus, Black Caraway. No. 224 - Corn, Goosefoot, Filbert. No. 225 - Averin, Mustard Oil, Edible Burdock, Tears Of Chios, Shoo-shoo Bush. No. 226 - Groundnut, Breakfast Cereal, Mexican Yam Bean, Indian Round Gourd. No. 227 - Yerba Mate, Galu Gasturi, Whelk, Quinnat Salmon, Radish. No. 228 - Rapini, Asparagus, Sake. No. 229 - Sundaikkai, Vanilla, Pepino, Cumquat, Syrup, Alaska Wild Rhubarb. No. 230 - Suzza Melon, Melde, Bulgur, Bunching Onion, Wood Ear, Raisin Bread, Brown Bear. No. 231 - Egg, Crown Daisy, Guwar Bean, Cottage Cheese, Crab, Hamburger. No. 232 - Neep, Distilled Beverage, Arabica Coffee, Popcorn, Kanaf, Thorny Burr, Hot Chocolate. No. 233 - Vanilla, Bauple Nut, Raspberry, Garden Asparagus. No. 234 - Mariah, Hulankeeriya, Strawberry Wine. No. 235 - Apple Cider Vinegar, Breadroot Scurf Pea, Arabica Coffee, Great Millet, Shallot. No. 236 - Flaxseed, Wild Eggplant, Garden Beet, Dayap, Bigarade Orange, Soya Bean, Dairy Products. No. 237 - Egg, Sea Squirts, Macadamia Nut, Carom Seed, Towel Gourd, Hen Of The Woods. No. 238 - Endive, Fruit Preserve, Cornbread, Semolina, Norfolk Spot. No. 239 - Calamus, Plumajillo Gordaldo, Cape Gooseberry, Asparagus. No. 240 - Vanilla, Breussels Sprout, Ljivovica, Common Octopus. No. 241 - Prickly Nightshade, Mandarin, Dark Tea, Beet, Boston Mackerel. No. 242 - Brazilian Arrowroot, Yerba, Brownbeard Rice, White Walnut, Globe Artichoke, Burdock, Soy Milk. No. 243 - Bamia Moschata, Sweet Coltsfoot, Egg, Water Convolvulus, Mollusc, Corn Oil. No. 244 - Garden Asparagus, Amaranthus, Marshmallow. No. 245 - Chinese Yam, Rakia, Fat Hen, Rice Bean, Citronella, Snow Hare, Vinegar. No. 246 - Vanilla, Turkey Berry, Downy Cherry, Beetroot. No. 247 - Bush Tea, Bitter Squash, Taco. No. 248 - Tartary Buckwheat, Painted Comber, Ambaralla, Nigella Seed, Sake. No. 249 - Egg, Garden Asparagus, Parsley, Nut Lettuce. No. 250 - Bulgur, Citrus Fruits, Rock Lobsters, Ricotta Cheese, Filbert Nut, Shiitake. No. 251 - Sweetcorn, Mandioca, Water Spinach, Edible Burdock, Cherry Pepper, Vanilla. No. 252 - Duckwheat, Agar, Musk Okra, Sugar Beet. No. 253 - Goober, Vegetable Juice, Mimosa Bush, Tofu, Black Tea, King Mackerel, Champagne. No. 254 - Pelecypoda, Hawaii Nut, Champak, Satsuma Orange, Nanking Cherry, Egg. No. 255 - Hagala, Corn Grits, Oregon Yampah, Asparagus, Craboo. No. 256 - Ginger, Table Beet, Common Ostrich. No. 257 - Milo, Matki, Swamp Cabbage, Courgette, Vanilla, Cassava. No. 258 - Dorado, Happy Major, Meatball, Cherry Pepper, Storax, White-flowered Gourd, Brandy. No. 259 - Prickly Nightshade, Sugar Corn, Pie Crust, Oyster Mushroom. No. 260 - Shrimp, Egg, Bartender's Lime, Roibos Tea. No. 261 - Chocolate Spread, Valerian, Freshwater Bream. No. 262 - Ambrette Seeds, Cooking Oil, Rutabaga, Ando Cherry, Pine. No. 263 - Pomme Blanche, Vanilla, Larga Seal, Bittergourd, Oak Nut, Apple Brandy, Lablab-bean. No. 264 - Semolina, Barley, Asparagus, Potato. No. 265 - Nutmeg

Flower, Corn, Paneer, Amaranth, Tomato, Artichoke. No. 266 - Cocktail, Cold Hardy Mandarin, Climbing Spinach, Red Algae, Hing. No. 267 - Black Tea, Pond Perch, Egg. No. 268 - Cocoa Butter, Thorny Burr, Peanut, Parsnip, Enokitake, Indian Baby Pumpkin. No. 269 - Green Turtle, Lamb's Quarters, Sesame. No. 270 - Corn, Vanilla, Finnish Whisky, Cauliflower, Yuca, Soy Milk. No. 271 - Spirulina, Highbush Huckleberry, Pimento, Macaroni Wheat, Netsik. No. 272 - Muttonfish, Coffee Mocha, Yellow Pond Lily, Hazel Nut, Satsuma Orange, Garden Asparagus. No. 273 - Peanut Butter, Lotus, Egg, Garbanzo Bean. No. 274 - Botany Bay Spinach, Other Dish, Green Buckwheat, Konyak, Kale, Pole Corn, Bagel. No. 275 - Paralithodes Camtschaticus, Ginseng, Arrowroot, Cocoa, Burdock, Uchche. No. 276 - Roman Coriander, Solanum Torvum, Vanilla. No. 277 - Jar Seal, Muquaqua, Cowberry, Semolina, Egg, Asafedity. No. 278 - Chhena, Yerba Mate, Lemon, Maya Nut, Chinese Broccoli. No. 279 - Lavendar, Wood Ear Fungus, Indian Potato, Ash Gourd, Swede, Blue Hare. No. 280 - Ketchup, Brackberry Brandy, Garden Hyacinth. No. 281 - Millet, Asparagus, Oats, Jesuit's Tea, Cornbread, Ginkgo Nuts, Blue-bait. No. 282 - Melde, Soft Drink, Breadroot, Kombu. No. 283 - Kudanekayi, Musk Okra, French Beans, Shaddock, Tasmania Bean, Vanilla. No. 284 - Pepper C. Baccatum, Yerba, Honey. No. 285 - Armanac Brandy, Rhodophyta, Tart Cherry, Red Salmon, Egg. No. 286 - Bulgur, Mexican Turnip, Mate, Red Beet, Corn Oil, Four-cornered Bean. No. 287 - Garden Asparagus, Jowari, Giant California Sea Cucumber, Grecian Laurel, Cucurbita, Muskdana, Prairie Turnip. No. 288 - Chocolate Spread, Cassic, Spread, Bauple Nut, Nutritional Drink. No. 289 - Vanilla, Coffee, Sweet Pepper. No. 290 - Fudge, Bergamot, Dates, Pombe, Cracker, Soy Yogurt. No. 291 - Pancake, Beetroot, Nutmeg Flower, Sea Ears, Pacific Jack Mackerel. No. 292 - Chickling Vetch, Squash Berry, Asparagus, Brussels Sprout. No. 293 - Maize Oil, True Seal, Tapioca Pearl. No. 294 - Gingko, Pakal, Egg, Bulgur, Edible Burdock, Eggplant, Anise. No. 295 - Yogurt, Other Bread Product, Capsicum, Green Tea, Rabbit. No. 296 - Sea Mullet, Vanilla, Hot Chocolate, Australian Pea, Chanterelle, Vermouth, Miso. No. 297 - Cornbread, Dinkel Wheat, Thousand-seal. No. 298 - Annual Hibiscus, Hulankeeriya, Turnip, Vanilla, Cotton Seed, Breussels Sprout. No. 299 - Saskatoon, Monkfish, Jasmine, Garden Asparagus, Roselle, Perciformes, Pummelo. No. 300 - Chayote, Bulgur, Purple Salsify, Madeira Wine. No. 301 - Asparagus, Sieva Bean, Roibos Tea, Pistachio, West Indian Arrowroot. No. 302 - Egg, Ornamental Okra, Sweet Marjoram, Maize Oil, Orxata, White Whale. No. 303 - Pepper C. Baccatum, Sundaikkai, Japanese Mustard Spinach. No. 304 - Lambsquarters, Rye, Icing, Vanilla, Garden Asparagus, White Turnip. No. 305 - Irish Moss, Salad, Black Cumin, Cottonseed, Wapato. No. 306 - Ceylon Spinach, Black Tea, White Bread. No. 307 - Chom Phu, Bitter Gourd, Acerola, Asliowica. No. 308 - Muskmallow, Egg, Sweetcorn, Prickly Mimosa Bush, Giant Butterbur, Walleye Pollock, Winged Bean. No. 309 - Chop Suey Green, Bread Wheat, Mixed Nuts. No. 310 - Satsuma Mandarin, Kelp, Cream Cheese, Cerasee, Bilberry Wine. No. 311 - Kale, Beet, Susumber. No. 312 - Green Tea, Bermuda Arrowroot, Vanilla, Gob, Garden Asparagus, Hibiscus Tea, Bulgur. No. 313 - Mallard Duck, Hazelnut, Egg, Wild Rice. No. 314 - Fermented Tea, Pita Bread, Leek, Jelly Ear. No. 315 - Camphor, Citrus Fruits, Black Katy Chiton, Pineapple, Millet. No. 316 - Garden Asparagus, Lingonberry, Molasses, Bottlegourd, Shoo-shoo Bush, Mountain Yam. No. 317 - Ajowan Caraway, Silverhull Buckwheat, Atlantic Redfish, Swedish Turnip, Vanilla, Teepsenee. No. 318 - Lappa, Muskdana, Peanut Oil, Raspberry Brandy, Sugar Corn, Arabica Coffee, Fat Hen. No. 319 - Ice Cream, Black Caraway, Pasta Wheat, Wonton Wrapper. No. 320 - Jellyfish, Pandanus Fasicularis, Prickly Nightshade, Egg, Semolina. No. 321 - Garden Asparagus, Blue Daisy, Cheddar Cheese, Lima Bean. No. 322 - Bush Nut, Cowberry, Okra, Brownbeard Rice, Milkshake. No. 323 - Prairie Turnip, Swede, Bush Tea, Taro, Lime, Cuttlefish. No. 324 - Dark Tea, Corn, Christophine, Orange Oil, Galu Gasturi, Ear Shells, Edible Chrysanthemum. No. 325 - Chocolate, Vanilla, Fruit Preserve, Ostrich. No. 326 - Climbing Bean, Huisache, Egg, Beer, Black Chiton, Tomato, Mate. No. 327 - Asparagus, Lappa, Nectarine. No. 328 - Corn Oil, Pacific Sardine, Manioc, Knotted Marjoram. No. 329 - Indian Round Gourd, German Turnip, Okro, Semolina, Breakfast Cereal. No. 330 - Vanilla, Bakeapple, Green Tea, Chestnut, Sweetcorn, Egg, Sweet Neem Leaves. No. 331 - Golden Beet, Multigrain Bread, Soy Yogurt, Tangerine, Manila Bean, Sunflower. No. 332 - Carrageen Moss, Mustard Spinach, Bulgur, Bookoo, Anise Brandy, Condensed Milk, Orxata. No. 333 - Abelmosk, Gelatin, Beggar's Buttons, Pimento, Ginseng. No. 334 - Greater Sturgeon, India Wheat, Coffee Mocha. No. 335 - Perlemoen, Cashew Nut, Karela, Beverage Alcolohic Other, Garden Asparagus, Liche. No. 336 - Vanilla, Maya Nut, Arrowroot, Popcorn, Bilolo, Ostrich Fern, Grass Pea. No. 337 - Ngombo, Elliott's Blueberry, Square Flipper Seal. No. 338 - Eppaw, Chinese Kale, Egg, Semolina. No. 339 - Musk Okra, Durra, Milfoil, Capsicum Baccatum, Freshwater Ling. No. 340 - Arabica Coffee, Remoulade, Devil's Dung. No. 341 - Prickly Nightshade, Cho-cho, Araru, Vanilla. No. 342 - Scotch Whisky, Possumwood, Radish, Indian Bean, Apple Cider Vinegar, Bush Tea. No. 343 - Bamia Moschata, Garden Asparagus, Energy Drink, Ginkgo Nuts, Cornbread, Soda Scones, Bok Choy. No. 344 - Rocket Salad, Topping, Nattiq, Nutmeg Flower, Pommelo. No. 345 - Jerusalem Artichoke, Ku Qiao, Egg. No. 346 - Arabica Coffee, Multiflora Bean, Vegetable Pear, Mentha Oil. No. 347 - Columbidae, Sweet Pepper, Lake Trout. No. 348 - Manchu Cherry, Enoki, Whey. No. 349 - Slivovitsa, Vinegar, Vanilla, Goosefoot, Muskmallow, Greater Burdock. No. 350 - Pomello, Beetroot, Bunk, Green Zucchini, Corn Grits. No. 351 - Squid, Egg, Asparagus, Mustard Oil, Garland Chrysanthemum, Cooking Oil, Paniphal. No. 352 - Pak Choy, Kamut, Spotted Seal, Black Gram, Cherry Pepper, Black Tea. No. 353 - Cassava, Red Wine, Satsuma Orange. No. 354 - Kaipakka, Moonfish, Jellies, Sweet Potato,

Vanilla, Bulgur, Filbert Nut. No. 355 - Maize Oil, Soy Milk, Bimli. No. 356 - Candy Bar, Flaxseed, Shanghai Cherry, Egg. No. 357 - Horseradish, Cherry Pepper, Soybean, Yuca, Breadnut. No. 358 - Kugua, Marzipan, Cinnamon, Asparagus, Hard Wheat, Swiss Cheese, Lappa. No. 359 - Cherry Brandy, Vanilla, Langustas, Mate. No. 360 - Tangerine, Aplodinotus Grunniens, Sweet Pepper. No. 361 - Mustard, Garden Asparagus, Kalonji, Cook's Cabbage, Common Linden, Lamb's Quarters, Margarine. No. 362 - Pole Corn, Sea Needle, Cottonseed, Yerba Mate, Semolina, Horchata. No. 363 - Rose, Ambrette Seeds, Carrot, Common Salsify, Vanilla. No. 364 - Tartary Buckwheat, Egg, Queensland Nut, Arrowhead, Bivalvia, Apple Gourd. No. 365 - Canadian Whisky, Corn Grits, Corn Chip. No. 366 - Girolle, Lablab Bean, Sheep Cheese, Pea Eggplant, Bitter Cherry, Water Oats, Snail. No. 367 - Ambari, Zambura, Sweet Cucumber. No. 368 - Garden Asparagus, Arabica Coffee, Cabbage, Fish Burger, Muskdana. No. 369 - Rutabaga, Peanut Oil, Buffalo Cod, Burdock, Longan, Egg. No. 370 - Aduki, Vanilla, Snap Beans, Ascidians, Nigauri. No. 371 - Potato, Fennel Flower, Corn, Pisco. No. 372 - Quinoa, Black Tea, Prickly Nightshade, Citrus Fruits, Maroochi Nut, Vanilla, Black Treacle. No. 373 - Huachinango, Bulgur, Large Indian Breadroot, Californian Jack Mackerel, Rhubarb, Blackberry Brandy, Vegetable Juice. No. 374 - Sugar Corn, Moong Bean, Nigella Seed, Turnip, Walrus, Gooseberry. No. 375 - Ashgourd, Sweet Grass, Soya Sauce, Fish Oil, Shoo-shoo Bush. No. 376 - Garden Asparagus, Vanilla, Komatsuna, Menschterkaas, Edible Burdock. No. 377 - Sesame, Soda Farls, Sorghum, Dayap. No. 378 - Mate, Prawn, Duck-potato. No. 379 - Alpine Sweetvetch, Truffle, Sweetcorn, Myrtle, New Guinea Bean. No. 380 - Liquor, Hyacinth, Pili Nut, Shortening, Cocoa, Sesbania Flower. No. 381 - Egg, Garden Asparagus, Hot Chocolate. No. 382 - Palak, Snake Bean, Ohelo Berry, Yerba, Malt, Common Persimmon, Processed Beef. No. 383 - Solanum Torvum, Vanilla, Garden Beet, River Spinach, Lake Char. No. 384 - Ground Apple, Aniseed, Popcorn, Storax, White Wine, Crawling Seals. No. 385 - Omani Lime, Mexican Turnip, Pipinola, Milk Fat. No. 386 - Bush Nut, True Sago Palm, Pepper C. Baccatum, Sweet Potato, Vanilla, Semolina, Roman Coriander. No. 387 - Muskmallow, Sucker, Egg. No. 388 - Thorny Burr, Corn, Indian Rice, Roibos Tea, Scented Matgrass, Blueberry. No. 389 - Milkshake, Kohlrabi, Water, Shoo-shoo Bush, Mexican Yam Bean. No. 390 - Balsam Pear, Garden Asparagus, Thousand-leaf, Japanese Persimmon, Gin, Cotton Seed, Sea Squirts. No. 391 - Chop Suey Green, Spinach, Dinkel Wheat, Other Pasta Dish. No. 392 - Vanilla, Bread, Turkish Gram. No. 393 - Abalone, Musk Seeds, Coffee, Asparagus, Egg. No. 394 - Beech Nut, Maize Oil, Mandarin, Greenland Turbot, Beet, Leaf Cabbage, Turkey Berry. No. 395 - Obedience Plant, Earless Seals, Melde. No. 396 - Dwarf Cherry, Tundra Hare, Semolina, Capsicum Baccatum, Round Melon, Swede. No. 397 - Anise Hyssop, Cognac Brandy, Storax. No. 398 - Cherry Pepper, North Pacific Giant Octopus, Vanilla, Soft Drink, Green Tea. No. 399 - Asparagus, Sesame, Citronella Grass, India Buckwheat, Tea, Breussels Sprout. No. 400 - Black Cumin, Nelma, Sweetcorn, Guar. No. 401 - Unshu Mikan, Munster Cheese, Japanese Green, Shallot, Egg. No. 402 - Mandioca, Stuffing, Golden Beet, Bush Tea, Sweetcorn, Wasabi. No. 403 - Vanilla, Palinka, Butternut. No. 404 - Indian Squash, Chinese Long Bean, Semolina, Krill, Happy Major. No. 405 - Capsicum, Pan Dulce, Jute, Malay Apple, Atlantic Salmon, Saskatoon Berry, Annual Hibiscus. No. 406 - Asparagus, Basmati Rice, Chinese Broccoli, Vanilla, Abalone Mushrooms, Mate. No. 407 - Sugar Beet, Mackerel Mint, Clam, Bermuda Arrowroot. No. 408 - Fruit Juice, Stravencchio, Setwall. No. 409 - Egg, Adzuki Bean, Kumquat, Potato Puffs, Simply Piì±on. No. 410 - Chinese Preserving Melon, Maya Nut, Black Chiton, Garden Asparagus. No. 411 - Tomato, Corn Oil, Hoot Owl, Pectin. No. 412 - Alpine Sweetvetch, Heart Of Palm, Canada Rice, Chinese Chestnut, Capsicum Chinese, Cucumber. No. 413 - Cupuaâ u, Tipsin, Semolina. No. 414 - Coffee Mocha, Fennel Flower, Mountain Yam, Dead Finish, Clove, Keta Salmon, Mountain Peach. No. 415 - Egg, Parsnip, Spirit, Vanilla, Sundaikkai. No. 416 - Langouste, Asparagus, Australian Pea, Malabar Spinach. No. 417 - Chrysanthemum Greens, Popcorn, Dark Tea, Cottage Cheese, Abelmosk. No. 418 - Cobnut, Ku Qiao, Jerusalem Artichoke, Shiitake, Hibiscus Tea, Swamp Cabbage, Mandarin Orange. No. 419 - Arabica Coffee, Eppaw, Egg. No. 420 - Boegoe, Pipinola, Potato Chip, Bengal Gram, Heart Cockle, Shrimp. No. 421 - Nigella Seed, Greater Burdock, Garden Asparagus, Ptarmigan, Tapioca Pearl. No. 422 - Percoidei, Bitter Berry, Solanum Torvum, Japanese Whisky. No. 423 - Neep, Nuts, Pak Choy, Maize Oil, Sauce, Vanilla. No. 424 - Musk Okra, Styrax, Yerba Mate. No. 425 - Wheat, Locust Bean, Scallion, Linesider, Lotus. No. 426 - Ormer, Soya Bean Oil, Soft Drink, Pommerac, Black Caps, Duckwheat, Tinda. No. 427 - Satsuma Orange, Bulgur, Mate, Flaxseed. No. 428 - Jowani Badian, Egg, Leaf Cabbage. No. 429 - Ringed Seal, Cherry Pepper, Pepper C. Chinense, Vanilla, Corn Grits, Milk Human, Macadamia Nut. No. 430 - Brazilian Arrowroot, Ginseng, Asparagus, Vinho Do Porto, Triticale. No. 431 - Pakal, Kai Lan, Elf, Hushpuppy, Crowndaisy Chrysanthemum, Common Sorrel. No. 432 - Salt, Goosefoot, Other Bread Product, Cocoa Powder, Cornbread. No. 433 - Velvetleaf Huckleberry, Green Tea, Sea Squirts, Korean Chestnut. No. 434 - Cedar, Beggar's Buttons, Edible Chrysanthemum. No. 435 - West Indian Arrowroot, Cocoa, Sea Spinach, Margarine Like Spread, Black Cumin, Egg. No. 436 - Susumber, Garden Asparagus, Malt, Monsterio Delicio, Wasabi, Orxata, Schlivowitz. No. 437 - Radish, Pamplemousse, Mushroom. No. 438 - Corn Grits, Suzza Melon, Vanilla, Bulgur. No. 439 - Black Tea, Broccoli Rabe, Ocean Perch, Irish Moss, Kudanekayi, White Walnut. No. 440 - Chinese Plum, Pickerel, Dolichos Bean, Xalapa, Garden Valerian. No. 441 - Payqu, Lappa, Macaroni. No. 442 - Oat Bread, Indian Potato, Crispbread, Flaxseed, Coffee Mocha. No. 443 - Asparagus, Egg, Mandarine, Wine, Langustas, Strawberry,

Icing. No. 444 - Gandule Bean, Tilsit Cheese, Common Mullet, Swede, Vanilla, Wild Eggplant. No. 445 - Hagala, Japanese Mustard Spinach, Corn Oil. No. 446 - Macaroni And Cheese, Ambrette Seeds, Milkshake, Roibos Tea, Camphor, Champak. No. 447 - Other Meat Product, Mexican Turnip, Spelt, Lettuce. No. 448 - Goa Bean, Burdock, Soybean Sauce, Garden Asparagus, Distilled Beverage. No. 449 - Turnip, Large Indian Breadroot, Mexican Lime, Water Chestnut, Cuaresmeno, Crab. No. 450 - Vanilla, Semolina, Burbot, European Chestnut. No. 451 - Kalonji, Fruit Preserve, Egg. No. 452 - Bush Tea, Cocktail, Northern Sea Lion, Tuica, Shougri, Garden Asparagus, Maitake. No. 453 - Rice, Water Morning Glory, Prickly Nightshade, Storax Balsam, Corn Chip. No. 454 - Bison Grass, Sweetcorn, Shi Tree, White-flowered Gourd, Pea Bean. No. 455 - Cinnamon Vine, Bamia Moschata, Velvetleaf Blueberry, Table Beet, Lambsquarters, Humpback Salmon. No. 456 - Vanilla, Yerba, Mì¢che. No. 457 - Greater Burdock, Garden Sorrel, Agar-agar, Lime, Crispbread, Almond. No. 458 - Kelp, Sugar Corn, Vinegar, Scotch Whisky, Asparagus, Cherry Pepper, Bulgur. No. 459 - Pipinola, Brussels Sprout, Egg, Elder. No. 460 - Fever Grass, Rutabaga, Scottish Mackerel, Garland Chrysanthemum, Black Caraway. No. 461 - Arabica Coffee, Larga Seal, Korean Cherry, Rice Bean. No. 462 - Chhena, French Beans, Oregon Yampah, Hard Wheat, Cinnamon, Vegetable Juice. No. 463 - Manioc, Mate, Cumquat, Cocoa Butter, White Gourd, Vanilla, Kale. No. 464 - Ornamental Okra, Egg, Gefilte Fish, Corn Oil, Oyster, White Turnip, Gelatin. No. 465 - Cherry Brandy, Black Tea, Sweet Chestnut. No. 466 - Garden Asparagus, Seaberry, Grass Pea, Righteye Flounders, Sweet Pepper, Muttonshells, Alpine Hare. No. 467 - Annual Wild Rice, String Beans, Edible Burdock, Broccoli Raab, Semolina. No. 468 - Cocoa Powder, Tortilla Chip, Yam, Satsuma Orange. No. 469 - Neroli Oil, Bay, Kugua, Bearded Seal, Kanyak, Roman Coriander. No. 470 - Coffee, Pole Corn, Annual Hibiscus. No. 471 - Asparagus, Wormseed, Beetroot. No. 472 - No-eye Pea, Vanilla, Egg, Tree Mushrooms, Florida Pompano, Cheese, Orxata. No. 473 - Brazil Nut, Gean, Leavening Agent, Crawfish. No. 474 - Pimento, Tofu, Armanac Brandy. No. 475 - Duckwheat, Opo Squash, Roibos Tea, Pomme Blanche, Dandelion, Chinese Cinnamon. No. 476 - English Chamomile, Gob, Maranta, Corn, Garden Asparagus. No. 477 - Clove Currant, Cold Hardy Mandarin, Water Convolvulus. No. 478 - Marshmallow, Malwa, Squid, Corn Salad, Sweet Potato, Galu Gasturi, Horchata. No. 479 - Highbush Huckleberry, Common Bream, Semolina, Chinese Broccoli. No. 480 - Abalone Mushrooms, Oak Nut, Egg, Asparagus, Maize Oil. No. 481 - Black Tea, Vanilla, Earth Apple, Cherry Pepper. No. 482 - Arrack, Bonavist Bean, Rye, Long Melon, Creosote, Common Pheasant. No. 483 - Dulce De Leche, Nattiq, Jambura, Bulgur. No. 484 - Eppaw, Rainbow Smelt, Table Beet. No. 485 - Spring Onion, Thorny Burr, Sugar, Lovage, Hedge Mustard, Pimbina, Sherry. No. 486 - Wild Rice, Muskdana, Asparagus, Bush Tea, Egg. No. 487 - Myrtle Pepper, Corn Grits, Piki Bread, Cardoon, Sundaikkai, Nutritional Drink, Nachos. No. 488 - Styrax, Vanilla, Sieva Bean, Pecans, Bulgur. No. 489 - Broadleaf Arrowhead, Pear Squash, Jellyfish, Swedish Turnip. No. 490 - Pak Choy, Yerba Mate, Tree Ear Fungus, Scotch Spearmint, Edible Chrysanthemum, Dolphin Fish, Lady's Fingers. No. 491 - Scotch, Golden Spoon, Durra. No. 492 - Egg, Mexican Lime, Nutmeg Flower, Hard Alcohol, Ketchup, Boegoe. No. 493 - Wapato, Mate, Muskmallow, Kingfish, Energy Drink, Garden Asparagus. No. 494 - Peanut Butter, Cranesbills, Cornbread, Cluster Bean. No. 495 - Staranise, Giant Pacific Octopus, Vanilla. No. 496 - Tomato, Bourbon Whisky, Carrot, Chinese Strawberry, Kakarakaya. No. 497 - Kale, Pistachio, Egg, Garden Asparagus, Bigarade Orange. No. 498 - Fried Potato, Feta Cheese, Wild Rice, Ear Fungus. No. 499 - Whelk, West Indian Arrowroot, Capsicum Chinese, Salmon, Green Tea, Agar, Asparagus. No. 500 - Bataw, Semolina, Bamia Moschata, Cauliflower, Fat Hen. No. 501 - Colocasia, Opaque Beer, Breadnut Tree Seed. No. 502 - Milo, Corn, Coolie Plum, Batabi, Pie Crust, Vanilla. No. 503 - Relish, Bush Tea, Fruit Juice, Shoo-shoo Bush, Indian Baby Pumpkin. No. 504 - Jasmine, Egg, Red Beet. No. 505 - Garden Asparagus, Ginkgo, Vanilla, Strawberry Jam, Northern Sea Lion, Oats, Potato. No. 506 - Snow Hare, Port Wine, Four-angled Bean, Sheefish, Rapini, Sesame. No. 507 - Field Lupine, Popcorn, Nigella Seed, Warrigal Greens And Warrigal Cabbage, Ground Apple. No. 508 - Asparagus, Egg, Coffee, Sweet Pepper, Pommelo, Bay Fish. No. 509 - Round Melon, Parsley, Topinambour. No. 510 - Ram's Head, Lentils, Casein, Pepper C. Chinense. No. 511 - Kumquat, Chocolate, Yerba, Grass, Beetroot, Jowari, Rhodophyta. No. 512 - Malt Whisky, Pacific Herring, Vanilla. No. 513 - Pole Corn, Soy Milk, Arabica Coffee, Mexican-tea, Parmigiano-reggiano, Clary. No. 514 - Hushpuppy, Turnip Cabbage, Focaccia, Butternut, Garden Asparagus, Bulgur, Long Melon. No. 515 - West Indian Lime, Pimento, Wild Crepe Myrtle, Netsik. No. 516 - Flaxseed, Creosote, Taro, Egg, Beech Nut. No. 517 - Common Cornsalad, Spirit, Pumpkin, Asparagus, Sugar Corn, Shortening, Chop Suey Green. No. 518 - Hyacinth Bean, Pasta Wheat, Lamb's Quarters, Coffee Mocha. No. 519 - Touladi, Sparkleberry, Sugar Beet, Chinese Yam, Ear Shells, Wort, Curd. No. 520 - Black Leather Chiton, Swamp Cabbage, Vanilla. No. 521 - Happy Major, Tangerine, Cocoa, Ooil-seed Camellia, Shoo-shoo Bush. No. 522 - Honey, Karela, Greylag Goose, Hawaii Nut, Corn Oil, Slivovitz. No. 523 - Egg, Triticale, Roibos Tea, Jack Mackerel. No. 524 - Asparagus, Spread, White Pea. No. 525 - Golden Beet, India Wheat, Slivovitza. No. 526 - Pot Marjoram, Mandarin Orange, Old Man's Pepper, Wapato, Corn Grits, Teepsenee, Ceylon Spinach. No. 527 - Sunflower, Fennel Flower, Cottonseed, Vanilla. No. 528 - Chayote, Lamellibranchiata, Lambsquarters, Capsicum, Pembina, Asparagus. No. 529 - Egg, Musk Okra, Brismak, Rice Cake, Bakery Products. No. 530 - Beggar's Buttons, Semolina, Catjang Pea, Sourdough, Sweetcorn, White Walnut. No. 531 - Common Mint, Radish, Mexican Lime. No. 532 - Yerba, Sheep's

Head., Egg, Duck-potato. No. 533 - Hibiscus Tea, Bell Fruit, Red Perch. No. 534 - Cider, Cherry Pepper, Mustard, Vanilla. No. 535 - Fever Grass, Bitter Squash, Crayfish, Vinegar, Happy Major, Garden Asparagus, Cornbread. No. 536 - Canada Blueberry, Cinnamon, Artichoke Thistle. No. 537 - Semolina, Cooking Oil, Northern Bluefin Tuna, Flageolet Bean, Egg, Cream. No. 538 - Bamia Moschata, Chrysanthemum Greens, Breakfast Cereal, Mustard Oil, Botrytized Wine. No. 539 - Swedish Turnip, Other Dish, Greenthread Tea. No. 540 - Chinese Broccoli, Yerba Mate, Pea Eggplant, Yellow Zucchini, Chestnut. No. 541 - Soda Farls, Tasmania Bean, Black Chinese Fungus (or Mushroom), Obedience Plant, Black Caraway, Sugar Corn, Red-sage. No. 542 - Vanilla, Irish Moss, Jabong, Pepper C. Baccatum, Lablab-bean, Cottonseed. No. 543 - Asparagus, Mountain Hare, Black Chokecherry, Ginseng, North Pacific Giant Octopus. No. 544 - Wine, Skimmed Milk, Bitter Buckwheat, Arabica Coffee, Asafoetida, Blueback Salmon, Bok Choy. No. 545 - Pipinola, Sunroot, Alpine Sweetvetch, Borage, Egg, Bloodwort, Prickly Nightshade. No. 546 - Ambrette Seeds, Bush Nut, Vanilla, Bush Tea, Potato Chip. No. 547 - Garden Asparagus, Berry, Small-leaved Lime, Nutritional Drink. No. 548 - Sea Cucumber, Sweetcorn, Common Dandelion, Wood Fungus. No. 549 - Gram Bean, Fruit Preserve, Jowari, Sparkling Wine. No. 550 - Gob, Salmo Trutta, Bok Choy, Currant, Arepa, Filbert Nut. No. 551 - Sugar Beet, Susumber, Mexican Turnip, Bulgur, Dark Tea. No. 552 - Snap Beans, Pomello, Nutmeg Flower. No. 553 - Black Tea, Bitter Gourd, Vanilla, Green Buckwheat. No. 554 - Egg, Mollusc, Kudrum, Asparagus, Lamb, Chinese Kale. No. 555 - Musk Seeds, Brazilian Arrowroot, White Sucker, Fig, Vodka. No. 556 - Red Raspberry, Ginkgo, Popcorn, Solanum Torvum, Garden Beet, Sugar Substitute, Goat Pea. No. 557 - Egg, Mandarin, Common Wheat, Black Katy Chiton. No. 558 - Geranium, Edible Chrysanthemum, Dolphin, Green Tea, Pie Crust. No. 559 - Capsicum Chinese, Fragrant Giant Hyssop, Apple Cider Vinegar. No. 560 - Muskmallow, Soy Milk, Melde, Wood Ear. No. 561 - Kudanekayi, Feldsalat, Cabbage, Bottle Gourd, Asliwowica, Square Flipper Seal, Obedience Plant. No. 562 - Parsnip, Garden Asparagus, Mountain Cherry, Vanilla. No. 563 - Cream Cheese, Plum Brandy, Egg, Popcorn, Filbert, Guar. No. 564 - Grapefruit, Sassafras, Brownbeard Rice, Yerba Mate, River Spinach. No. 565 - Wild Eggplant, Other Sandwich, Steller Sea Lion, Abelmosk, Anchovy, Cocoa Powder, Biscuit. No. 566 - Arrowhead, Hyacinth, Semolina. No. 567 - Garden Angelica, Long Melon, Blaeberry, Cognac. No. 568 - Moringa, Leavening Agent, Kalonji, Coffee Mocha, Hulled Wheat. No. 569 - Asparagus, Egg, Turkey Berry, Runner Bean, Langouste, Vanilla. No. 570 - Milkshake, Capsicum Baccatum, Hazel Nut, Beet. No. 571 - Broccoli, Mandarine, Corn Grits. No. 572 - Carob, Giant Devil Ray, Emu, Maranta, Dark Tea. No. 573 - Galu Gasturi, Fruit Wine, Sultana, Crawling Seals, Opo Squash, Jostaberry, Canada Rice. No. 574 - Hen Of The Woods, Helianthus, Chamomile, Pectin, Yerba, Vanilla. No. 575 - Prairie Turnip, Neep, Garden Asparagus, Lobster, Bodi. No. 576 - Egg, Fruit Juice, Pea Eggplant. No. 577 - Beluga, Green Beans, Satsuma Mandarin, Walnut, Corn, Allspice, Semolina. No. 578 - Potato, Lappa, Peanut Oil, Rosada. No. 579 - Milk Powder, Lamb's Quarters, Californian Jack Mackerel, Cho-cho. No. 580 - Bush Tea, Seriz, Garden Heliotrope. No. 581 - Vanilla, Sweet Pepper, Rye Bread, Bread Wheat. No. 582 - Black Treacle, Pepper C. Chinense, Turnip Cabbage, Cocoa, Oyster, Slivovitza, Egg. No. 583 - Macadamia Nut, Sweetcorn, Storax Balsam, Turnip, Haricot Bean, Sea Spinach. No. 584 - Hamburger, Jerusalem Artichoke, Brandy Bottle, Asparagus, Chinese Preserving Melon, Cherry Pepper, Horchata. No. 585 - Gruyere Cheese, Mushroom, Pamplemousse, Black Caraway. No. 586 - Roibos Tea, Tofu, Yellowfin Tuna, Wonton Wrapper, Sage. No. 587 - Wasabi, Beverage Alcolohic Other, Water Oats, Vanilla, Yemen Gum, Beetroot. No. 588 - Japanese Pumpkin, Carrageen Moss, Pole Corn, Egg, Cape Gooseberry, Asparagus, Mate. No. 589 - Cooking Oil, Pomme Blanche, Sundaikkai. No. 590 - Wholewheat Bread, Crowndaisy Chrysanthemum, Ashgourd, Capsicum Chinese, Devil's Dung, Gandule Bean, Eppaw. No. 591 - Leather Chiton, Quinoa, Coffee Mocha, Ambrette Seeds. No. 592 - Seriola Lalandi, Egg, Bergamot, Breadroot Scurf Pea. No. 593 - Nuts, Earth Apple, Clary Sage, Maize Oil, Vanilla. No. 594 - Soft Drink, Black Tea, Sweet Potato, Nutmeg Flower, Chocolate Spread, Armagnac Brandy. No. 595 - Redskin Onion, Bulgur, Dolichos Bean. No. 596 - Kombu, Large Indian Breadroot, Tomato, Garden Asparagus, Sukiyaki, Sallowthorn, Girolle. No. 597 - Macaroni, Canada Rice, Butterbur, Burdock, Miso, Field Mint. No. 598 - Popcorn, Goosefoot, Typical Smelts, Yerba Mate, Cornbread, Vegetable Pear, Ljivovica. No. 599 - Steller's Sea Lion, Vanilla, Dairy Products, Pummelo, Sugar Corn. No. 600 - Macaroni Wheat, Ornamental Okra, Garden Asparagus, Brussels Sprout, Maroochi Nut, Citrus Peel Oil, Winged Bean. No. 601 - Swede, Champaca, Pita Bread. No. 602 - Ararao, Capsicum Baccatum, Egg, Orxata, Arecaceae, Williams Pear, Soy Yogurt. No. 603 - Armagnac, Capsicum, Trassi, Icing, Coffee, Garden Beet. No. 604 - Ornamental Okra, Pacific Ocean Perch, Crowberry,âêblack Crowberry, Corn Oil. No. 605 - Garden Asparagus, Semolina, Bucco, Egyptian Kidney Bean, Cracker. No. 606 - Horseradish, Egg, Chili. No. 607 - Cold Hardy Mandarin, Bush Tea, Vanilla, Bittergourd, Whelk, Kai Lan, Hazelnut. No. 608 - Henjana, Buttermilk, Brinjal, Mountain Yam, Shoo-shoo Bush, Sesame. No. 609 - Yerba, Wild Duck, Peanut Oil, Meringue, Soybean Oil. No. 610 - Paralithodes Camtschaticus, Kaffir Beer, Egg. No. 611 - Garden Asparagus, Morchella, Water Convolvulus, Ginseng, Semolina, Great Millet. No. 612 - Vegetable Juice, Vanilla, Sunchoke, Capsicum Chinese, Squash Berry, Sugar Corn, Vanilla Grass. No. 613 - Wild Endive, Nigella Seed, Muskdana, Red Algae. No. 614 - Channel Catfish, Indian Baby Pumpkin, Fermented Tea, Alpine Sweetvetch, Rutabaga, Bok Choy. No. 615 - Pimento, Pommelo, Wild Rice, Diospyros Kaki, Tangerine Sage, Cherry Brandy, Asparagus. No. 616 - Arabica Coffee, Artichoke, Gelatin, Field

Salad, White Vetch, Vanilla. No. 617 - Pole Corn, Brazil Nut, Sunroot, Soy Milk, Shrimp, Egg, Green Tea. No. 618 - Wimberry, Cucurbita, Southern Yellowtail Amberjack, Emmentaler, Flour, Allheal. No. 619 - European Rabbit, Bulgur, Broccoli Raab, Mandarine, Cotton Seed. No. 620 - Fat Hen, Musk Okra, Jelly Ear, Tortilla Chip, Arhar, Baked Potato, Red Beet. No. 621 - Giant California Sea Cucumber, Garden Asparagus, Solanum Torvum. No. 622 - Black Tea, Corn Grits, Whisky, Jalapeno. No. 623 - Thorny Burr, Indian Potato, Common Sunfish, Bottlegourd, Eucalyptus, Cashew Nut. No. 624 - Pacific Serviceberry, Cocktail, Beggar's Buttons, Jute, Egg, Oriental Wheat. No. 625 - Redskin Onion, Small-leaved Linden, Spotted Seal, Bilolo, Vanilla, River Spinach, Shortening. No. 626 - Coffee, Sagebrush, White Turnip. No. 627 - Sweetcorn, Goat Cheese, Musk Seeds, Cherry Pepper. No. 628 - Roman Coriander, Steeple-top, Bread Wheat, Pombe, Bulgur. No. 629 - Apple Gourd, Kelp, Guvar Bean. No. 630 - Truffle, Cocoa Butter, Acorn, Crown Daisy, Asparagus, Egg, Rapini. No. 631 - Orange, Yerba Mate, Inca Berry, Ngombo, Piki Bread. No. 632 - Pepper C. Baccatum, Sanguinary, Jellyfish, Caribou, Arrowroot, White Wine. No. 633 - Corn Grits, Balsam Pear, Citrus Fruits. No. 634 - Green Tea, Hot Chocolate, Common Kidney Bean, Indian Rice, Greenland Halibut. No. 635 - Vanilla, Egg, West Indian Arrowroot, Oregon Yampah, Beet. No. 636 - Sugar Substitute, Wild Eggplant, Garden Asparagus, Kohlrabi. No. 637 - Coffee Mocha, Toffee, Largha Seal, Brazilian Cherry, Chocolate, Greater Burdock. No. 638 - Abelmosk, Cerasee, Lemon Grass, Basil. No. 639 - Corn, Sheep Milk, Walrus. No. 640 - Jerusalem Star, Beech Nut, Chinese Broccoli, Millet Beer. No. 641 - Fetticus, Jicama, Vanilla, Pea Eggplant, Tartary Buckwheat, Nutmeg Flower, Dayap. No. 642 - Ajowan, Muttonshells, Kombu, Garden Asparagus, Semolina. No. 643 - Potato Bread, Egg, Cucurbita, Spineless Monkey Orange, Roibos Tea, Asparagus. No. 644 - Spurdog, Musk Okra, Azuki, Chocolate Spread, Lime Peel Oil, Larga Seal, Swedish Turnip. No. 645 - Vanilla, Broadleaf Arrowhead, Slivovitsa, Parmesan Cheese. No. 646 - Kale, Topping, Maize Oil. No. 647 - Thimbleberry, Mate, Globe Artichoke, Long Melon, Rapunzel. No. 648 - Tomato, Gingko, Garden Asparagus, Barley, Earless Seals, Gob, Water Morning Glory. No. 649 - Jambura, Nutritional Drink, Egg. No. 650 - Fat Hen, Storax, Black-eyed Pea, Atlantic Halibut, Arabica Coffee, Balm. No. 651 - Sweet Grass, Chinese Yam, Finnish Whisky, Prickly Nightshade. No. 652 - Pitanga, Vanilla, Shuttlecock Fern, Breussels Sprout, Annual Hibiscus, Cucumber, Japanese Green. No. 653 - Rock Lobsters, Molasses, Cornbread, Cloud Ear Fungus, Egg, Kayam. No. 654 - Semolina, Limburger Cheese, Black Caraway, Red Rice. No. 655 - Turnip, Processed Beef, Pepper C. Chinense, Lablab Bean, European Carp. No. 656 - Fruit Gum, Almond, Annual Wild Rice, Java Jute, Garden Asparagus, Solanum Torvum, Kale. No. 657 - Scallop, Sunchoke, Pear Brandy. No. 658 - Yerba, Common Cornsalad, Honey, Bakery Products, Southern Gooseberry. No. 659 - Kumquat, Chinese Chestnut, Table Beet, Pole Corn, Vanilla, Wort, Choko. No. 660 - Water, Inconnu, Egg. No. 661 - Breussels Sprout, True Yellow Mombin, Viper's Grass, Pimento, Flaxseed, Black Katy Chiton, Saunf. No. 662 - Ku Qiao, Mountain Yam, Bush Tea, Chickpea, Rum, Breadnut Tree Seed. No. 663 - Muskrat, Cascalotte, Wood Fungus, Garden Asparagus. No. 664 - Lavendar, Golden Beet, Alpine Sweetvetch, Egg, Black Cumin, Lemon, Mud Shark. No. 665 - Gelatin, Bay-rum Tree, Bulgur. No. 666 - Chive, Rice, Cherry Pepper, Weinbrand Brandy. No. 667 - Corn, Pelecypoda, Happy Major, American Pokeweed, Brazil Nut, Guar, Teepsenee. No. 668 - Coffee, Brazilian Arrowroot, Opo Squash, Pisco, Vanilla. No. 669 - Junket, Maya Nut, Asparagus, Hibiscus Tea, West Indian Lime, Long Green Onion, Muskmallow. No. 670 - Wheaten Bread, Rye, Walrus, Carrot, Drag¡©e, Prickly Mimosa Bush. No. 671 - Egg, Cornbread, Syrup, Sweet Pepper. No. 672 - Bream, Wasabi, Liquor, Whimberry. No. 673 - Garden Bean, Two-needle Piì±on, Duck-potato. No. 674 - Coffee Mocha, Asparagus, Vanilla, Cobnut, Edible Burdock, Hot Chocolate, Plumcot. No. 675 - Rose, Sea Squirts, Soya Sauce, Nanking Cherry, Wild Eggplant, Radish. No. 676 - Pandanus Fasicularis, Konyak, India Wheat, Egg, Kakarakaya. No. 677 - Cocoa, Yerba, Semolina. No. 678 - Common Octopus, Yellow Walleye, Indian Pea, Shaddock. No. 679 - Yerba Mate, German Turnip, Junket, Fruit Wine, Pistachio, Black Fungus, Sugar Corn. No. 680 - Lesser Reedmace, Sugar Beet, Bulb Onion, White Pepper, Garden Asparagus, Thorny Burr. No. 681 - Meat, Kareli, Vanilla. No. 682 - Egg, Rice Bread, Breakfast Cereal, Casein, Cassava, Mate. No. 683 - Chalviande, Satsuma Orange, Squid, Mulberry, Susumber. No. 684 - Lamb's Quarters, Scotch, Blue, Musk Okra. No. 685 - Guwar Bean, Tofu, Garden Asparagus, Camomile, Water Spinach, Kalonji, Garland Chrysanthemum. No. 686 - Corn Grits, Sweet Potato, Vegetable Juice. No. 687 - Egg, Sorghum, Vanilla, Ice Cream Cone, Yam. No. 688 - Nut Lettuce, European Chestnut, Thorny Burr, White-flowered Gourd, Langouste, Paneer, Annual Hibiscus. No. 689 - Turkey Berry, Coffee, Sherry, Oil-seed Camellia, Rock, Parsley. No. 690 - Cumquat, Durian, Sauce. No. 691 - Okro, Gavar Bean, Myrrh, Sourtop Blueberry. No. 692 - Basmati Rice, Jew's Ear, Mandioca. No. 693 - Swede, Prairie Turnip, Popcorn, Vinegar, Nutritional Drink, Irish Moss. No. 694 - Bulgur, Vanilla, Milk. No. 695 - Black Tea, Tealeaf Willow, Asparagus, Musk Seeds, Raspberry Brandy, Sunfish, Kaipakka. No. 696 - Black Cumin, Corn Oil, Rutabaga, Egg, Cinnamon Vine. No. 697 - Beggar's Buttons, Pita Bread, Vanilla, Roibos Tea, Buffalo Spinach, Soybean Sauce. No. 698 - Mixed Nuts, Spelt, Dayap, Shoo-shoo Bush. No. 699 - Goosefoot, Mustard Spinach, Garden Asparagus, Giant Pacific Octopus, Rajma. No. 700 - Thousand-seal, Muskmallow, Rakia. No. 701 - Coffee, Kalonji, Pea Eggplant. No. 702 - Chanterelle, Cocoa Butter, Egg, Yumberry, Fish Oil. No. 703 - Golden Beet, Chrysanthemum Greens, Corn, Topping, Wild Swine, Vanilla. No. 704 - Suzza Melon, Endive, Other Sandwich, Pimento, Hot Chocolate, Leather Chiton, Lin Kok. No. 705 - Diosma, Butter, Mate, Earth Apple. No. 706 - Brazil Nut, Tangerine,

Wheat. No. 707 - Bamia Moschata, Egg, Pak Choy, Urad Bean, Bantu Beer, Asafedity, Asparagus. No. 708 - Semolina, Fish, Babassu Palm, Phyllo Dough. No. 709 - Storax Balsam, Maize Oil, Jellies, White Gourd, Sunroot. No. 710 - Lappa, Bush Tea, Prickly Nightshade, Red Beet, Quick Beam, Goober. No. 711 - Dutch Hyacinth, Dinkel Wheat, Mexican Yam Bean, Horchata, French Beans, Vanilla, Apple Brandy. No. 712 - Egg, Earless Seals, Breadroot. No. 713 - Margarine Like Spread, Breadnut, Domiati Cheese, Cold Hardy Mandarin. No. 714 - Filbert, Melde, Sea Cat, Durum Wheat, Dandelion. No. 715 - Indian Squash, Peanut, Popcorn, Cerisier Carri©, Abelmosk, Garden Asparagus, Ngombo. No. 716 - Arabica Coffee, Evening Primrose, Neep, Susumber. No. 717 - Hard Liquor, Perlemoen, Papaya, Sweet Marjoram, Black Chiton, Watercress. No. 718 - Araru, Egg, Vanilla. No. 719 - Edible Burdock, Gelatin Dessert, Breadnut Tree Seed, Ash Gourd, Roman Coriander, Brownbeard Rice, Ylang-ylang. No. 720 - Champak, Pili Nut, Horseradish, Caviar. No. 721 - Pole Corn, Semolina, Lambsquarters. No. 722 - Candy Bar, Beef Processed, Other Pasta Dish, Milkshake. No. 723 - Lamellibranchiata, Green Tea, Lima Beans, Spirit, Asparagus. No. 724 - Pepper C. Baccatum, Yuca, Ambrette Seeds, Turnip, Oriental Wheat, Mandarin Orange. No. 725 - Bulb Onion, Wild Eggplant, Vanilla, Garden Chamomile, Egg, Bottle Gourd, Coffee Mocha. No. 726 - Rowan Berry, Storax, Tipsin. No. 727 - Corn Grits, Enokidake, Chum Salmon, Egg. No. 728 - Arrack, Butternut, Perciformes, Winter Squash, Mexican Breadfruit. No. 729 - Garden Asparagus, Roquette, Goat Milk. No. 730 - Lamb's Quarters, Unshu Mikan, Sweet Potato. No. 731 - Salt, Burdock, Topinambour, Walnut, Pipinola, Pea Eggplant. No. 732 - Cognac Brandy, Flaxseed, Semolina, Mate, Edible Chrysanthemum. No. 733 - Boysenberry, Hard Wheat, Garbanzo, Vanilla, Chopper, Pole Corn. No. 734 - Asparagus, Jar Seal, Taro, Kohlrabi, Soft Drink. No. 735 - Soya Sauce, Bagel, Egg, Hyssop Oil. No. 736 - Star Anise, Kudanekayi, Bunching Onion, Beetroot, Fennel Flower, Coffee, Evron. No. 737 - Scotch Whisky, Pommelo, Lima Bean, Indian Round Gourd, Vanilla. No. 738 - Maize Oil, Brandy Bottle, Canada Rice, Egg, Dark Tea, Sundaikkai. No. 739 - White Cheese, Thorny Burr, Bush Nut, Muskdana. No. 740 - Broccoli, Chanterelle, Netsik, Oregon Yampah, Greenthread Tea, Ravioli, Garden Asparagus. No. 741 - Sugar Beet, Norway Pout, Hulankeeriya. No. 742 - Roseapple, Deccan Hemp, Dragon Bean, Asliwowica, Hagala. No. 743 - Sweet Pepper, Roibos Tea, Malt, Clam, Cornbread. No. 744 - Sugar, Egg, New Zealand Spinach, Angelica, Teepsenee, Vanilla. No. 745 - Galu Gasturi, Green Tea, Cocoa Powder. No. 746 - Kumquat, Arrowroot, Black Crowberry, Beer. No. 747 - Ajowan, Asparagus, Raisin Bread, Lobster, Swede. No. 748 - Big-sage, Barley, Hawaii Nut, Greater Burdock, Common Dandelion, Peas, Bulgur. No. 749 - Great Amberjack, Japanese Mustard Spinach, Cherry Pepper. No. 750 - Sugar Corn, Mallard, Bush Tea, Steller Sea Lion. No. 751 - Mandarin, Tasmania Bean, Egg. No. 752 - Leaf Cabbage, Vanilla, India Buckwheat, Sheep's Head., Common Blueberry, Macaroni, Maranta. No. 753 - Temple Plant, Table Beet, Cream. No. 754 - Thorny Acacia, Sesame, Ascidians, Fruit Juice, Cognac, Garden Asparagus. No. 755 - Stuffing, Fat Hen, Pupusa, Blue Whiting, Vanilla, Breakfast Cereal, Corn Oil. No. 756 - Pepper C. Baccatum, Mixed Nuts, Cottonseed. No. 757 - Guavasteen, Moringa, Turkey Berry, Arabica Coffee, Bitter Gourd. No. 758 - Broadleaf Arrowhead, Egg, Semolina, Bearded Seal. No. 759 - Crown Daisy, Bataw, Corn Chip, Black Caraway. No. 760 - Komatsuna, Madeira Wine, Soya Sauce, Kotberry, Alpine Sweetvetch, Pummelo, Asparagus. No. 761 - Yerba Mate, Marjoram, Cassie, Ricotta Cheese, Ornamental Okra. No. 762 - Carrot, Dolphin Fish, Durum Wheat. No. 763 - Vanilla, Egg, Chestnut, Round Melon. No. 764 - Arrowroot, Shoo-shoo Bush, Largha Seal, Sake, Sweetcorn, Energy Drink. No. 765 - Painted Comber, Bulgur, Turnip Cabbage, Tree Ear Fungus. No. 766 - Coffee, Asparagus, Sunflower. No. 767 - Blue Sweet Pea, Lime, Molasses, Egg, Jamb. No. 768 - Amur Mountain Ash, Obedience Plant, Wakame, Spirit, Ambrette Seeds, Capsicum, Sweet Grass. No. 769 - Peanut Butter, Arecaceae, Tree Mushrooms, Pakal, Jowari, Gob. No. 770 - Vanilla, Bok Choy, Eppaw, Nuts. No. 771 - Red Algae, Quail, Poor Man's Pepper, White Turnip, Sesame. No. 772 - Ricebean, Black Tea, Fragrant Giant Hyssop, Mustard. No. 773 - Sunchoke, Red Wine, Pea Eggplant, Hibiscus Tea, Pole Corn, Junket. No. 774 - Egg, Kamut, Vinegar, Common Salsify, Wonton Wrapper. No. 775 - Garden Asparagus, Fishing Frogs, Orris, Kareli, Roibos Tea, Nigella Seed, Helianthus. No. 776 - Kidney Beans, Bulgur, Netsik. No. 777 - Prickly Nightshade, Soy Cream, Zambura, Vanilla, Spread, Garden Beet. No. 778 - Tall Deerberry, Cornbread, Yam, Rapini. No. 779 - Hulled Wheat, Pecans, Solanum Torvum, Capsicum Baccatum, Muskmallow, Garden Asparagus, Japanese Chestnut. No. 780 - Poire Williams, Sheep's Head., Soy Milk, Camphor, Tetragon. No. 781 - Styrax, Garlic, Okaka, Japanese Green. No. 782 - Egg, Mate, Swedish Turnip, Bitter Buckwheat, Tinda. No. 783 - Kumquat, Feta Cheese, Lobster, Mamey, Melde, Corn, Rowanberry. No. 784 - Meringue, Armanac Brandy, Garden Asparagus. No. 785 - River Spinach, Egg, Vanilla, Tomato, Tapioca Pearl, Caraway. No. 786 - Breadnut Tree Seed, Galu Gasturi, Turkish Gram, Great Horned Owl, Katsuobushi. No. 787 - Fennel Flower, Canola Oil, Oak Nut, Semolina, Arabica Coffee. No. 788 - Neep, Japanese Bunching Onion, Asparagus, Steller's Sea Lion. No. 789 - Pectin, Beggar's Buttons, Batabi, Whortleberry, Vegetable Pear, Muskdana. No. 790 - Mexican Yam Bean, Oyster, Triticale, Canadian Whisky, Vanilla, Corn Oil, Teepsenee. No. 791 - Soft Drink, Lamb's Quarters, Egg, Snack Bar. No. 792 - Giant Butterbur, Apple Cider Vinegar, Wormwood. No. 793 - Mate, Pimento, Emmenthal, Garden Asparagus. No. 794 - Kanaf, Moth Bean, Custard Apple, Larga Seal, Taro, Nanking Cherry, Kumquat. No. 795 - Popcorn, Bulgur, Mustard Oil, American Shad, Filbert Nut, Cherry Pepper. No. 796 - Vanilla, Muttonfish, Quinoa, Crowndaisy Chrysanthemum. No. 797 - Egg, Cinnamon, Botrytized Wine. No. 798

- Ambrette Seeds, Chocolate Mousse, Beet, Towel Gourd. No. 799 - Cabbage, Miso, Black Matpe Bean, Asparagus, Coffee Mocha. No. 800 - Liquor, Burdock, K kihi, Corn Grits, Oyster, Milfoil, Water Oats. No. 801 - Prickly Nightshade, Malt Whisky, Roman Coriander, Fermented Tea. No. 802 - Bush Tea, Sunroot, Ling Cod, Orxata, Annual Hibiscus, Mandarin Orange. No. 803 - Chinese Bush Cherry, Alpine Hare, Ginkgo. No. 804 - Vanilla, Rock Lobsters, Pear Squash, Broccoli Rabe, Chicory. No. 805 - Char, Red Gram, Cooking Oil, Pisco, Radish, Cracker, Cherry Pepper. No. 806 - Provolone Cheese, Egg, Peanut Oil, Garden Asparagus, Colewort, Kohlrabi. No. 807 - Semolina, Sweetcorn, Coffee, Opaque Beer, Guava. No. 808 - Jellies, Bittergourd, Melde. No. 809 - Indian Potato, Palak, Arabica Coffee, Cocoa. No. 810 - Buchu, Soya Bean, Trail Mix, Shaddock, Soda Scones, Californian Jack Mackerel. No. 811 - Black Chinese Fungus (or Mushroom), Vanilla, Northern Sea Lion, Pepper C. Chinense, Ginseng, Rose Wine. No. 812 - Brownbeard Rice, Sweet Pepper, Sucker, Maize Oil, Asparagus. No. 813 - Sweet Gale, Ajowan Caraway, Garland Chrysanthemum. No. 814 - Chinese Kale, Ginkgo Nuts, Jambura, Sunroot, Mammee Apple, Asparagus, Hot Chocolate. No. 815 - Soy Yogurt, Eggplant, Yerba Mate, Ashgourd, Muskdana, Palinka. No. 816 - Largha Seal, Egg, Seville Orange, Fruit Preserve, Solanum Torvum, Guar. No. 817 - Beetroot, India Wheat, Sugar Corn, Vanilla. No. 818 - Green Tea, Lemon Beebrush, Pacific Jack Mackerel, Mustard, Bamboo Shoots, Cocoa Butter. No. 819 - Bulgur, Cottage Cheese, Lappa. No. 820 - Shoo-shoo Bush, Cattalo, Musk Seeds. No. 821 - Garden Asparagus, Abalone Mushrooms, Nutmeg Flower, True Seal. No. 822 - Almond, Alpine Sweetvetch, Pole Corn, Bergamot. No. 823 - Canada Rice, Cinnamon Vine, Asliwowica, Sourtop Blueberry, Yerba, Macaroni. No. 824 - Needle Bush, Turnip, Vanilla, Flaxseed, Uchche. No. 825 - Soda Farls, Egg, Percoidei, Energy Drink, Chinese Broccoli. No. 826 - Matki, Cornbread, Asparagus, Cherry Pepper, Cardamom, Western Chokecherry, Pancake. No. 827 - Tailor, Capsicum Chinese, Butter Bean. No. 828 - Dandelion, Roibos Tea, Rice, Singhara. No. 829 - Brazilian Arrowroot, Gelatin, Tuica, Maroochi Nut, Courgette, Cucumber. No. 830 - Egg, Beefalo, Bulgur, Achillea, Muskmallow, Jute, Bartender's Lime. No. 831 - Crawfish, Asparagus, Red Beet, Focaccia. No. 832 - Mandioca, Breussels Sprout, Water Oats, Wild Eggplant. No. 833 - Vanilla, Cisco, Whisky, Estragon, Soy Milk. No. 834 - Corn Grits, Emmental Cheese, Coffee Mocha, White-flowered Gourd, Egg, Chinese Chestnut. No. 835 - Mung, Brown Bear, Perciformes, Prairie Turnip, Welsh Onion, Sweet Acacia, Enoki. No. 836 - Pepper, Chop Suey Green, Spirulina. No. 837 - Black Huckleberry, Bamia Moschata, Happy Major, Mustard Oil, Simply Piì±on. No. 838 - Garden Asparagus, Goosefoot, Cherry Pepper, Corn Oil, Green Tea, Long Green Onion, Indian Baby Pumpkin. No. 839 - Alaskan King Crab, Marshmallow, Queensland Nut. No. 840 - Mexican Lime, Haricot Bean, Farkleberry, Golden Beet. No. 841 - Bermuda Arrowroot, Vanilla, Pear Brandy, Egg, Oats, Pak Choy, Maize Oil. No. 842 - Pimento, Crayfish, Asparagus, Dark Tea, Black Tea, Kalonji, Wort. No. 843 - Agar, Sea Ears, Cherimoya, Semolina, Edible Burdock, Carp Bream. No. 844 - Obedience Plant, Potato Puffs, Pili Nut, Blue Giant Hyssop, Galu Gasturi. No. 845 - Cajeput, Jar Seal, Manchu Cherry. No. 846 - Gin, Yerba, Pasta, Cream Cheese. No. 847 - Garden Asparagus, Karela, Durra, Tangerine, Champaca, Pole Corn, Sundaikkai. No. 848 - Scarlet Runner Bean, Honey, Vanilla, Swede, Hedge Mustard. No. 849 - Margarine, Coal Cod, Common Sage. No. 850 - Nuts, Asparagus, Green Buckwheat, Egg, Mexican Turnip, Ceylon Spinach. No. 851 - Deer, Bush Tea, Musk Seeds, Jellyfish, Arar. No. 852 - Black Caps, Fruit Juice, Lambsquarters, Arak, Water Spinach, Bay Laurel, Mandarine. No. 853 - Chayote, Sugar Corn, Bengal Quince. No. 854 - Turkey Berry, Pistachio, Vanilla, Shad. No. 855 - Chinese Yam, Garden Asparagus, White Turnip, Egg, Bread Wheat, Grass Pea, Potato Bread. No. 856 - Phoenicean Juniper, Semolina, Soya Sauce, Green Tea, Greater Burdock. No. 857 - Kudanekayi, Rhodophyta, Wild Black Raspberry. No. 858 - Strawberry Wine, Nigauri, Musk Okra, Artichoke, Black Caraway. No. 859 - Omani Lime, Botany Bay Spinach, Ghee, Rapini, Coffee Mocha. No. 860 - Wapato, Catfish, Sweet Potato, Morchella, Corn Oil, Eruca. No. 861 - Tortilla, Asparagus, Vanilla, Myrtle Pepper, Beech Nut, Egg, Maya Nut. No. 862 - Yardlong Bean, Pasta Wheat, Prickly Nightshade, Nutritional Drink. No. 863 - Turkey, Langustas, Molasses, Roibos Tea, Sherry, Cornbread. No. 864 - French Toast, Musk Seeds, Holy Grass. No. 865 - Bitter Gourd, True Sole, Broccoli, Happy Major, Vanilla, Green Tea, Parsnip. No. 866 - Muttonshells, Macaroni Wheat, Cold Hardy Mandarin, Hazelnut, Arabica Coffee. No. 867 - Spiny Lobster, Egg, Water, Corn Grits, Aubergine. No. 868 - Manioc, Canada Blueberry, Jasmine, Vine Spinach, Wild-sage, Shoo-shoo Bush. No. 869 - Garden Asparagus, Australian Pea, Apple Cider Vinegar. No. 870 - Alaska Pollock, Indian Rice, Cardamom, Bilberry Wine. No. 871 - Broccoli Raab, Bat Nut, Semolina, Yuca, Vanilla. No. 872 - Coffee, Miso, Black Chiton, Eppaw. No. 873 - Black Oyster Plant, Cucurbita, Beverage Alcolohic Other, Cumquat, Egg, Striped Mullet, Cocoa. No. 874 - Breadnut Tree Seed, Pork, Shellfish, Rutabaga, Ginkgo Nuts. No. 875 - Teepsenee, Orxata, Corn. No. 876 - Squaw Huckleberry, Asparagus, Prickly Nightshade, Fennel Flower. No. 877 - Cassava, Capsicum Baccatum, Narrowleaf Cattail, Colocasia. No. 878 - Satsuma Orange, Sweet Custard, Myrrh, Water Convolvulus, Oriental Wheat, Cottonseed, Enokitake. No. 879 - Hard Alcohol, Sweetcorn, Relish, Globe Artichoke, West Indian Arrowroot, Mung Bean. No. 880 - Paralithodes Camtschaticus, Papaw, Egg, Mate, Asparagus. No. 881 - Bivalvia, Ornamental Okra, Vanilla, Cho-cho. No. 882 - Tomato, Fried Potato, Kayam, Syrup, Cashew Nut, Winberry, Sweet Potato. No. 883 - Burdock, Garbanzo, Semolina. No. 884 - Berry Wine, Bloodwort, Yellow Zucchini, Fat Hen, Swamp Cabbage. No. 885 - Corn Oil, Leather Chiton, Yerba Mate, Cinnamon Vine, Canada Rice, Creosote. No. 886 - Common Ling,

Ambrette Seeds, Rucoli, Greenthread Tea. No. 887 - Plum Brandy, Pamplemousse, Egg, Sweet Bay. No. 888 - Christophine, Cauliflower, Asparagus, Pole Corn, Green Zucchini. No. 889 - Kefir, Pineapple, Bush Tea, Agar-agar, Vanilla, Black Cumin, Susumber. No. 890 - Mollusc, Pigeon Pea, Sugar Beet, Baked Potato, Sprat, Cedar. No. 891 - Nuts, Bulgur, Ear Fungus, Capsicum Chinese, Bakeapple, Hard Wheat, Yerba. No. 892 - Popcorn, Annual Hibiscus, Wapato, Storax Balsam, Indian Squash. No. 893 - Sesbania Flower, Pommelo, Garden Asparagus, Vodka. No. 894 - Egg, Turnip, Vanilla. No. 895 - Arabica Coffee, Bubbot, Bison, Black Treacle, Chickling Pea, Tipsin. No. 896 - Prawn, Sugar Corn, Shallot, Arrowhead, Kamut. No. 897 - Bitter Cherry, Bread, Coffee Mocha, Aniseed, Lamb's Quarters, Ginseng, Bulgur. No. 898 - Sweet Pepper, Bush Nut, Pepper C. Baccatum. No. 899 - Hibiscus Tea, Black Cumin, Garden Chervil, Slivovitza. No. 900 - Atlantic Croaker, Black Salsify, Leaf Cabbage, Asparagus, Bucco. No. 901 - Bottle Gourd, Kombu, Sesame, Peanut Butter, Red Kidney Bean, Grapefruit. No. 902 - Soy Milk, Ararao, Hen Of The Woods, Cherry Tomato, Vanilla, Sweetcorn, Black Tea. No. 903 - Sparkling Wine, Egg, Hawaii Nut. No. 904 - Spelt, Munster Cheese, Tomato, Malabar Spinach. No. 905 - Dandelion, Kiwifruit, Neep, Fruit Preserve, Krill, Mexican Yam Bean, Asparagus. No. 906 - Chinese Broccoli, Lentils, Spot Croaker. No. 907 - Schlivowitz, Marshmallow, Ash Gourd, Storax, Arabica Coffee. No. 908 - Sugar Corn, Vanilla, Sponge Wattle, Bulgur, Annual Hibiscus, Canada Rice. No. 909 - Salmo Trutta, Oregon Yampah, Citrus Fruits, Potato, Vanilla. No. 910 - Gob, Knotted Marjoram, Candleberry. No. 911 - Sweetcorn, Kareli, German Turnip, Cherry Pepper. No. 912 - Red Algae, Garden Cress, Almond, Egg, Sugar Substitute, Abelmosk, Rakia. No. 913 - Yerba Mate, Other Frozen Dessert, Table Beet, Vegetable Juice, Nutmeg Flower. No. 914 - Pacific Sardine, Garden Asparagus, Pomme Blanche, Vanilla, Duckwheat. No. 915 - Brazilian Arrowroot, Black Fungus, Cornbread. No. 916 - Lettuce, Azuki, Chocolate Spread. No. 917 - Variable Hare, Prickly Nightshade, Red Bayberry, Sweet Grass, Green Tea, Hulankeeriya. No. 918 - Tamarind, Tilefish, Piki Bread, Locust Tree. No. 919 - Flaxseed, Helianthus, Thorny Burr, Red Beet, Vegetable Pear, Sea Cucumber, Kai Lan. No. 920 - Ricotta Cheese, Egg, Semolina, Asliwowica. No. 921 - Annual Bunch Grass, Milo, Lime, Arabica Coffee, Vanilla, Wattle. No. 922 - Acorn, Corn Grits, Topping, Pimento, Chocolate. No. 923 - Brinjal, Garden Asparagus, Wild Cherry, Northern Pike, Dew Bean, Roman Coriander, Tapioca Pearl. No. 924 - Garden Beet, Ingu, Brussels Sprout, Coffee Mocha. No. 925 - Crispbread, Kaipakka, Fat Hen. No. 926 - Greater Burdock, Clawed Lobster, Anise Brandy, Vanilla, Orxata, Mugwort. No. 927 - Haddock, Bulgur, Capsicum, Egg, Jabong. No. 928 - Rye Bread, Bamia Moschata, Sweet Potato, Coffee Mocha. No. 929 - Wheat, Sheep's Head., Sunchoke. No. 930 - Vigna Mungo, Peanut Oil, Pole Corn, Rosato, Kakarakaya. No. 931 - Golden Beet, Vanilla, Arabic Gum, Bayberry, Gingko. No. 932 - Asparagus, Horseradish, Garland Chrysanthemum, Pear, Oil Palm, Jellyfish. No. 933 - Vinegar, Batabi, Galu Gasturi, Silverbrite Salmon, Pepper C. Chinense, Bush Tea, Egg Roll. No. 934 - Pet Speckled Hen, Drumstick Leaf, Water Oats, Indian Potato, Hot Chocolate, Egg. No. 935 - Skunk Currant, Ringed Seal, Sauce. No. 936 - Ambrette Seeds, Maize Oil, Garden Asparagus, Brackberry Brandy. No. 937 - Flour, Cherry Pepper, Tinda, All-heal, Vanilla. No. 938 - White Walnut, Broccoli Rabe, Bartender's Lime, Semolina, Japanese Buckwheat, Choko, French Bean. No. 939 - Dairy Products, Carrot, Crown Daisy, Roibos Tea, Rosada, Striped Mullet. No. 940 - Jelly Ear, Chinese Bush Cherry, Cotton Seed, North Pacific Giant Octopus, Tartary Buckwheat, Yuca, Corn. No. 941 - Lambsquarters, Egg, Vanilla, Japanese Mustard Spinach. No. 942 - Happy Major, Roman Chamomile, Nutmeg Flower. No. 943 - Breakfast Cereal, Cocoa, K kihi, Arrowroot, Slivovitsa, Clove, Garden Asparagus. No. 944 - Mallard, Common Dandelion, Coffee, Pan Dulce. No. 945 - Maroochi Nut, Mandarine, Coffeeweed, No-eye Pea, Nutritional Drink, Bay-rum Tree, Yerba Mate. No. 946 - Vanilla, Radish, Beluga, Christophine, Black Chiton, Egg. No. 947 - Wild Eggplant, Large Indian Breadroot, India Buckwheat. No. 948 - Jute, Dulce De Leche, Semolina, Goosefoot. No. 949 - Perlemoen, Garden Asparagus, Cornbread, Milkfish, Ketchup, Yam. No. 950 - Silky Heads, Flaxseed, Raisin, Finnish Whisky, Vanilla. No. 951 - Roibos Tea, Egg, Brazil Nut, Chinese Preserving Melon, Lappa. No. 952 - Dock, Meat Bouillon, Beetroot, Barbados Cherry, Honey, Scallop, Sundaikkai. No. 953 - Asparagus, Russian Whale, Green Gram, Soft Drink. No. 954 - Chinese Kale, Shaddock, Scallion, Common Wheat. No. 955 - Scotch, Phyllo Dough, Parsley, Egg, Sweet Potato, Mexican Yam Bean, Vanilla. No. 956 - Corn Oil, Mate, Soy Yogurt, Sesame, Sturgeon, Shrimp, Soya Bean Oil. No. 957 - Indian Baby Pumpkin, Beet, Sweet Pepper. No. 958 - Mooseberry, Vanilla, Cassic, Millet Beer, Lavendar. No. 959 - Komatsuna, Tundra Hare, Capsicum Chinese, Pummelo, Barley, Lamb's Lettuce. No. 960 - Fermented Tea, Asparagus, Comte Cheese, St John's Bread. No. 961 - Egg, Hazel Nut, Duck-potato, Rice Bread, Black Tea, Pole Corn, Cocktail. No. 962 - Whelk, Enokidake, Indian Date, Triticale, Gelatin Dessert. No. 963 - Broccoli, Storax, Lamb's Quarters. No. 964 - Semolina, Atlantic Pollock, Vanilla, Muskdana, Bora. No. 965 - Asparagus, Pomello, Nigella Seed, Cho-cho. No. 966 - Yerba, Redskin Onion, Swede, Cherry Pepper, Sweet Chestnut, Manna Grass, Mexican Husk Tomato. No. 967 - Giant California Sea Cucumber, Cassava, Lumpfish, Tamale, Meridian Fennel, Scotch Whisky. No. 968 - Capsicum Baccatum, Garden Asparagus, Egg. No. 969 - Coffee Mocha, Edible Chrysanthemum, Popcorn. No. 970 - Spirulina, Pomme Blanche, Diamondleaf Willow, Jowari, Cucumber. No. 971 - Vinegar, Small Leaf Linden, Moose, Goat Milk, Mungo Bean, Pea Eggplant. No. 972 - Mandarin, Abelmosk, Brandy. No. 973 - Egg, Kelp, Dinkel Wheat, Velvetleaf Blueberry, Vanilla, Orange Roughy, Taro. No. 974 - Wasabi, Turkey Berry, Apple Cider Vinegar, Raisin Bread, Arabica Coffee, Swedish Turnip. No. 975 -

Garland Chrysanthemum, Corn Oil, Enokitake, Spiny Lobster, Beverage Alcolohic Other. No. 976 - Hot Chocolate, Asparagus, Orange Oil. No. 977 - Mexican Lime, Opo Squash, Red Vine Spinach, Egg. No. 978 - Bauple Nut, Vanilla, Arrowroot, Bulgur, Mate, Musk Seeds, Melde. No. 979 - Moong Bean, Scup, Gob. No. 980 - Black Caraway, Woodapple, Solanum Torvum, Black Leather Chiton, Garden Asparagus, New Guinea Bean, Sweetcorn. No. 981 - Black Cap Raspberry, Ginseng, Quinoa, Rosebay Willowherb. No. 982 - Styrax, German Turnip, Russian Cheese, Yerba, Shortening. No. 983 - Staranise, Malt Whisky, Spinach, Beggar's Buttons, Milkshake, Vanilla, Pommelo. No. 984 - Egg, Papaya Brandy, Garden Asparagus, White Lupine, Arabica Coffee, Earth Apple. No. 985 - Breadroot Scurf Pea, Dutch Hyacinth, Ginkgo, Rutabaga, Giant Pacific Octopus, Mackinaw. No. 986 - Great Millet, Annual Hibiscus, Pole Corn, Wonton Wrapper. No. 987 - Peanut, Peanut Butter, Yerba Mate, Semolina, Capsicum Chinese, Frankfurt Sausage, Distilled Beverage. No. 988 - Karela, Kudanekayi, Icing. No. 989 - Asparagus, Large Indian Breadroot, Corn Salad. No. 990 - Japanese Green, Pili Nut, Cornbread, Torsk, Bergamot, Chinese Yam. No. 991 - Crawling Seals, Lamb's Quarters, Egg, Hen Of The Woods, Green Tea. No. 992 - Hard Wheat, Western Juneberry, Fruit Juice. No. 993 - Japanese Bitter Orange, Cluster Bean, Vanilla, Turnip. No. 994 - Blackberry Brandy, Snow Chicken, Cerasee, Galu Gasturi, Irish Moss, Cherry Pepper, Bonito. No. 995 - Macadamia Nut, Sweetcorn, Breadnut, Crowndaisy Chrysanthemum, Water Convolvulus. No. 996 - Wild Rice, Creeping Spinach, Vodka, Neep, Garden Asparagus, Roibos Tea. No. 997 - Other Fermented Milk, Hing, Ambari. No. 998 - Marshmallow, Bulgur, Thorny Burr, Bivalvia, Araru. No. 999 - Almond, Basmati Rice, Tallow Goud, Vanilla.

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