Prolegomena to Tetrachordal Structure

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Preface

> *The quality of vitality that makes any culture significant involves something else, the presence of which constantly undermines tradition; it is found in the perceptive freshness of the Tang Dynasty poets, the bold curiosity of the Renaissance Florentines. In large measure it is compounded of investigation, investigation, investigation.*
>
> Harry Partch, *Genesis of a Music*, xv

At the tail end of the twentieth century, James Tenney leveraged his unique position in American musical history as perhaps the only individual to have been personally involved with every important figure in the American developments of "serious" music—from Charles Ives and Carl Ruggles, to Harry Partch, to John Cage, to Philip Glass and Steve Reich—to make an argument that, after Arnold Schoenberg emancipated dissonance and John Cage emancipated sound, the next logical step in music was to emancipate harmony, which lacked any substantial development since the advent of extended tonality earlier in the century.

If harmony became the unacknowledged parameter, the purpose for such ignorance is, without question, the problem of tonality; that being, twelve equal tempered tones cannot develop beyond the final emancipation by Schoenberg, who, in his

insistence of tones related only to themselves, allowed for an exhaustion of all harmonic possibilities. Thus, if there is nothing left for us in twelve tone equal temperament, the next step is then expanding the practice of intonation beyond that of twelve tone equal temperament to some form of microtonality.

There is, of course, a problem: if we expand our range of pitches, the number possible rises from twelve to thousands—if one takes into account the audible difference of two or three cents—and then the question that we must raise is: if we desire to make use of every possible pitch to experience every harmony, how we should organize these? We could follow the example of the two most important European microtonal composers, Ivan Wyschnegradsky and Alois Haba, for whom microtones were nothing more than the next step in extended tonality. Just a cursory glance at the titles of their harmony treatises alone—Haba's *Neue Harmonielehre des diatonischen, chromatischen, Viertel-, Drittel-, Sechstel- und Zwolftel-Tonsystems* and Wyschnegradsky's *Manuel d'harmonie a quarts de ton*—reveals the conception that the most important aspect of tonality, harmonic functionality, is the primary goal; consequently, microtones are then nothing more than a slightly larger step beyond the gradual use of 7ths, 9ths, 11ths, and 13ths in the developments from 17th to 20th century harmony, and it is reflected in their music, which is overtly tonal despite the added pitches. Yet, there is a deep problem in this method in that their music—and the music of others who simply use quarter tones in an otherwise equal tempered twelve tone context—cannot convince the listener that the microtonal pitches are intrinsic as opposed to ornamental.

We could otherwise follow the example of previous microtonal composers, though there is no true "systematic" method of organization across the board; rather, each composer has developed methods of working that are determined by the natural features of their tunings or temperaments. It might be directly

determined by the materials or it might simply be whatever works. One would believe that this latter methodology is preferable, as, even in the twenty first century, the legacy of serialism has led many to be apathetic or even violently opposed to "systematic methods;" yet, there are two primary problems that are associated with post-Partch trends in microtonality, for which a solution requires a flexible systematic method.

First, the deference to Just Intonation, which appears to be nothing more than replacing equal temperament with a new, all encompassing structural form that cannot be questioned or permuted. Partch, for all his accomplishments, is nothing more than a man who believed that Just Intonation was the only answer simply due to his interpretation of its purity, and it was the creation of a hero cult around him that codified his personal practice into law; conversely, what he demands in his book is not that the reader makes use of his 43 tone division of the octave, but that they personally investigate music and not take an arbitrarily defined tuning as truth without question. Yet, this attitude toward just intonation denies the permutations that pure, fifth based tunings undergo in various cultures naturally according to ear—where are the pure ratios in the variation of tuning in gamelan groups, the relative nature of the twenty-two Shruti in performance, the notion of shade in ancient Greek practices? Partch's only goal can be assumed to create his own system around rediscovering pure ratios for his own expressive needs, not to codify a "correct" method of performing music; therefore, it is possible that one may misconstrue his rhetoric as a zero sum game in which either pure ratios are victorious or not, and emphasizing the harmonic series and just intonation to the detriment of all other sounds cannot move us forward musically, only create a new status quo to replace equal tempered tonality.

Second, the development of highly irrational tunings which are mostly focused on mathematical, as opposed to practical, ends

that are better suited to electronic music than acoustic music. Music as we know of it through Partch and Cage is corporeal; that is, it is a physical reality that comes through the act of performance as creation, and Tenney's break from electronic music can be read as a distancing of his work from the rhetorical manipulation of tape music and a movement toward stark reality in the sensation of tone, created by his interests in the harmonic series through the influence of Partch, which—despite what one might interpret as dry, theoretical abstraction in Tenney's later music—was a direct development away from abstraction toward corporeality in engaging with the vital sonic resources of acoustic instruments. It is not to be dismissive of electronics as legitimate instruments, but one should encounter electronic music with some skepticism, as though sine wave generators create real acoustic phenomena there is no physical connection to the music being made, like that of the vibration of strings or the blowing of air through reeds and brass. In contrast to these electronic music is nothing more than triggering a signal sent to a set of speakers via MIDI, the act of doing so being pallid and effete. The act of performance requires a certain physicality in listening and touching the instrument: the placement of the fingers, the buzzing of the lips, the fluttering of the tongue, the amount of air, the placement of the bow, the string chosen, the vibration of the strings, the vibration of the body, the space in which the performance occurs, etc. How one balances these factors, many of which cannot be emulated by electronics to the same degree as in a live performance, directly affects the creation of music and the manner in which it is experienced.

Perhaps worse is that these tunings can also be faulted for exaggerating the importance of arbitrary divisions of the octave and demanding exact tunings that mean that the music can only be experienced as a recording, as the barrier for a musician to perform it is years of specialized training. This attitude cannot be

truly corporeal because the composer demands that performance must be literal and artificial, a product of the mind without the engagement of the ear, defined by electronic tuners and memorized, as opposed to the performance being defined by the cultural and musical practices of the performers. It is perhaps also an expression of the uselessness of extreme virtuosity, though this is not to say that we should not be excellent performers, simply that if the music is too difficult for a majority of performers it cannot travel in a manner that others can experience its vitality universally.

Consequently, for us, in the line of logic we are following, the investigation of harmony as a practical parameter requires, to some extent, a method of systematic, structural organization so that the music can be truly corporeal and performed according to any and all tunings without losing its shape, so that anyone, at any point in time, with any instrument, may experience the act of creation.

Structurally, tones need a reason to exist beyond isolated frequencies, as a pitch is only defined in the context of others: the difference between 84/64 and 5/4 is not obvious until they are cast against 1/1 and become a Pythagorean major third or just major third, respectively. Thus, musical systems create easily comprehensible structural methods of organizing content, and if any music has proven itself inferior to tonality it is because it could not sufficiently suspend the disbelief of the listener and make them believe that the pitch relations are solid and logical as opposed to a fleeting fancy or coincidence. Structures derived from tunings are axiomatic, and tonality succeeds in convincing us that the triad is the standard by which all relationships are defined, that triadic harmonies are not moments of time, as they are in Palestrina, but objects of importance, as they become through Monteverdi.

Tonality itself, if how it sounds is put aside, is a quite

convincing structure: through a series of major and minor triads a scale is created. Our two most natural keys, C major and F Major, are the results of the modal systems of Christian chant, a diatonic and the same with a flattened B, rebuilt according to ascending sets of triads. The ascending pattern is already available from modality, a diatonic structure is created through five wholetones and two semitones:

C D E F G A B C

Yet, the structure conveniently reveals itself through sets of triads. For example, if we did not know the actual scale itself, we can create it from a succession of triads, starting with the root pitch:

G
E
C

These triads also provide us with additional pitches. Because we know G is natural, we find an E minor chord, and because we know from the E minor chord that B is natural, we find a G major chord:

B	D
G	B
E	G

If we do the same for D, it is more difficult, as all the pitches created from a D triad do not appear in the triads we have already built, and thus there are no triads to compare results to; therefore, we must use our knowledge of triads to confirm that, first, A is a perfect fifth. Yet, what then of the third? Is it F♯ or F?

One should discern the result according to the pitch that is the

perfect fourth from the start, C-F, as there should naturally be no augmented fourths in relationship to the root point in a major or minor scale. Thus,

A
F
D

A final triad, built from B, is unnecessary, first because all our pitches have been found, but second because both of its major and minor chords require accidentals of pitches already defined as natural:

F♯	F♯
D	D♯
B	B

Thus, through this simple method making use of triadic structures, we can extrapolate the entire C major scale from one set of triads, *a priori*, without ever needing knowledge of stepwise functions; instead, stepwise functions are revealed to us through the results of the triads, *a posteriori*, through the scale created:

Whole tone, whole tone, semitone, whole tone,
whole tone, whole tone, semitone

Of course, this method can be applied to any possible scale, and we can do the same for the F Major scale. Our first triad is F major:

C
A
F

This triad provides us with two new triads, using our current knowledge of A and C being natural, we can create A minor; then, knowing E is natural, we find C major:

E	G
C	E
A	C

Knowing that G is natural, we can build the last triad we need to find the scale, G minor, by finding its fifth, D, and the perfect fourth of F, B♭:

D
B♭
G

Once again, we do not need to find the triad of the seventh, E, to find our final scale:

F G A B♭ C D E F

As triads become the focus, keys can appear according to the root point, and tonality is built by these shared relationships generated from a root triad; moreover, if one only knows the basic C major, they can find the other keys through the method of augmenting the perfect fourth and finding the pitch a semitone above, or diminishing the seventh and finding the perfect fifth.

For example, if the F in our C major is augmented to F♯, G becomes the new root pitch, and the G major scale can be found without needing to find new triads. This can be implemented further to find D major by raising the C in G major to C♯ and making D the new root note.

Likewise, if we did not know F major, we could find it by

taking B in the C major and diminishing it to B♭ and finding the perfect fifth, F. This can be done again to find B♭ major by diminishing E to E♭ in F major and finding the perfect fifth, B♭. These results would be the same if one built the keys from the root triad.

In addition, the highly self-similar similar construction of strict triads means that the very nature of octaving is inherent within the structure, as opposed to a self-contained unit such as a hexachord in which octaving functions are conceived by manipulation of pitch through modulation, as each triad contains the pitches that one can use to recreate the scale with an octave higher, e.g. In a C major scale, F major contains A and C, which can provide A minor and C major, respectively, which contain equivalent pitches an octave higher. Thus, octaving scales becomes less our expectation of a series of pitches being the same and much more a self-perpetuating series of similar pitches, whether or not we conceive of them as such.

Consequently, these patterns, and others found in minor scales, create a convincing and highly coherent logical structure in which triadic composition develops from, and which expresses the non-functionality of added note chords, as the further one muddles the structure from a pure triad, the less coherent, and multidirectional, the musical fabric becomes. One could write the scales according to their steps and understand them as ascending patterns from root pitches, as a collection of notes, but this is simply not as convincing. As a student, immediately after pursuing modality to escape tonality, I began compiling symmetrical scales as Messiaen did, and, trying to make use of them, non-transposable or otherwise, wrote hundreds of counterpoint exercises. Yet, none of the music struck me as convincing, though I could never finger the reason why until I reflected upon the unifying factors of lasting systems, all of which had a structural basis beyond a stepwise scale; that is, what was

not important were the steps themselves, but the manner in which they were unified, making the steps not the generative factor, but the result of a structural attribute.

This perfection of construction of the major scale is, without question, the result of tonality being focused on the triad, not on a hexachord as previous medieval theory rested on, as the hexachord is, unlike a triad, not a constructive unit but a constructed unit; that is, a series of notes does not create the division of the octave, but instead the division of the octave defines a series of notes. This is naturally why the division of the tonality into octaves larger than twelve tones, as Wyschnegradsky and Haba attempted, is impossible, because purely triadic construction does not provide tones any smaller than a semitone.

Thus, the value that we place on the scalar entities we know today, the keys, are the result of theorists such as Zarlino and Rameau placing a great deal of stress on this structural object that allowed for the cultivation of a new manner of engaging music according to the functionality of triadic harmony.

Because triadic functions create a fascinatingly "equal" set of scales, created from specific stepwise structures that appear from the triadic pitches, the older Pythagorean tunings become insufficient. Pythagorean tunings place emphasis on the fifth and, in inversion, the fourth, as perfect structures from which the scalar forms are produced, and thus thirds are ignored and, if untempered, often discordant. However, it is not simply the triad that led to the development of equal temperament, as it is functional in meantone tunings, but this equal nature of triadic based scales; for example, if one were to use the existing pitches from C and F major then they would eventually find that in triadic structures there are naturally twelve chromatic tones, and thus there are, through triadic construction, twelve possible scales; all, if produced in the same manner through extrapolation via triad, are, in construction, equal entities with the same steps. That

music developed according to the desire for all keys to be equal, impossible in meantone tunings, meant that the teleology of triadic functions required the theorization of an equal temperament to equalize the twelve keys, and the act of codifying a tuning itself leads to the logical endpoint of the development of tonal music, which makes puttering around in tonality useless for the development of new music.

To step away from tonal functionality and triadic stress allows a composer to produce different forms as long as they are, in some sense, functional—not in the manner of harmonic functionality, but instead in the manner in which there are logical connections that produce something equivalent to triads in harmonic and melodic gravity. For example, George Russell's *Lydian Chromatic Concept of Total Organization* is built according to the functionality of the dominant through the perfect fifth. By stacking fifths:

C G D A E B F♯

He finds his root C Lydian scale that becomes the basis for his modal concepts:

C D E F♯ G A B C

The primary focus of all musical structures is this perceived functionality, an internal connectivity that places all pitches into the positions in which they need to exist, not necessarily the sounds that they create.

The only other major method of organization, dodecaphony, is perhaps the most convincing equal tempered musical system devised. Both Arnold Schoenberg[1] and Josef Matthias Hauer's[2] approaches to dodecaphony are built according to one infallible and indisputable principle: in equal temperament all tones are

equal and stress does not need to be defined by the scale, as extrapolated from triads, but by the twelve chromatic pitches alone, from which there are no vestiges of the tonal system: major or minor, tonic or dominant functions. Thus, the goal of any system defined by the division into twelve equal parts is for that relationship in which each pitch works toward a single goal, and the work is defined by the sum of its parts as opposed to a primary pitch of importance.

Schoenberg himself understood that the unifying factors of the row created a clear coherency to the music:

> The main advantage of this method of composing with twelve tones is its unifying effect. In a very convincing way, I experienced the satisfaction of having been right about this when I once prepared the singers of my opera *Von Heute Auf Morgen* for a performance. The technique, rhythm and intonation of all these parts were tremendously difficult for them, though they all possessed absolute pitch. But suddenly one of the singers came and told me that since he had become familiar with the basic set, everything seemed easier for him. At short intervals all the other singers told me the same thing independently.[3]

As in order for a system to be successful for the listener, it is imperative that it must set up some sort of functional relationship within the structure itself; thus, Schoenberg removes the functionality of tonal harmony and replaces it with the functionality of the row, that, in all inversions and shuffling, retains the same relationship between pitches defined in the prime row. Consequently, the structural interval shifts from the triad to

the octave divided into twelve parts.

Likewise, in seeking a functional system, the starting point must be a structural interval that can define all possible pitches and also be malleable enough to be coherent no matter the tuning. The structure that I stumbled upon effectively ordered any and all possible pitches within the space of the tetrachord, and several of these tetrachords could be put together, artificially, to create a double octave, as I have chosen to do so. The process is equivalent to the Greek system in construction, but in context it is of the contemporary era; thus, the value of the study of ancient Greek music is beyond musicological concerns, allowing the studies to be freer, not necessarily interested in historical accuracy, but proper functionality. Therefore, it is imperative that the goal of this study was to never "revive" ancient greek modulatory practice, something that is so far gone and of such a different culture that there is no logical reason to revive it; after all, I am not a classicist who finds it fascinating to do so, I am a man who desires to find a coherent method of composing something more than twelve tone equal tempered music.

Thus, the resulting system is artificial, yet it developed organically, derived from solutions to problems I have faced in my studies, and I must make it clear that I did not plan the system as if I sat down at a desk and created relationships *ex nihilo*; rather, it came to me gradually, *as if a dream*, piece by piece so that it might provide answers to the questions I asked one after another. In some manner my goal in organizing a system is that of applying a speculative theoretical view; that is, not codifying ideas that we have encountered in music, but searching for a way of articulating those that we have not encountered, but are perhaps possible if we are willing to alter the way we discern, and appreciate, the physical experience of sound beyond initial perception; and, with that speculative nature in mind, the arguments are much less scientific or mathematical than one might read in the major

theoretical works on microtonality, as the requirement for the desired result of something malleable and universally true is intonational leniency.

Moreover, this is not the result of years of study alone, but from years of listening and contemplation, from the shock of discovering those things seemingly distant being of one mind. It is, as all things are, a synthesis of what I have come to know, and it could not have been without being a peculiar point at which medieval, serial, and indeterminate traditions have met. At each point in time I have found parallels in my studies to the music that I appreciate. In the construction: Arnold Schoenberg, Milton Babbitt, and Yoritsune Matsudaira; in the line: Guillaume Dufay, Johannes Ockeghem, and Jo Kondo; in the context of the musical fabric: John Cage, Christian Wolff, Antoine Beuger, and Burkhard Schlothauer; in the dignity and integrity found in ancient Greek artistic attitudes: Carl Ruggles, Harry Partch, Lou Harrison, and Toru Takemitsu.

The results are first principles for creating what I believe is a completely coherent method of organization for any and all tunings that privilege the perfect fourth as a structural foundation, the prime factor being the endlessly malleable construction in which pitches are not defined by scale degrees, but merely by relative position; therefore, one may apply, beyond any Pythagorean based tunings, the various tetrachords outlined in John Chalmer's *Divisions of the Tetrachord*. To express it in a completely systematic fashion, this work is divided into two major sections: the first, a discussion of the tetrachord and the manner in which it is built; how the tetrachord becomes the octave species and its role in the practice of composition; the building of the greater perfect system from the tetrachord and its structural aspects as an aggregate in relationship to the octave species. The second, a discussion of melodic construction through the analysis of melodic contour; a discussion of a few applications

of the octave species and the aggregate in the practice of composition; the implementation of these techniques in a proper composition.

The work should be read as a whole, from beginning to end, in the same manner it was developed, not pieced apart and digested out of order, as each succeeding section builds on those prior and they are interconnected in such a manner that they would be incomprehensible otherwise. Furthermore, the music discussed in this study should be seen in the context of their purpose as studies in different manners of composition according to the aspects of the developing structure. As none of the music was performed publicly it should be clear that it is not to be allowed to stand on its own, but always be a reflection of the developments made over the years I have invested into this study—one that has transformed from a small pamphlet for my peers, akin to Messiaen's *The Technique of My Musical Language*, to a systematic expression of the possibilities of a method that may apply any and all possible tunings and temperaments while retaining the coherency of the musical line.

It should not be left unwritten that the most important goal is to satisfy the hunger of all those who are musically minded, of all those blessed with musicality as opposed to virtuosity, and of those with a healthy attitude toward life as investigation opposed to codification. This work is not a compendium, it is not a work of analysis, and it is not a work of standard theoretical ideas; rather, this is a workbook in the sense that it is a series of steps that the reader can apply to their own musical practice; thus, this work is something that scholars and academicians will hopefully find no interest in, but lovers of music will find of value. It is best said in the words of Harry Partch:

> I should make it clear that I do not intend this book for musicologists, nor even for musicians in

the ordinary sense. It is addressed to those who are searching for more than intellectual openings into the mysteries of music and intonation. I have written it for those with a musically creative attitude: (1) for composers; (2) for those who expect to compose; (3) for anyone, even without a knowledge of ordinary music theory, who has this creative attitude.[4]

Acknowledgements

I would like to express gratitude to my teachers and mentors, without whom the contents of this study—and the impetus to spend six years of my life searching for something of value—would have never existed: Martin Rokeach, who, single handedly, allowed for me to begin my studies, formally or otherwise; Frank La Rocca, who offered invaluable guidance in the formulation and realization of the ideas and theories of these studies as they progressed; and Antoine Beuger, who, in offering me his precious time and goodwill, discussed endlessly with me the personal and communal processes of musical practice, notation, and the meaning of what we put on paper, without which I could not have even imagined a notion so important to the manner in which we think about music: that how we conceptualize something defines how we write it out, how we write it out defines how we perform it, and how we perform it defines how we experience it.

Prefatory note on intonation

Before we begin looking at the possibilities of this method of organization, it is of importance to discuss the nature of intonation, especially in light of the examples that will be provided in the work. In these examples all accidentals are enharmonic values, thus sharps and flats are not equivalent, but separated by the Pythagorean comma, 23.46 cents. There are many who are fascinated with tuning and intonation from a mathematical perspective, but I am disinterested in mathematics beyond the need for it to develop one favorable to my own ear. For me, this is one with both perfect and imperfect intervals, something easily developed through the stacking of fifths to create a standard Pythagorean tuning. Thus, in every example I provide, the harmonic choices are not random—though they are a matter of consequence, as I write each voice as a separate part, only tied in relation to the other voices at the beginning of the piece so that the harmonies are not sought, but found—but clearly defined according to my own ear, that being what I know is sweet or bitter. As it should be known for the sake of musical examples, the tuning that I generally apply is a 29 tone octave that accounts for the entirety of the enharmonic intervals created by the Pythagorean tuning, with the quarter tones filled in by an equal distance of a Pythagorean comma;[5] however, I believe that any form of intonation with enharmonic and quarter tone intervals, up to 29 tones,[6] will function without issue within the context of the structure of the greater perfect system. The exact intervals are provided in example 1 as a guide.

c'	2/1	1200.0000
c𝄫	1048576/531441	1176.5400
b/c𝄭	243/128	1109.7750
a𝄪/c𝄮	31381059609/17179869184	1043.0100
a♯/b𝄫	59049/32768	1019.5500
b♭	16/9	996.0900
b𝄮	8388608/4782969	972.6300
a	27/16	905.8650
g𝄪	3486784401/2147483648	839.1000
g♯/a𝄫	6561/4096	815.6400
a♭	128/81	792.1800
a𝄮	67108864/43046721	768.7200
g	3/2	701.9550
f𝄪	387420489/268435456	635.1900
f♯/g𝄫	729/512	611.7300
g♭	1024/729	588.2700
g𝄮	536870912/387420489	564.8100
f	4/3	498.0450
f𝄫	2097152/1594323	474.5850
e/f𝄭	81/64	407.8200
d𝄪/f𝄮	10460353203/8589934592	341.0550
d♯/e𝄫	19683/16384	317.5950
e♭	32/27	294.1350
e𝄮	16777216/14348907	270.6750
d	9/8	203.9100
c𝄪	1162261467/1073741824	137.1450
c♯/d𝄫	2187/2048	113.6850
d♭	256/243	90.2250
d𝄮	134217728/129140163	66.7650
c	1/1	0.0000

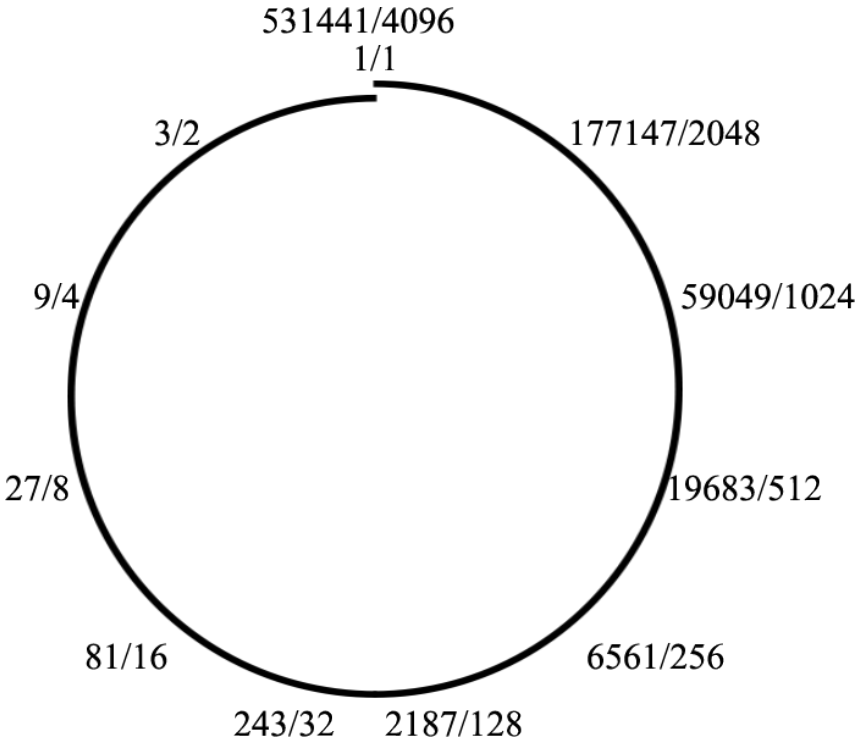
Example 1. 29 tone Pythagorean

As I have already made it clear that I am disinterested in mathematical pursuits for their own sake, it is important to note that there will be very little discussion of such in this work;

furthermore, I believe it unnecessary to even broach the topic as Harry Partch and John Chalmers have done a job of such quality that anyone even concerned with such topics should find their way to their books. Of course, I must defend my own choice of arrangement in this situation, which I will provide in a systematic fashion.

As this series of 29 tones is very close to Partch's initial 29 tone scale, perhaps the most important question is why I have chosen Pythagorean as opposed to his Just Intonation. The answer to this is not defined by stray medievalisms, but an honest desire for a tuning in which perfect and imperfect intervals coexist. As I already have noted, my own ear, the defining factor for musical and creative investigations, prefers a relationship in which bitter, harshly dissonant sounds strengthen the sweetness of the consonant perfect intervals, which is why the imperfections of 3-limit tuning, in which only prime ratios of 3 are just, are of value to me. Concerning questions of taste, Just Intonation is boring to me in the same manner equal temperament is; that is, the unique results of interval contrast are weakened for a purely mathematical or practical goal. What makes the Pythagorean tuning intriguing is the manner in which the Pythagorean comma subtly alters the values of the enharmonic pitches and produces wildly impure ratios.

Yet, the question the reader might ask is, why provide such a privilege to the Pythagorean comma, a seemingly irrational ratio of 531441/524288, and apply it for the distance between the enharmonic and the quarter tones? If I am to answer this fully, one should understand that when building a Pythagorean based tuning by stacking perfect fifths they will eventually reach a similar pitch to the starting point at $(3/2)^{12}$, about seven octaves above, that is not a direct seven octaves, 128/1, but is instead 531441/4096:



Example 2. Cycle of fifths

If one divides this ratio by seven octaves, $(2/1)^7$, then one finds the discrepancy between 1/1 and the end of the cycle is the Pythagorean comma, 531441/524288, or 23.46 cents.

$$\frac{\frac{3}{2}^{12}}{\frac{2}{1}^{7}} = \frac{\frac{531441}{4096}}{\frac{128}{1}} = \frac{531441}{524288} \approx 23.46$$

The comma appears in more than just the result of the cycle of fifths, but also as the difference between the enharmonic pitches, the apotome and limma. When we build the enharmonic pitches, the limma is, using our cycle of fifths, the difference between three octaves, 256, and five fifths, 243,

$$\frac{2^8}{3^5} = \frac{256}{243} \approx 90.23$$

When we build the apotome, the result is the difference between seven fifths, 2187, and four octaves, 2048,

$$\frac{3^7}{2^{11}} = \frac{2187}{2048} \approx 113.69$$

The difference between the two results is, naturally, the Pythagorean comma,

$$113.69 - 90.23 = 23.46$$

As a result of these observations, I understand the comma as an organic function of Pythagorean tuning, intrinsic to its creation; thus, to make use of the comma as the distance for the enharmonic notes is not necessarily an arbitrary choice, but a reflection of the functional role of the comma in creating an organic pitch discrepancy.

Yet, why have I chosen to not use any enharmonic quarter tones? A simple answer is that the more I split the octave, the more irrational and unwieldy it becomes, and very few have interest in interpreting music with six divisions of the semitone. That music remains portable and modular, so anyone may perform it in any manner without losing its essence, is the key reason for using this system of organization. Another is that the ancient Greek practices that build the basis of this study made no use of any division beyond the quarter tone. In the study—as well as in Sachs' transcriptions—one will find that, unlike my personal 29 tone scale provided in example 1, no sharps will have quarter tone pitches, only flats. As quarter tone pitches are those derived from the enharmonic pitches, they are flatter or sharper than the flats and sharps—or, in the case of the pitches between *b-c* and *e-f*,

derived from the higher pitch and are then flatter than it; therefore, it should be noted that the equivalent enharmonic spellings are provided in the initial tuning (example 1) and in example 3.

c♯ c♯
d𝄲 c♯
d♭ d♭
d𝄳 d𝄳

Example 3. Equivalent enharmonic pitches

It is then that, due to this distinction in intention, I should admit that this approach is less microtonal and much more ultra-chromatic, and, furthermore, it is not a quarter, or twenty four, tone system as I do not divide the space equally. It should ultimately be noted that I am merely making use of the quarter tone flats in the work to keep in line with Curt Sachs' transcriptions, which are the basis for the modulation experiments.

In the practical performance of the scores provided one might wonder about the question of singability of these exact enharmonic and quarter tones; yet, one should not seek exact intonation, as singers generally do not have "proper" intonation, but derive it from other sources through endless micro-correction, as Partch describes it:

> Much of the oft-heard railing against the intonation of singers is scandalously lacking in candor. As composers and educators, we give them an accompanying instrument - the piano - which is continually at odds with their instincts. After they have mastered this incongruity, we

> pose them in an a cappella choir or before an orchestra, where they are at the mercy of each intonational whom of concertmasters and conductors (who are by no means agreed on intonational rectitude). And we then proceed to criticize them for their "bad" intonation. As musicians we have no intonational norm, and we vent our annoyance over this situation upon innocent singers, who have no norm simply because we have none.[7]

This can likewise be understood from the practice of Christian chant, which is notoriously autocephalous in the manner in which the monks either use any unfixed pitch sung first by the cantor as a reference point—an experience I have found in the few monasteries I have visited is that do in any antiphons or psalms throughout an office or a service is a different reference pitch in each, though not by any more than a whole tone from *c*—or use an organ to ensure proper intonation. Lou Harrison, in fact, encouraged imperfect intonation in his definition of “free style,” assuming that, if intonation is a non-static variable, that one might use it in the same manner one uses static intonation without any detriment to the musical fabric, thus pitches in notation become positions and not those with definitive intonation, instead fluctuating naturally.

Thus, there is no reason to force singers to intonate perfectly as if they were fixed instruments, but rather give them guides to singing the pitches. One should never give a singer a quarter tone they could not perform, and for the performance of enharmonic tones one should simply define it as a pitch slightly above or below the chromatic pitch used as reference.

Finally, the instruments that are most suitable for this system, chordophones, should be touched upon. Just as Partch

believed the cello most suitable for his 43 division of the octave,[8] there is no question it is the most suitable without major work; yet its range is far too deep for the range of the double octave, *A2-A4*, that compromises the content of this study; of course, a viola, an octave higher, with the *C3* string tuned to *B2*, is the perfect instrument,[9] encompassing all pitches with exception of the proslambanomenos, *A2*, allowing it to play each of the four tetrachords and their modulations. The other major visual instrument of this class, the guitar, would require either refretting or correct intonation with a slide, though the lap steel is a more feasible method for guitarists to attain accurate intonation, and the many ancestors with movable gut strings may find values close enough for practical use.

However, the playing method of these instruments should not remain the same as developed through equal temperament. Equally spaced intervals make for easier performance of quick passages, and vibrato generally hides the bland nature of the temperament or poor intonation. Partch's own method of playing the adapted viola,[10] similar to a slide technique, is well suited to any chordophone and allows for the performer to express the sounds with near perfect intonation, as the index finger allows for the greatest precision in exchange for the speed of legato; however, the question of portamento is more cultural or personal than practical, Partch's technique being derived from Indian technique. Fingerboards should be marked for ratios despite the arguments frequently made by string players about the negative implications of marks and stickers. This attitude might satiate the pride of a violinist who performs in equal temperament with vibrato, but for this musical practice exact ratios are the absolute goal, and to rely on the ear alone is not enough. As Partch notes, "when such fingerboards have been used, intonation has generally been excellent; when they have been discarded, intonation has deteriorated immediately."[11] It should be clear that we exist in a

society so adapted to equal temperament that one can properly intonate by ear without the need for markings, but if a musical practice is completely alien the performer must always be going against their ear, as it has been compromised; thus, one can only trust the ratios.

Finally, as the piano is still the most popular instrument, keyboards should be discussed. Aside from the archicembalo there are no keyboards with enough keys, which requires, like other microtonal systems, retuning the piano. In investigating the necessary space needed for the greater perfect system as a double octave, there are two systems that I believe one can do so with a total of three pianos. The first is a completely enharmonic tuning that requires only two pianos so that they may perform, at the least, enharmonic music with the proslambanomenos, *A*, existing as a unique pitch on each keyboard, moving all the quarter tones to the third piano (example 4).

However there is the possibility of a mixed tuning if the composer desires non-repeating diatonic pitches on the piano, with the third piano only necessary for one fourth quarter tones, but with enough available keys to provide options for a variety of other mixed sets (example 5).

However, I should implore interpreters of music of any kind to—despite my insistence on a set tuning in my personal practice—not view any tuning as absolute, but rather, understand that the primary values in a line are contour and shade, and that the latter is given prominence through non-fixed tuning practices. In the time prior to equal temperament, from the ancient world through the classical, each theorist made the case for their own tunings and no music necessarily sounded the same across Europe; thus, the shade shifted according to the personal practice of those that performed the music. In the same spirit, as the tetrachord only requires a perfect fourth as a fixed interval, it is not according to my own practice that others should necessarily

conform, but to that which must be done to ensure the vitality of the musical line across minds and cultures.

A2	A♯2	B2	C3	C♯3	D3	D♯3	E3	F3	F♯3	G3	G♯3	A3	A♯3	B3	C4	C♯4	D4	D♯4	E4	F4	F♯4	G4	G♯4	A4
A	A♯	B	c	c♯	d	d♯	e	f	f♯	g	g♯	a	a♯	b	c′	c♯′	d′	d♯′	e′	f′	f♯′	g′	g♯′	a′
A	B♭	B	c	d♭	d	e♭	e	f	g♭	g	a♭	a	b♭	b	c′	d♭′	d′	e♭′	e′	f′	g♭′	g′	a♭′	a′
A	B𝄾	B𝄪	c𝄪	d𝄾	d𝄪	e𝄾	e𝄪	f𝄪	g𝄾	g𝄪	a𝄾	a𝄪	b𝄾	b𝄪	c𝄪′	d𝄾′	d𝄪′	e𝄾′	e𝄪′	f𝄪′	g𝄾′	g𝄪′	a𝄾′	a𝄪′

Example 4. Three piano tuning with two enharmonic and one quarter tone pianos

A2	A♯2	B2	C3	C♯3	D3	D♯3	E3	F3	F♯3	G3	G♯3	A3	A♯3	B3	C4	C♯4	D4	D♯4	E4	F4	F♯4	G4	G♯4	A4
A	A♯	B	c𝄲	c♯	d	d♯	e	f𝄲	f♯	g	g♯	a	a♯	b	c𝄲′	c♯′	d′	d♯′	e′	f𝄲′	f♯′	g′	g♯′	a′
A	B♭	B𝄲	c	d♭	d𝄲	e♭	e𝄲	f	g♭	g𝄲	a♭	a𝄲	b♭	b𝄲	c′	d♭′	d𝄲′	e♭′	e𝄲′	f′	g♭′	g𝄲′	a♭′	a𝄲′
-	B𝄾	-	-	d𝄾	-	e𝄾	-	-	g𝄾	-	a𝄾	-	b𝄾	-	-	d𝄾′	-	e𝄾′	-	-	g𝄾′	-	a𝄾′	-

Example 5. Three piano tuning with mixed interval pianos

Notes

1. The term *emancipation of the dissonance* refers to its comprehensibility, which is considered equivalent to the consonance's comprehensibility. A style based on this premise treats dissonances like consonances and renounces a tonal center. By avoiding the establishment of a key modulation is excluded, since modulation means leaving an established tonality and establishing *another* tonality. (Schoenberg 105)
2. The intervals play an exclusive role in atonal music, which originates from the "totality." Through them musical character is no longer expressed by major and minor keys or by characteristic instruments (thus by a color), but only by the totality of the intervals and tone-colors. This totality is of value purely on an equal-tempered instrument. In atonal music there are no longer any tonics, dominants, subdominants, degrees of the scale, resolutions, consonances—only the twelve intervals of the equal temperament. Consequently, its "scale" originates from out of the twelve tempered half-tones (Hauer, qtd. in Harvey 142)
3. Schoenberg 143
4. Partch xix
5. This can otherwise be interpreted as an untempered version of the 29 tone Just Intonation scale that Harry Partch began with on the adapted viola.
6. This is true only if one desires music capable of infinite mutability across tuning. Pitches should always be considered fundamentally equivalent in their relationships between 1/1 and 2/1 for there to be any possibility of universality. Subsets are always possible, and when Partch would play a mode he would designate a subset space within his 43 tone octave; however, the goal of this method of organization is for it to exist anywhere, at any time, in any way, and to write music that is incompatible with another's practice is a useless endeavor.
7. Ibid. 256-257
8. Ibid. 99
9. Though it should be mentioned that this was not planned. I had stumbled upon its usefulness after several failed attempts at finding a luthier willing to adapt the viola to match Partch's instrument.
10. Ibid. 201-202

11. Ibid. 201

Section I.

Concerning construction

The tetrachord as brick

As it has been discussed in the preface, tonality and its scales prove to be a highly structured and thus deeply convincing system; consequently, the only way to match such a construction is to prove that any other system is equally well thought out. Just as the triad generates all possible pitches of any scale, a tetrachord may generate a convincing pitch structure as well. If we were to begin with a simple diatonic tetrachord:[1]

A
G
F
E

We have a confirmed set of pitches, and with this we can assume two precepts: if our tuning assumes that fourths and, in inversion, fifths, are perfect intervals, then our tetrachord is naturally built upon a perfect fourth and fifth in relationship to the root pitch, just as the triad assumes a perfect fifth and a major or minor third accordingly. It is then naturally so that we do not tend to view augmented or diminished intervals as functional in tunings that are not defined by an augmented or diminished tempering. Knowing our new structure, we can begin building the second tetrachord without prior knowledge of what it could be by seeking the perfect fifth above the root pitch:

B
A
G
F
E

And, quite intuitively, we can apply this knowledge of the perfect fifth to build the upper tetrachord in full by applying it to each successive pitch:

E
D
C
B
A
G
F
E

This final double diatonic, derived from a natural source—that is, the intervals and their perfect relationships to one another and nothing else—is what one can consider a pure tetrachordal structure, the logic of which was applied in the ancient world in the earliest form of Greek scale: the lyre's tetrachord, tuned to *a g f e*, a small diatonic tetrachord that later become the base for the heptachord of *d' c' b a g f e*. From this, the addition of the octave pitch on the top provided the first octave species, the Dorian, *e'-e*. Just as the tetrachord worked out earlier was built by seeking the distances of a perfect fourth and fifth, the first octave species was constructed according to this manner. View for yourself that the relationship between the pitches in the first tetrachord to the second and note that they are all a fifth from the pitch that occupies the same space in the tetrachord—*b-e, c'-f, d'-g, e'-*

a—and, just as the pitches in the lower tetrachord are within the distance of a fourth from the root, these upper pitches are within the distance of a fourth from the root pitch's octave. Thus, the perfect fourth and fifth relationships are palindromic, and the structure itself is thus perfect from either end.

This central octave structure was to become the basis for the greater perfect system, described by Euclid in the fourth century B.C. In his study of ancient Greek music in the work, The Rise of Music in the Ancient World, Curt Sachs notes:

> it was perfect as a unique attempt to organize the musical space from one center, *a*. The center stands in its original octave of Dorian structure, *e'-e*, which, by adding half an octave above and half an octave below, is extended to two octaves *a'-A*. This new unit could be shifted both up and down by half an octave ether way and thus cover three octaves.[2]

This new structure was built in the fashion of two conjunct tetrachords, splitting at the disjunct section of the Dorian species, with a single pitch outside the tetrachords, *A*. These pitches are given in example 6 and in their equivalent names in scientific pitch notation in example 7.

Despite the ease of scientific pitch notation, a majority of the content provided, ignoring scores, will reflect the bracketed tetrachord system of ordering the greater perfect system, as within the context of the system the unique notational approach allows for the contemporary composer to apply it without historical connection in a manner that abstracts the pitch content from the degrees of tonal practice and creates a system in which the aggregate system is the entirety of the pitch content and lacks the distinct trait of infinitely octaving scales that defines western tonal

a' Nete hyperbolaion
g' Paranete hyperbolaion
f' Trite hyperbolaion
e' Nete diezeugmenon
d' Paranete diezeugmenon
c' Trite diezeugmenon
b Paramese
a Mese
g Lichanos meson
f Parhypate meson
e Hypate meson
d Lichanos hypaton
c Parhypate hypaton
B Hypate hypaton
A Proslambanomenos

Example 6. Greater perfect system

a' a4
g' g4
f' f4
e' e4
d' d4
c' c4
b b3
a a3
g g3
f f3
e e3
d d3
c c3
B b2
A a2

Example 7. Pitch range in relation to scientific notation

practice—the fixed audible range being *C0* to *C10*. It is certainly true that later it can be exported into scientific pitch for notating a score, but the act of abstracting a musical value into a tetrachordal system without reference to the pitch range allows for the composer to work with pure blocks of intervals defined by relative position, not a series of notes within a grand frequency spectrum. Thus, it will be posited that the aggregate is a series of positions within a void so the only pitches that exist are those currently defined.

The traditional tetrachord forms originally applied in ancient Greek musical practice are the Diatonic, ST-WT-WT, Chromatic, ST-ST-m3, and Enharmonic, QT-QT-M3, genera. In these examples the tetrachord *d-a* will appear, as it contains both semitone and whole tone steps, but the order of steps in filling the tetrachord will be upward from *a-d*.[3]

d	d	d
c	b	b♭
b♭	b♭	b♮
a	a	a
Example 8. Diatonic	Example 9. Chromatic	Example 10. Enharmonic

Beyond these, there are other possible ways of organizing tetrachords that are outside of Greek practice, due to which they will be considered "artificial" tetrachords. John Chalmers, in *Divisions of the Tetrachord*, has already detailed several possible opportunities in the construction of genera in the fourth chapter, much of which are mathematically derived and built around tempering the individual notes within the tetrachord; however, as the goal of this work is structural, not necessarily mathematical, our tuning is defined; and furthermore, as we are interested in the positions of pitches and intervals, not the distance between them, they will not be part of the discussion of genera.[4]

The first of which to discuss, because it exists within the last modulation (example 25) of the Michigan Instrumental Papyrus (P. Mich. 1205r), is the augmented, or "whole tone," tetrachord. This genus is not accounted for in any ancient treatise, and thus is in no early scholarly work on ancient Greek music. It is peculiar in that it does not respect the integrity of the perfect fourth that defines a proper tetrachord, instead requiring an augmented pitch at either end of the tetrachord. As the name implies, it is built from a succession of whole tones, WT-WT-WT, at either end.

d♯
c♯
b
a

Example 11.
Upper Augmented

d
c
b♭
a♭

Example 12.
Lower Augmented

The next to discuss is a retrograde form, in which the traditional genera are reversed; thus, the Diatonic becomes WT-WT-ST, the chromatic becomes m3-ST-ST, and the enharmonic becomes M3-QT-QT.

d
c♯
b
a

Example 13.
Retrograde
Diatonic

d
c♯
c
a

Example 14.
Retrograde
Chromatic

d
c♯
d𝄲
a

Example 15.
Retrograde
Enharmonic

A final, major form is a "shuffled" method, in which the steps are rotated in a manner between the original and retrograde forms; thus, the Diatonic becomes WT-ST-WT, the Chromatic becomes ST-m3-ST, and the Enharmonic becomes QT-M3-QT.

d	d	d
c	c♯	c♯♯
b	b♭	b𝄫
a	a	a
Example 16. Shuffled Diatonic	Example 17. Shuffled Chromatic	Example 18. Shuffled Enharmonic

The last set of forms that are worth discussing are much more of a side note, nothing more than permutations of the major forms already known as respellings for the sake of enharmonic pitches. Knowing that enharmonic pitches are a consequence of my choice of Pythagorean tunings, it is of interest to contemplate the matter of how they fit within the tetrachords we know. It is without question that if enharmonic pitches are employed, then one can respell a chromatic value within a tetrachord so that a flat might become the enharmonic sharp, which will shade the line and its harmony in a different manner.

Notes

1. All pitch content will be provided in descending form.
2. Sachs 222
3. If one builds downward, simply reverse all steps.
4. Of course, the reader is encouraged to read Chalmers' work to understand opportunities provided through tempering pitches, and should keep in mind that the structural aspects of this study are applicable to any set of pitches within the context of the tetrachord.

Octave species as pitch content

It is best to define the results of conjoining tetrachords into a set of eight pitches not as a scalar form, but as a collection, perhaps like a gamut, as all ancient Greek music exists as instances of the octave species as pitch content, not as a scalar form; that is, despite the nature of the similarities of a scale and an octave species, the octave species is still a modal structure outside of the tonal system in which all scales operate. The mese, *a*, and the dynamic mese, the fourth pitch in the octave species, are the points around which ancient Greek melody revolves,[1] but the first pitch of the species does not act in the manner of the tonic, or even as the final in chant, a distinction that separates the ancient modal practice from the medieval modality that tonality emerged from. In this manner, the octave species acts entirely as a pitch collection from which composers write melodies around either a static or dynamic mese, and at any point in time this collection may modulate to provide new pitch content. Thus, despite the structure of the octave species, there is no theoretical purpose to it octaving as opposed to simply existing as a modal heptachord other than it being a choice in the ancient world to add on the octaving pitch.

Transposition of the octave species

The method of developing the different octave species in ancient Greek music is somewhat arbitrary thanks to the contradictory developments in their musical theory over time. In their earliest forms these species are "analogous to the 'white key' modes"[2] of the medieval period: *f'-f*, *e'-e*, *d'-d*, etc; yet, they are unrelated to them with exception of name, as when Boethius defined them in

De Musica the meaning of the names had changed; in contrast, Curt Sachs, in explaining the complicated, and often contradictory, history of ancient Greek music theory, provides a variety of modes and transpositions he calls keys, which appeared around the fourth century B.C.[3] The keys are intrinsic to his transcriptions of the ancient Greek fragments; thus, as we are using them to study the application of the octave species in the fragments, it is best to provide them in the same form he does in his study.

Sachs provides a table of the octave species assumed to be employed by the ancient Greeks to create the keys for his transcriptions.[4] He makes use of the starting point of Dorian as *e′*-*e*, from which we might build a table delineating this method of transposition (example 19).

Hypermixolydian	up	2 semitones
Mixolydian	up	1 semitone
Lydian	up	2 semitones
Phrygian	up	2 semitones
Dorian		
Hypolydian	down	1 semitone
Hypophrygian	down	2 semitones
Hypodorian	down	2 semitones

Example 19. The method of transposing octave species from the Dorian according to Sachs' table

The results of this method of modulation provides these octave species (example 20), quite different from the church modes that those trained in the western tradition are accustomed to. The dynamic mese is in bold.

Moving beyond the initial species

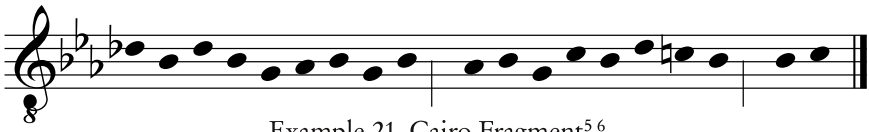
An assumption is that if the species are embedded within a larger

Hypermixolydian	*a′ g′ f♯′ **e′** d′ c′ b*
Mixolydian	*a′ g′ f′ e′ **d′** c′ b♭ a*
Lydian	*g♯′ f♯′ e′ d♯′ **c♯′** b a g♯*
Phrygian	*f♯′ e′ d′ c♯′ **b** a g f♯*
Dorian	*e′ d′ c′ b **a** g f e*
Hypolydian	*d♯′ c♯′ b a♯ **g♯** f e d♯*
Hypophrygian	*c♯′ b a g♯ **f♯** e d c♯*
Hypodorian	*b a g f♯ **e** d c B*

Example 20. The octave species in transposition

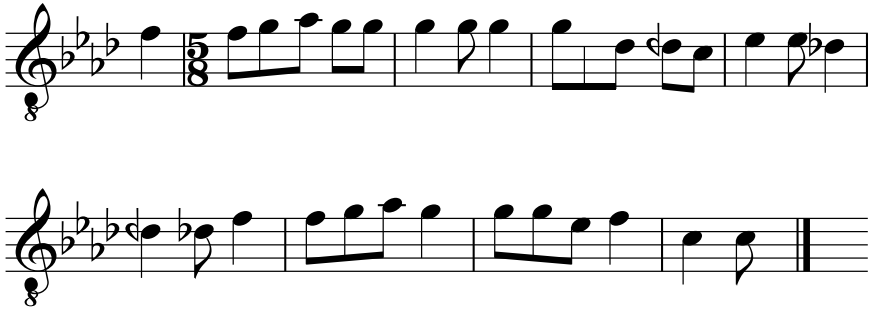
structure, and they are transpositions of the base greater perfect system, then outside the species the pitches of the entire system must also transpose to reflect the new species, just as modulation in tonality applies to all pitches despite the octave; however, because the octave species is the entirety of the applied pitch collection and it is not expected for the composer to leave this range, but instead modulate into a new form, the pitches of the greater perfect system outside the octave species of are no interest. It is then that the octave species is an abstracted set of pitches within a void in the same manner the greater perfect system is; or rather, an abstraction of an abstraction.

For example, the Cairo fragment (example 21) exists within the octave species *g′*-*g*, with the modulated form being *f′*-*g*, and the melodic line reflects this: no pitch breaches the point beyond *g*, and no pitch ever expands beyond *f′*; thus, there is a definitive wall that reigns in the melodic line, and it possesses a very real, very finite, physical space. It is the same in the First Delphic Hymn



Example 21. Cairo Fragment[5 6]

section B (example 22), in which the entire space is *a'-c* in both the octave species and its modulation—both of which extend beyond the limits of the double octave.

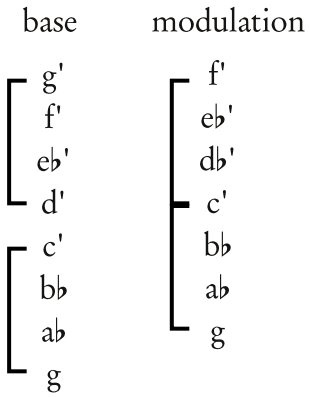


Example 22. First Delphic Hymn section B[7]

It is again clear that the limit of the line is defined by this space of *a'-c*, and the composer does not travel beyond *c*, the floor of the melodic line.

If we ignore all ancient treatises, theory, and musicological conclusions so that the fragments themselves are the only manner in which we seek to understand ancient Greek music, then it must be designated that it is only through the act of modulation that one finds new pitches, meaning that one cannot simply slide up and down the system as if it were the tonal system in which one travels among octaves. This is the system from which we draw the notion that the octave species is an abstracted form of the greater perfect system, there then being a void beyond the defined range. As modulation is the only method of finding new pitch content, it becomes a powerful tool in traversing the modal void.

All modulation forms, as they are understood through available fragments, are generally alternations of disjunct and conjunct tetrachords, with disjunct into conjunct and conjunct into disjunct. The entirety of the modulations that remain extant consist of the first type, metabole, in which the point of pivot—so called because it is the point at which a conjunct form is joined, and in a disjunct form is at either the top of the lower tetrachord or the bottom of the upper tetrachord—is at a regular, diatonic interval. For example, the modulation in the Cairo fragment contains a modulation with the point of pivot being *c'*, with both tetrachords retaining a diatonic genus.



Example 23. Modulations from the Cairo Fragment

In this conjunct form the new tetrachords are built from the center of *c'*. As *g'* cannot be the top of the upper tetrachord, being a fifth above *c'*, a new tetrachord is filled in, this instance being a diatonic *f'-c'*. The only consequence of a conjunct form is that the octave species is broken, the double tetrachord structure becomes a non-octaving heptachord.

However, not every fragment provides a modulation from disjunct into conjunct. Those that modulate disjunct to disjunct

are deemed "parallel" as the tetrachord structure in the original and modulation are similar. In these, the point of pivot is less obvious because what is more likely to change is not the structure itself, but the form of the tetrachords alone. What one might consider a point of pivot is where the tetrachords modulate; thus, in the First Delphic Hymn section B, what might be the point of pivot is *d♭*, with the result being a parallel disjunct form, the lower tetrachord seeming to "fold in" from diatonic to enharmonic.

base	modulation
c'	c'
b♭	b♭
a♭	a♭
g	g
f	f
e♭	d♭
d♭	d♮
c	c

Example 24. Modulations from the First Delphic Hymn section B

In this situation, *d♭* is the focal point of the tetrachord, being the only shared inner tetrachord pitch in the base and modulated form. Of course, one could argue that *c* or *f* should be considered the point of pivot, as it is generally from either pitch that the new tetrachord fills in; yet, because the result is a standard genus there is no reason to fret over the source, as each point still illustrates the shift to the end result of an enharmonic genus.

These two examples are the most frequent forms of metabole modulation, but there is one more chain of modulations that is of interest in the Michigan Instrumental Papyrus, in which lies the augmented, or "whole tone," genus defined earlier. This is the only modulation chain not supplied by Sachs, having been discovered at a later date.[8]

base	I	II	III	IV	V
a'	a'	a'	g'	a'	e'
g'	g'	g'	f'	g'	d'
f'	f'	f'	e♭'	f'	c'
e'	e'	e'	d'	e'	b♭
d'	d'	d'	c'	d'	g'
c'	c'	c'	b	c'	f'
b♭	b	b♭	a	b♭	e♭
a		a		a	d

Example 25. Modulations from the Michigan Instrumental Papyrus

The Michigan Instrumental Papyrus features several unsurprising modulations from the base species, a diatonic *a'-a*, prior to the final modulation. The first is a diatonic conjunct at *e'*, the second is a return to the original species, the third is a diatonic/shuffled diatonic conjunct at *d'*, the fourth is a return to the original octave species, and the final is a parallel modulation to a lower augmented/diatonic disjunct, seemingly at *e'* and filled downward.

There are several questions that this raises in the final modulation. The first is the downward, parallel modulation. If we know that modulation is generally a conjunct to disjunct shift in the majority of examples, including the Michigan papyrus, and that the point of pivot is either the top or bottom point of a tetrachord—ex. *d* or *e* in the base form of the Michigan papyrus—then the last modulation provides a conundrum: a parallel modulation, disjunct to disjunct, and the point of pivot, *e*, creating a new tetrachord, moving downward. Though there are instances of parallel modulation, such as in the First Delphic Hymn section B (example 24), in those situations the octave species remains unchanged; yet, in this situation one finds the opposite, a completely new set of tetrachords that do not function as an octave species, the new form possessing a distance of a ninth.

The second is the use of a genus compromising whole tone relationships alone: the top tetrachord contains the pitches *bb c d e*, an expression of the augmented tetrachord defined earlier, the only instance of an augmented tetrachord in any extant fragments. Finally, the third is that the distance between the two disjunct tetrachords is greater than a whole tone. In most examples, the distance between the disjunct forms is a diatonic semitone or whole tone; e.g. *b-c* or *g-a*; however, the final modulation contains a *g-b♭*, a distance of a minor third. For these there can be no answers whether they are proper, functional traits or mischievous rule breaking simply because there is not enough evidence, but they will be of use to us in later practical studies.

Beyond the metabole are the irregular forms, pathos, so called because they do not modulate at a regular, diatonic interval, but instead modulate at quarter tone intervals. Of these there are no musical evidence of, the only explanation being from Aristides Quintilianus in his *De Musica*.[9] These forms are the spondiasmos, modulation upward by three quarter tones, eklysis, modulation downward by three quarter tones, and ekbole, modulation upward by five quarter tones. As there are no extant examples, what is being provided are reconstructions based upon knowledge of modulation from the metabole, meaning that the examples will be disjunct to conjunct and the point of pivot will be the point at which the interval will modulate. In the earlier forms it was clear that the point of pivot did not change; that is, *d'-c'* becoming *c'* was assumed to be the two merging together and bridging the disjunct divide without becoming a new pitch; and, in the context of the parallel modulation at *d♭*, there was no change in the point of pivot, but only in the tetrachord as a result of the modulation. In contrast, what we will find in these modulation forms is that the point of pivot must modulate according to the direction defined as to fill in the tetrachord structures. Thus, *c'* will not be the joining point of a conjunct form, but the pitch that *c'*

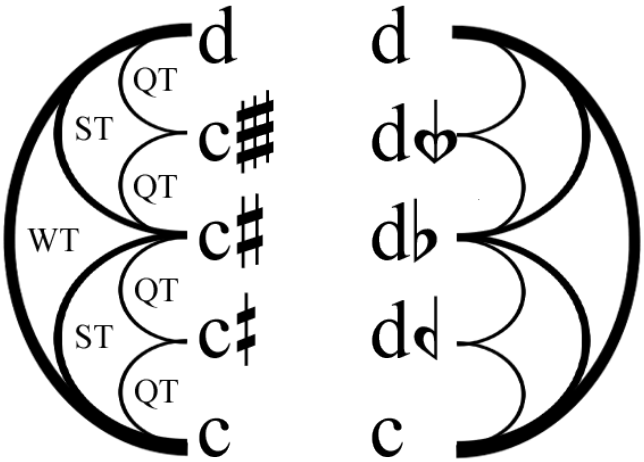
modulates into will be the joining point. In each example the base octave species will be the Dorian *e'-e* and they will modulate into a conjunct form and return to a disjunct form. To aid the modulation process, take note of examples 26 and 27 showing the stepwise relationships between whole tone and semitone diatonic pitches.

base	I	II
e'	c𝄫'	e'
d'	b𝄪	d'
c'	a𝄪	c'
b	g𝄫	b
a	f𝄫	a
g	e𝄪	g♭
f	d𝄫	f
e		e

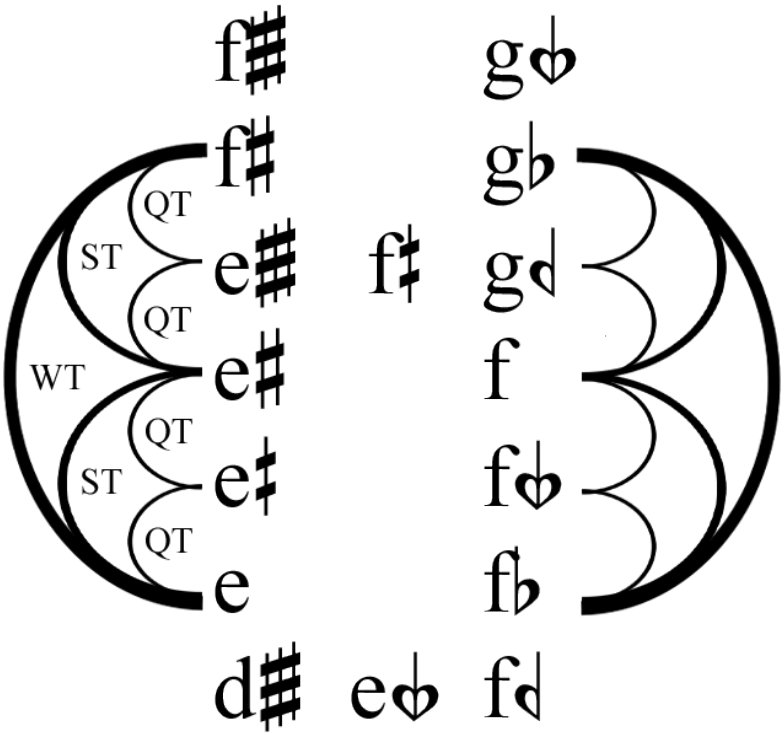
Example 28. Spondiasmos moduations

In the spondiasmos (example 28) the point of pivot for the first modulation is *f*, which modulates upwards to the pitch g𝄫, creating a diatonic conjunct form, which then modulates at a one quarter flat to become the *b* in the upper tetrachord, the new form being a diatonic top and chromatic bottom. In this modulation both points of pivot are performed at a pitch that is neither on the disjunct divide nor the conjunct joining point, in the same manner the First Delphic Hymn section B modulated from an inner pitch, as to show another instance of an inner point of a tetrachord. As long as one understands that the modulation pitch must become the joining point or one of the two points at the disjunct divide, then any pitching within a tetrachord might be applied as a point of pivot.

In the eklysis (example 29) the first modulation is at *e'*, modulating down to *e𝄪'*, the new form being diatonic. It then modulatesat



Example 26. Step relationships between a diatonic whole tone



Example 27. Step relationships between a diatonic semitone

base	I	II
e'	a𝄲'	e♭'
d'	g𝄲'	c'
c'	f𝄲'	b'
b	e𝄲'	b♭
a	d𝄲'	a♭
g	c𝄲'	g♭
f	b𝄲	f♭
e		e♭

Example 29. Eklysis moduations

b𝄲' to become *a♭* in the new disjunct structure with a chromatic tetrachord on top and a diatonic tetrachord below. The top tetrachord is written in a manner that retains a scalar form for easier pitch delineation.

The ekbole modulation (example 30) begins at *a*, modulating to *c𝄫'*, the new structure being diatonic, and then modulates again at g𝄫, becoming *b* in a return to the original Dorian octave species.

base	I	II
e'	f𝄫'	e'
d'	e𝄲	d'
c'	d𝄲	c'
b	c𝄫	b
a	b𝄫	a
g	a𝄲	g
f	g𝄫	f
e		e

Example 30. Ekbole moduations

Each of these examples modulates at different positions to show the opportunities of the ability to modulate at any point within the octave species. If one actively seeks quarter tone composition

the varying of the metabole and pathos moduations, taking into account the transpositions of the octave species as more than starting material, might provide a much larger library of pitches than standard tonal modulation between keys without conforming to a strictly chromatic system.

Matters of unmixed and mixed octave species

In the introductory discussion of the tetrachord and its use in the construction of the octave species, it was clear that the purest form of the early octave was always defined by unmixed tetrachords; that is, both being diatonic, chromatic, enharmonic, or otherwise. This is how the octave species remains "functional" in that it is built according to some natural, self-evident manner that ensures that the result is self-generating, not made by hands, so to speak, but a natural result of the relationships between two perfect frequencies.

Yet, it should have come to one's attention that this was not necessarily so in practice, as we have discovered in the strange, somewhat unprecedented, modulation at the end of the Michigan Papyrus (example 25). This structure is mixed, devised by the amalgamation of two different tetrachords into one octave species, and the distance between the two pitches has become an imperfect interval of a sixth. Both of these facts are also discussed by Chalmers concerning the tuning of the greater perfect system: "while in theory all five of the tetrachords must be the same, in practice mixed tetrachords and considerable chromaticism occurred."[10]

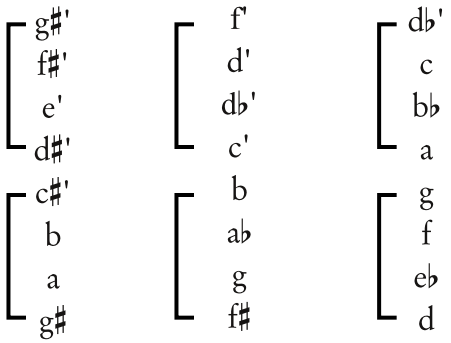
This mixing and muddling of the functional structure that defines the system is important, not only as we see the same transgressions in tonality through the creation of whole tone, augmented, and diminished scales that sever the tonal scales from their purely functional form, but also because much of what we

will come to discuss following these early theoretical and functional foundations will deal with shattering the perceived "connectivity" of the tetrachords. It is then important to express that the functionality sought is merely the beginning of developing something that has the capacity to break from a pure form, yet still retain its original distinct identity. Just as extended tonality requires a foundation in purely triadic structures to provide the opportunity to bend the structure, so must a modal form have a pure foundation, as we have developed so far, to allow for broken tetrachords, transforming the structure into one in which no tetrachords are related to one another, the discussion of which one can find in the section "Greater perfect system as aggregate." It is, of course, important to note that even in situations in which modulations have broken the pure form, the starting point is generally a conservative structure that provides a basis for being bent out of shape, which allows for coherency and the suspension of disbelief in the listener.

The technique of modulation in practice

As it is in tonality and dodecaphony, the act of modulation allows for thematic transformation in which the content is changed according to species permutations, creating limitless content from a seemingly limited system. For example, in an earlier experiment, *Et nox ultra non erit* (2018), the compositional process is a test of the opportunities in developing a line through pitch permutations alone. Of the set of modulations, three exist for the sake of the solo line, which appear in example 31.

The first is an exposition, but the following species transform the pitch content, slowly descending over time. The direct result (example 32) appears in how the line changes in a manner where the line retains a sense of familiarity in its contour, yet the content is totally unknown to the listener.

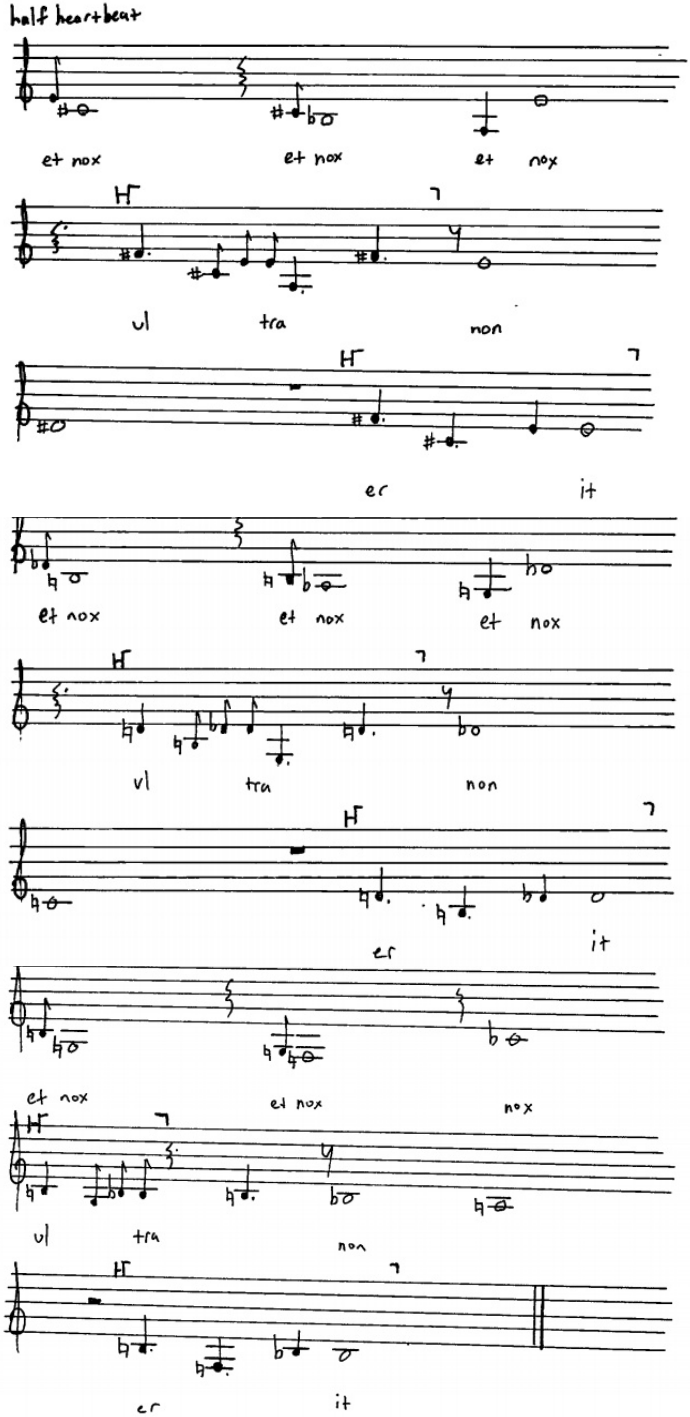


Example 31. Excerpts from the *Et nox ultra non erit* modulation set

This is best defined within the context of the two traits of a musical line described earlier, contour and shade: a line is given a shape by contour, but contour is not necessarily a specific set of pitches; instead, it is a motion that could be as easily drawn as notated. However, contour provides the foundation for shade, the combined sets of intervals that the contour delineates. Shade is the next logical step in the discussion of musical color applied to tonal music—though color itself, and the related synesthesia, seems to occur as the result of tonality and keys, as color is described the result of harmony and chordal structures. In contrast to color as a manifestation of tonality, shade is an intrinsic aspect of modality and modal structures in which the vertical harmony is circumstantial, and the line, and its horizontal harmony, is paramount.[11]

In respect to the shades of the church modes, Guido of Arezzo notes:

> Although every song is built from the same tones and intervals, the tone in which the song closes asserts its superiority; this sounds longer and more impressively. Also the tones preceding this are placed so that they seem to take, in some wonderful fashion, a certain color from it, which



Example 32. Et nox ultra non erit pp. 1, 4, 7

> is discernible only through practice.[12]

And concerning the difference of shade attributed to the varying orders of the modes:

> All songs are set down out of the eight different tones... in their varying qualities (graves, acutao, superacutae), and each preserves its own gradation in its own song throughout, so that it moves in one of the eight keys. Conforming with the earlier sayings, each tone retains its individual relationship to the ground tone, its own coloring, which, therefore, is always changing whenever the ground tone, representing the tonality itself, is changed.[13]

In comparison to the strong contrasting behavior of chords, the only clear differences in the single line in chant are the final, its reciting tone, and the presence of a flattened *b*; thus, to the observer who knows nothing of chant process, yet otherwise might clearly recognize a change of key in tonal music, the shift of a mode in a single line is difficult to discern as the church mode shifts up and down according to the white keys in such a manner that the same pitches will often be employed in a different order in contrast to the audible chromaticism of tonality. Thus, the slight difference in a line according to the final of the mode, even if the contour remained the same, is what creates this shade, and it is better described as if one viewed the line from a different angle.

Tetrachordal modulation has a clear effect on the line, allowing for shade to not simply be the manner in which the pitches are tempered, as discussed in the section on tuning, but how the line itself transforms according to the current octave species. The contour does not change, but the new pitches and their

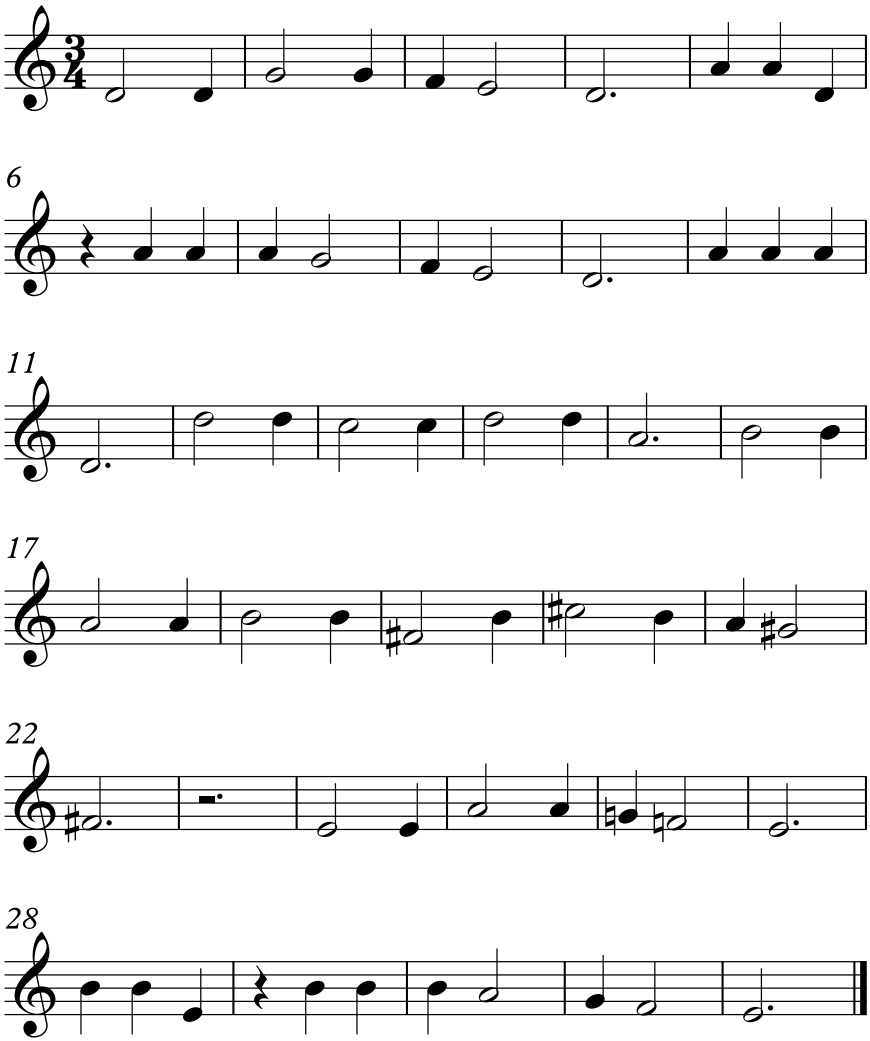
relationship to one another fundamentally changes the result of said contour. Thus, whereas color in tonality is often primary colors—shimmering golds, vibrant reds, deep blues—shade in modality is much more subtle—a white or an untreated primary color growing brighter or fading away through the various combinations of shadow and light.

Let us apply this concept to an existing line by looking at *L'homme armé* transformed by modulation (example 33) and its set of modulations (example 34).

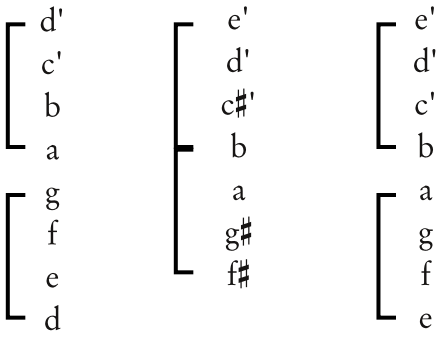
The first half begins in the original *d'-d* Dorian, but modulates at bar 16 to a conjunct *e'-f*♯ set. Both follow the standard Dorian WT-ST-WT structure within the tetrachords. The final modulation occurs at the restatement of the first phrase at bar 24, transforming to an *e'-e* Phrygian. In this method there are two noticeable differences in the shading of the line: the first is that the act of modulation shifts the line up and down so that the root of the mode is higher or lower than the previous, but the stasis of the contour prevents the line from losing coherency as it rises and falls; the second is the inclusion of accidentals that, in an enharmonic tuning, shade the semitone differently than equal tempered accidentals.

It should not be surprising that any theoretical or aesthetic notions of shade are entirely relegated to examples from medieval modality and pre-equal tempered thought—or perhaps post-equal tempered if the music of James Tenney, as well as his students Marc Sabat and Chiyoko Szlavnics, has proven anything—as the difference between shade and color is also in the method of performing a line and its harmonization. It might be said that color becomes significant when diversity of timbre and orchestration become primary traits of music, but shade more so in those situations defined by homogenous timbral groups and ascetic instrumentation.

Of course, there are subtle differences beyond shade, notably



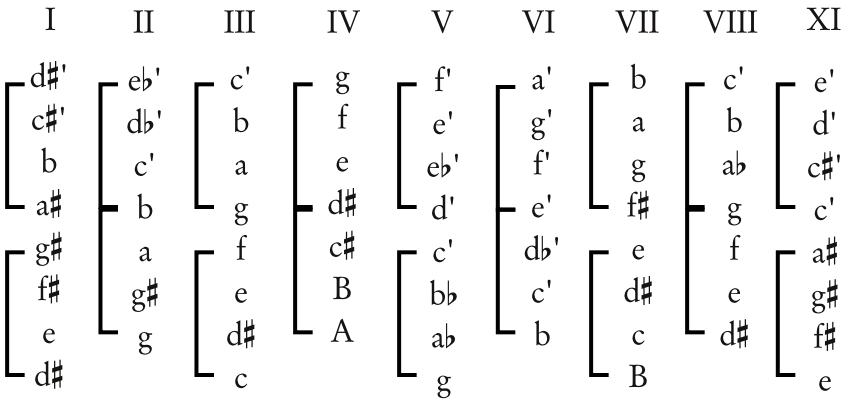
Example 33. *L'homme armé* in modulation



Example 34. *L'homme armé* modulation set

that the third permutation in *Et nox ultra non erit* (example 32) is missing a pitch. This perversion of the line is a problem of range in any voice, different from the limitation of the octave—that is, the theoretical range of a species may extend above or below the practical range of a voice precisely because it does not octave—is one of the hidden consequences of modulation.

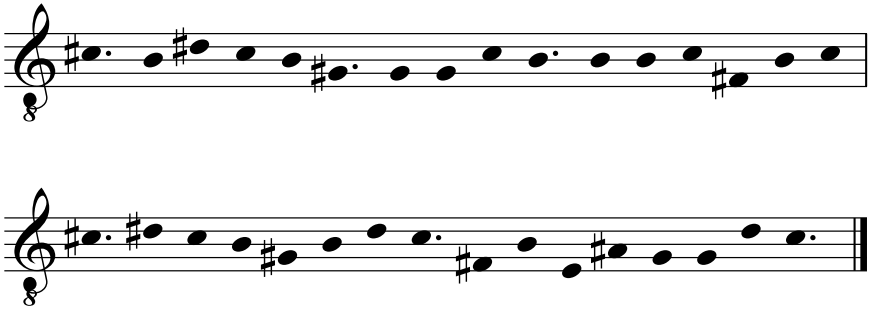
To further investigate this problem of the conflict between the octave species and the range of a voice, let us turn to *Study Score A* (pages 31-40), which deals with the results of modulation on a single melodic line, but attempts to apply the octave species modulation from *Et nox ultra non erit* to a polyphonic environment, a difficult task if one seeks something other than pointillism. In this piece the modulation chain will proceed as follows:



Example 35. Set of modulations from *Study Score A*

The transformations are Hypolydian (I), conjunct metabole at *b* (II), disjunct metabole at *g* (III), conjunct metabole at *d*♯ (IV), disjunct building up from *g* (V), conjunct at *e'* (VI), disjunct building down from *b* (VII), conjunct at *g* (VIII), disjunct at *c'* (IX).

The music unravels from a single melodic line that is distributed among the voices as content, and the entirety of the piece is derived from the line provided in example 36.



Example 36. Melodic source from *Study Score A*

The first form is a restating of that melodic line in the same octave species as the original line in measures 1-3.

This system reaches the end of the original melody, which is then transformed into new content for the next section. The modulation to II is performed at a consonant interval in the bass voice in measure 4, after which the other voices follow, the tenor modulating stepwise.

In species I the distinctions of where the line begins and ends is clear, but by species II the transformation of the line through modulation begins to blur the form of the original melody. Thus, when II modulates to III in measures 6-7 the melody is not complete, yet the listener is no longer aware the pitch content is the same, they are immersed in the exact material of the first set but cannot recognize it.

In measures 6-8 we find the modulation takes us to the new end

pitch, *b*, and from that the melody begins once more in a new form.

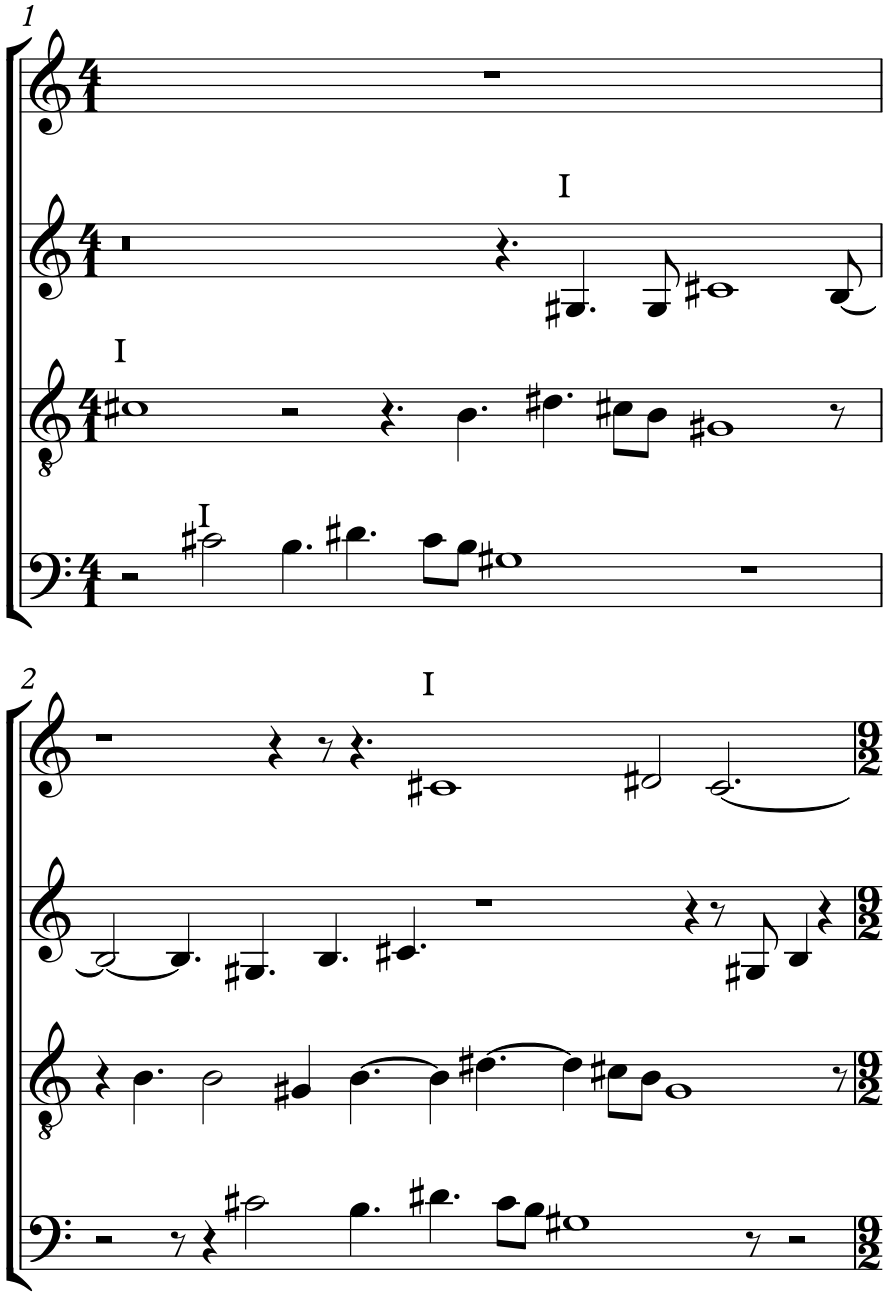
From the exposition here the bass modulates to IV for only two pitches. IV is a species modulated to for the sake of the lower register of the bass voice and thus the limited range means that it has limited function, something not encountered until this moment; however, it also is an example of the idea that several species might exist at once, out of phase, so to speak—note that IV exists at the same moment as III in the tenor. From this the three remaining voices skip IV and all modulate to V.

Take note that the soprano finishes the melody on *e'* in measure 10. This leads to VI, which, as it only encompasses the higher range, does not apply to the tenor and bass voices, again showing the limited range of the octave species in the context of a polyphonic language.

This is finally broken by two more out of phase modulations in measures 15-16, VIII in the tenor and VII in the bass against VI in the soprano, all of them finishing the last variation on the melody after modulating to IX.

The primary conclusion of this study is that the act of modulation allows for a wide variety of possible variations in a simple melodic line, and the act of modulation as pitch generator is not as apparent as imitation or canon, as well as just as subtle as pitch generators in dodecaphonic methodology. It is coherent, yet also permuted in a manner that blurs the curve of the original line in tandem with standard variation practices; as a result, one modulation might flow in a more or less exaggerated manner than the original line and the variations of the line that appeared prior whereas if one modulated a line in the tonal system only the color would vary.

Of course, the most obvious problem is that limited range of the octave species is unfit for non-staggered polyphonic composition, not simply for the bass voice, which suffers greatly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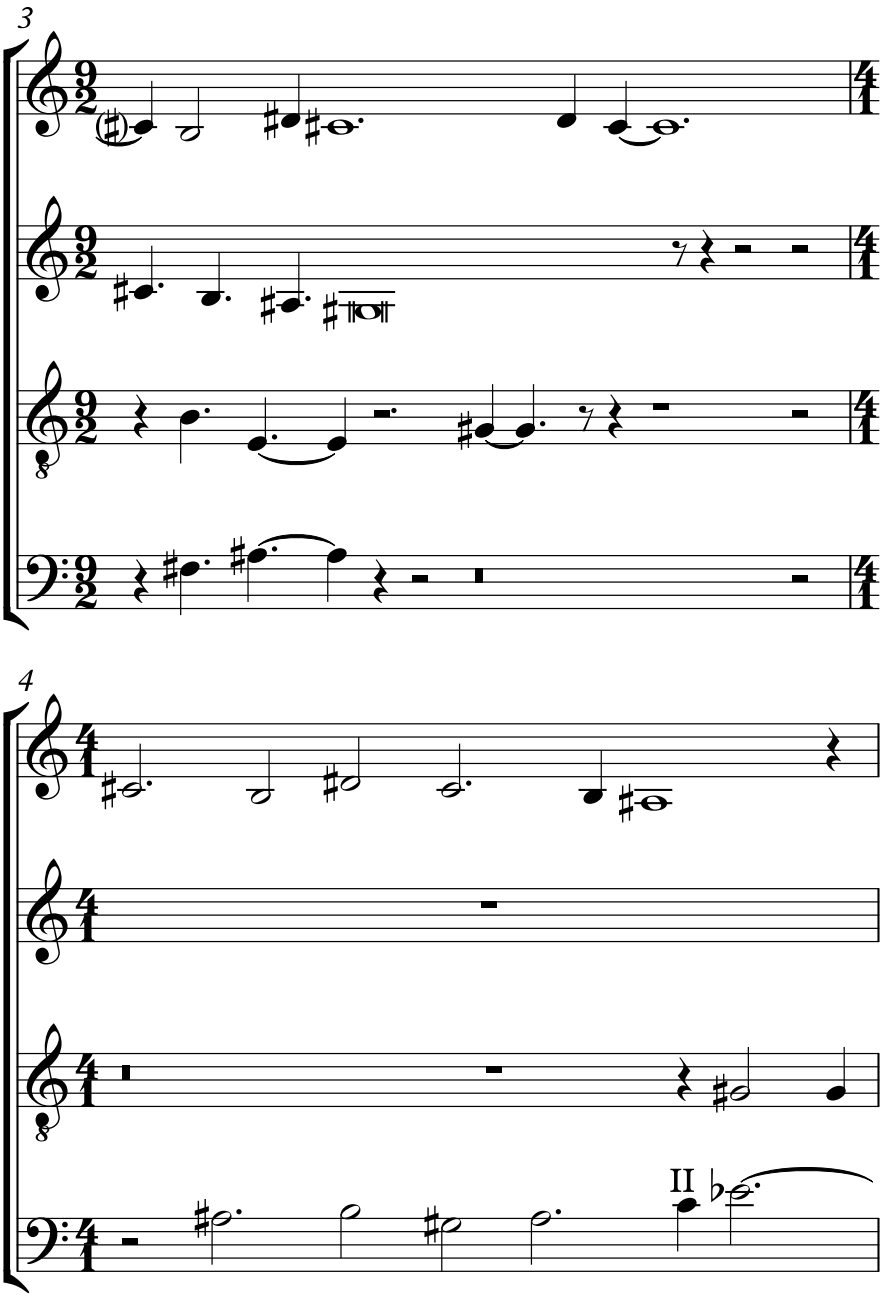
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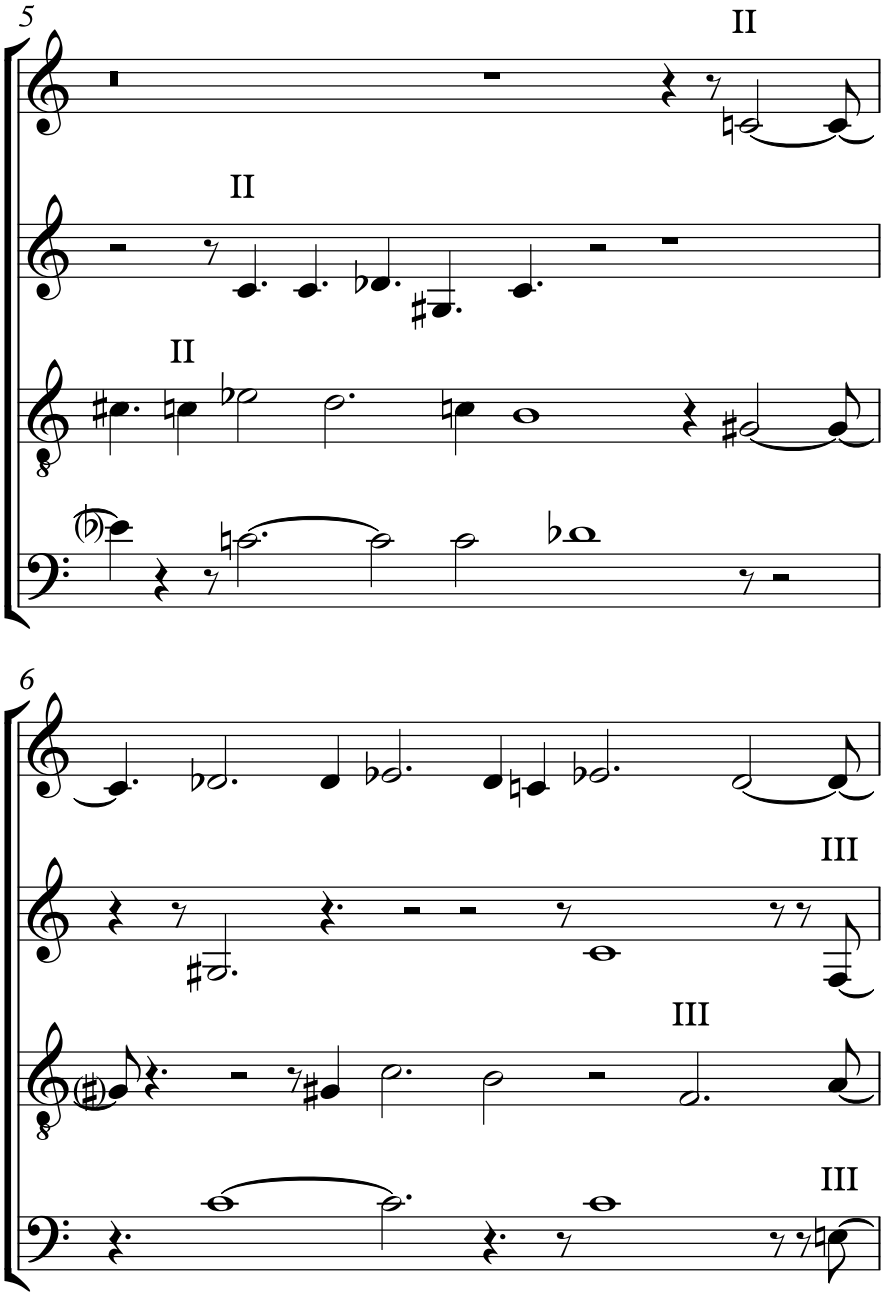
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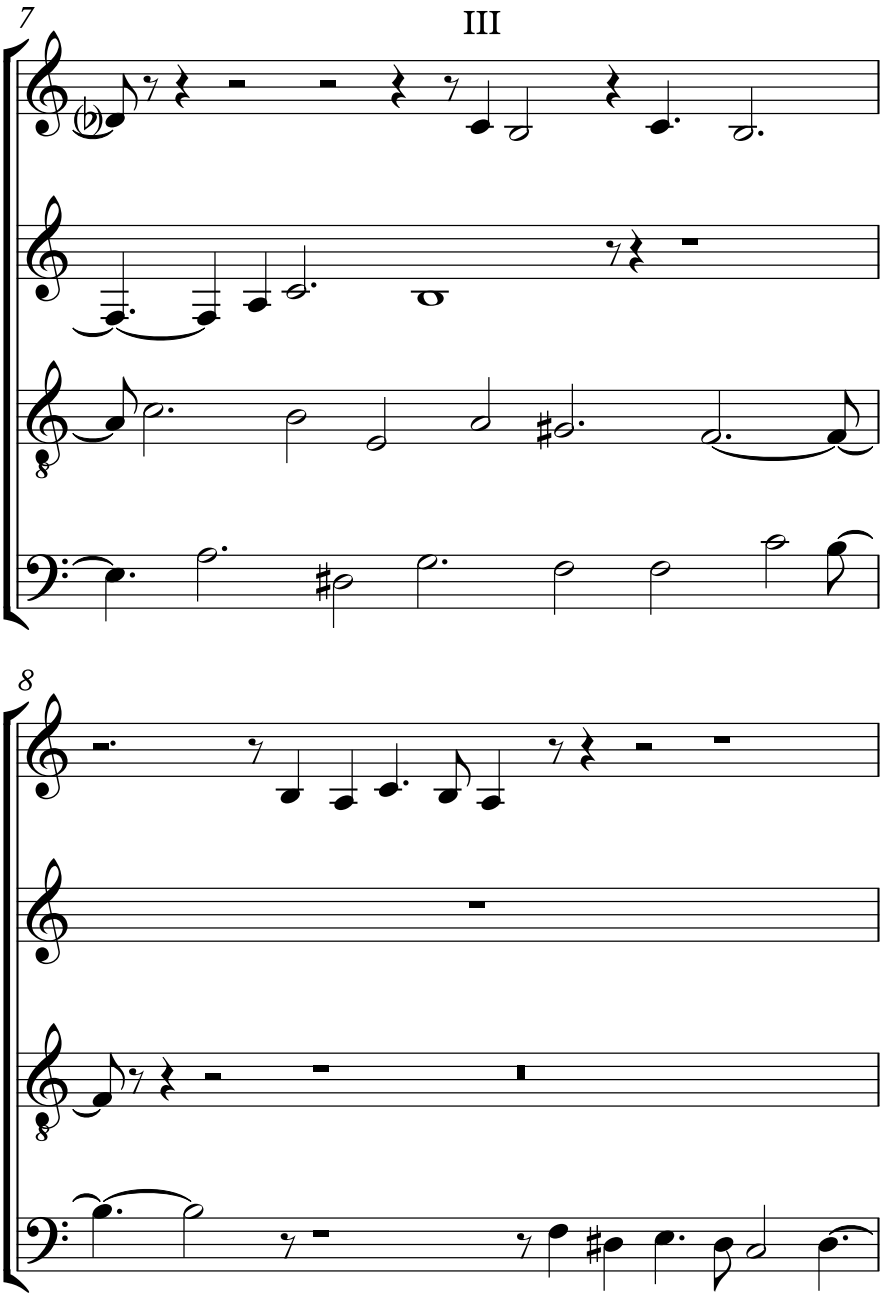
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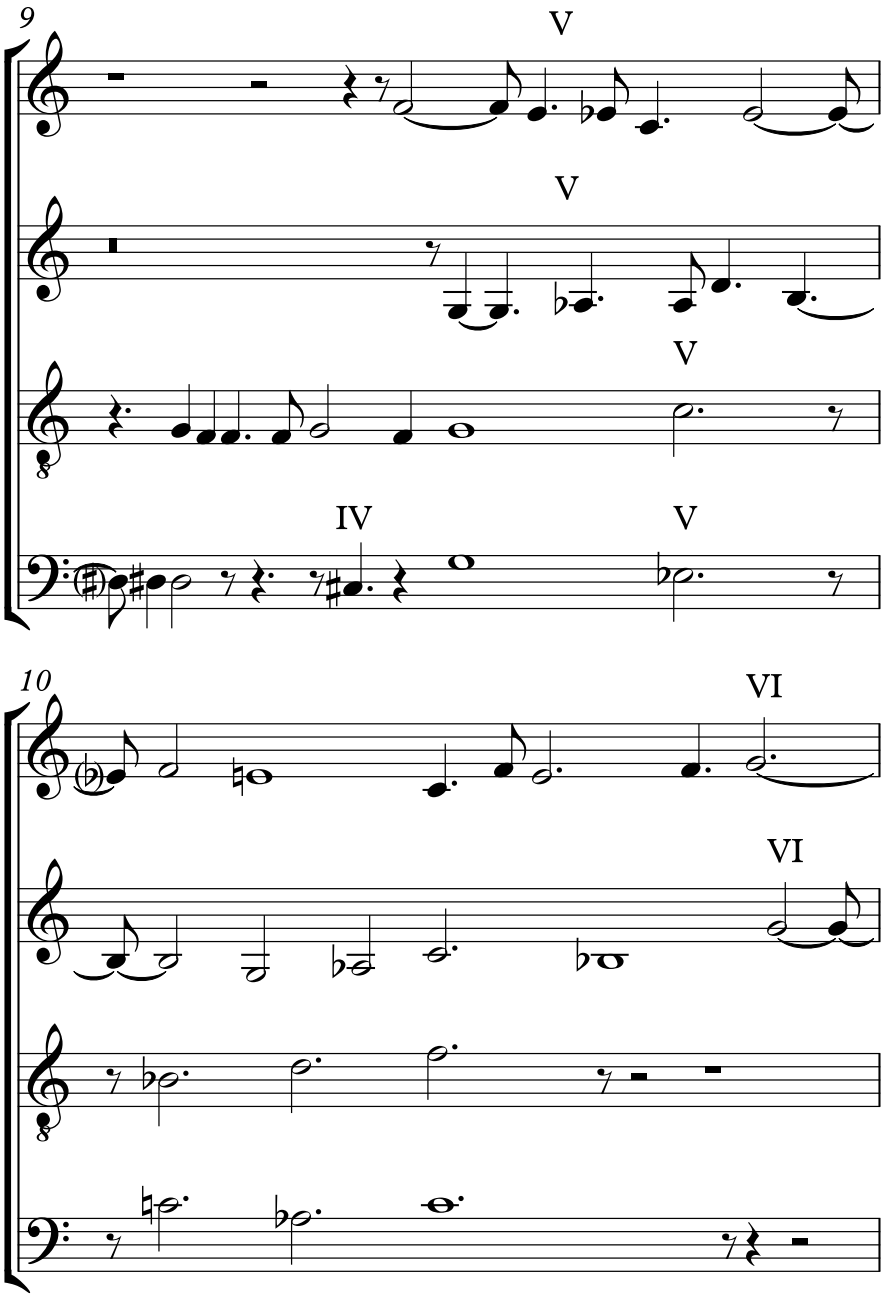
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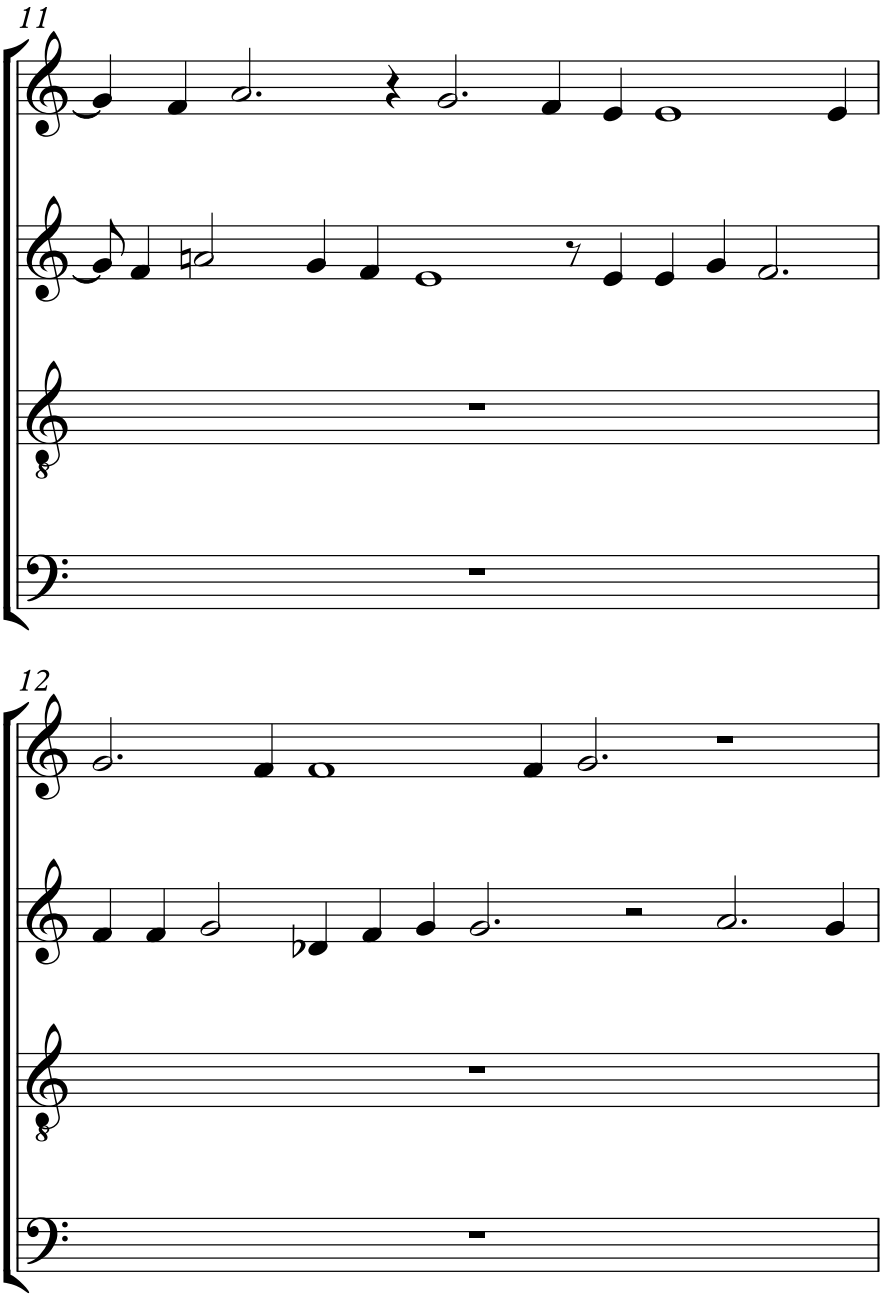
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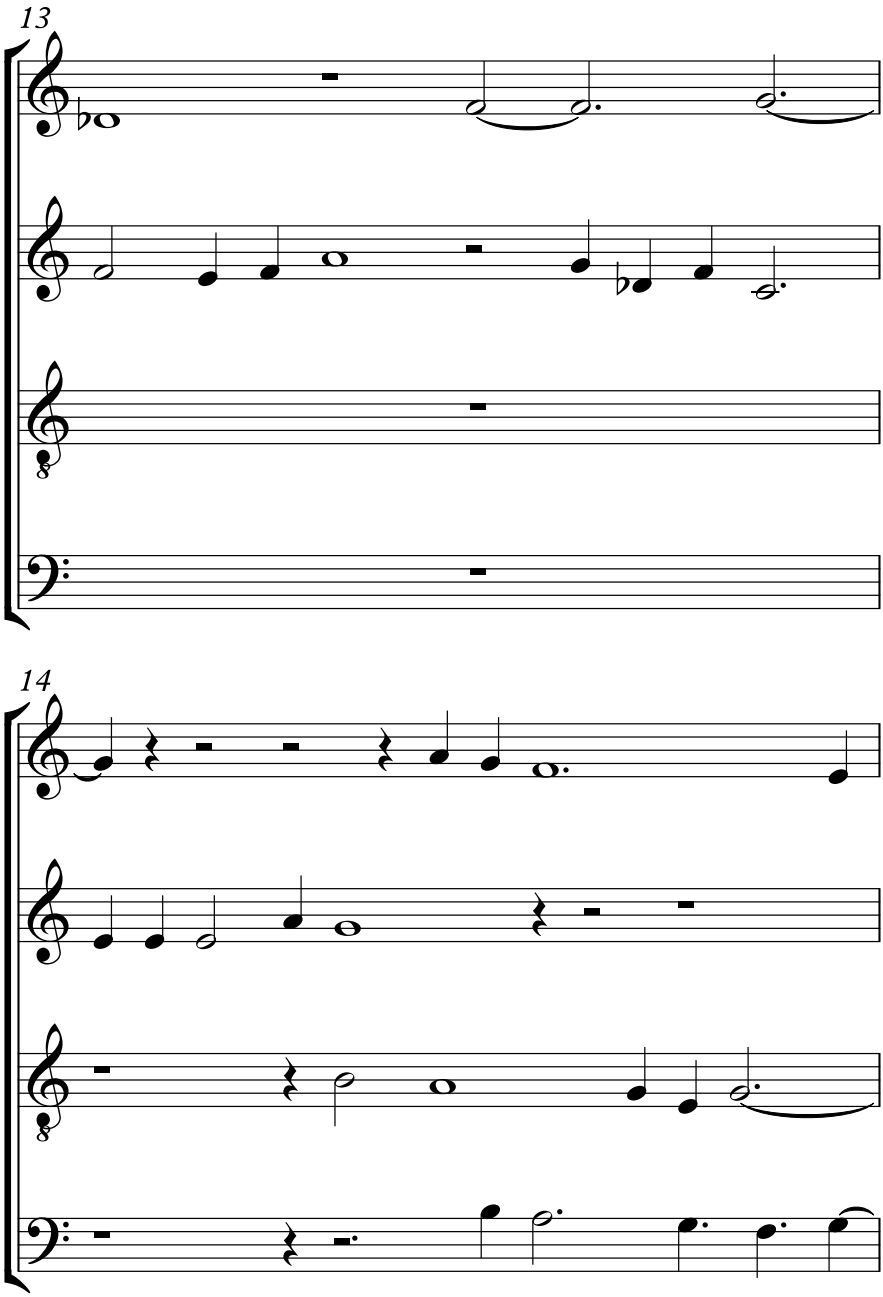
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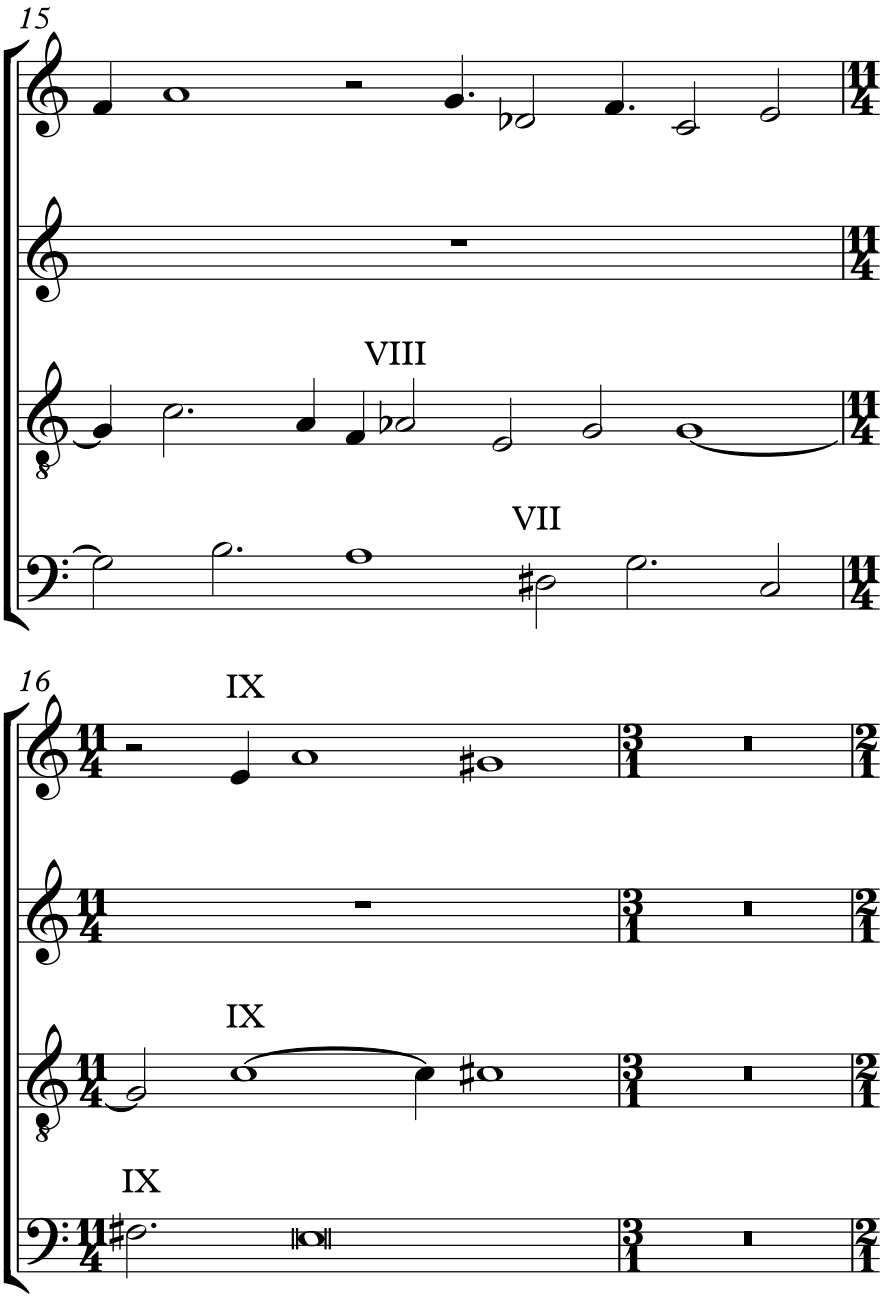
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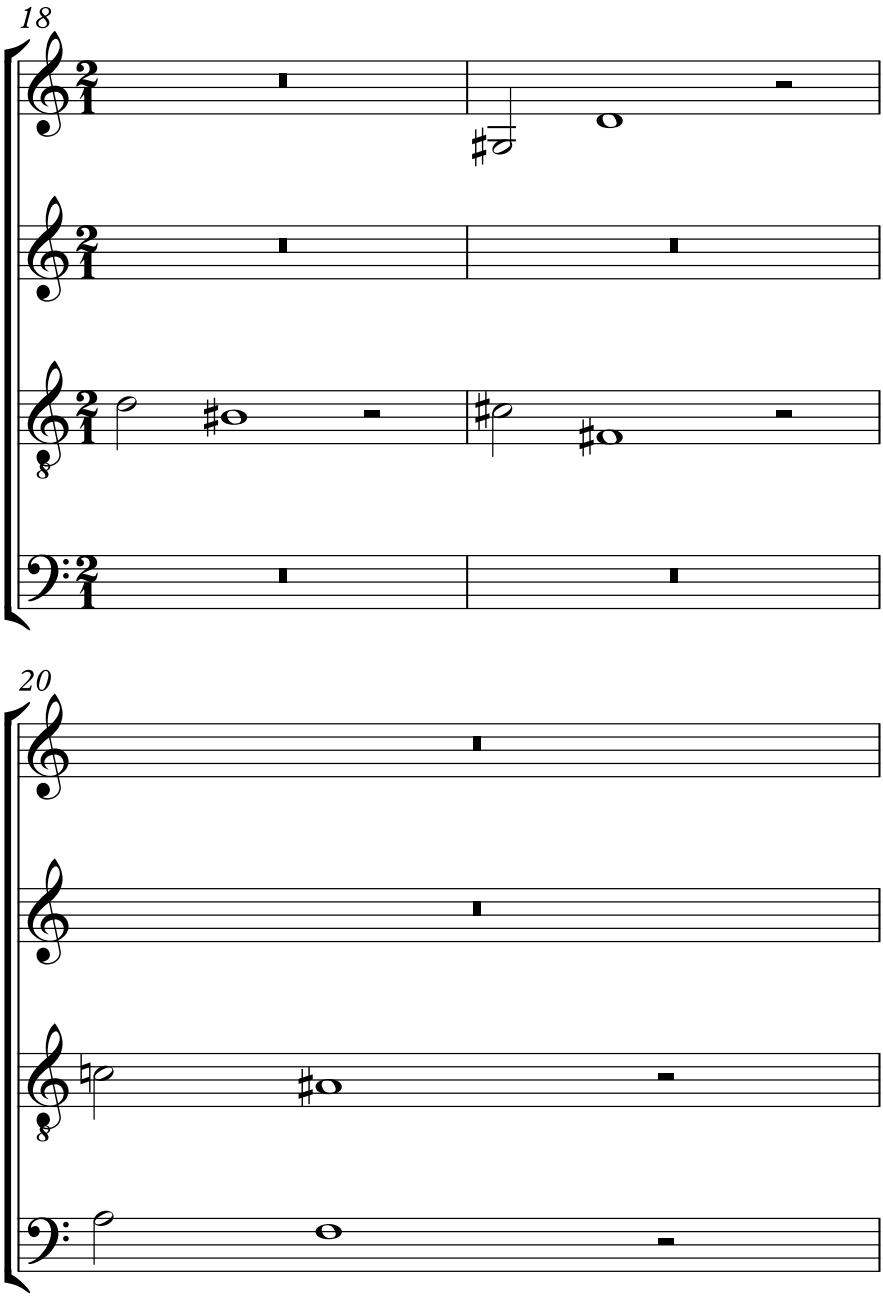
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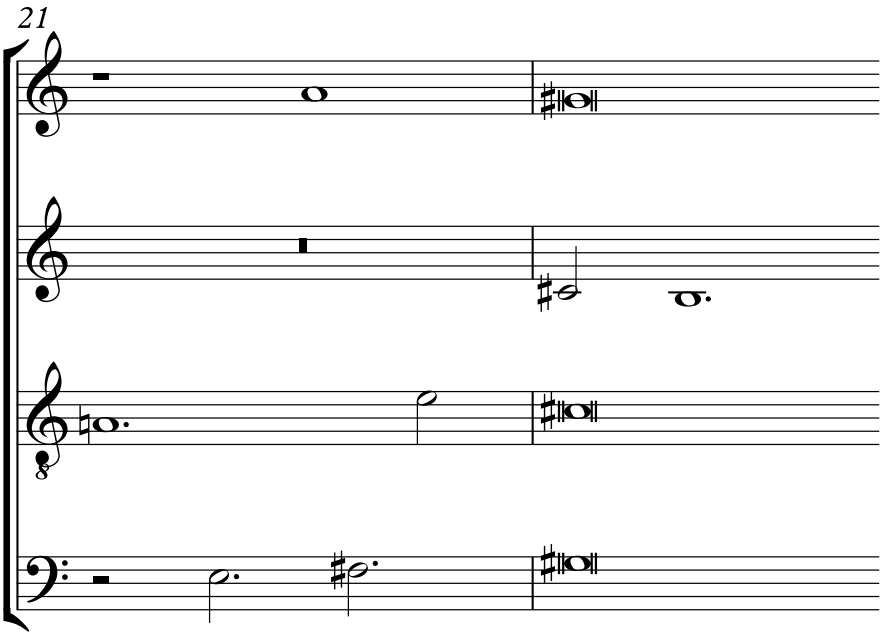


in comparison to the tenor and alto, but for the soprano as well, as the majority of pitches exist within the lower ranges, much more suitable for the alto voice. The final system of the piece is an attempt to remedy this problem through the application of simultaneous octave species moduations, all related to one another as successive modulations, and this simultaneity is applied and discussed in greater detail in the analysis of *Study Score B* in the section "Advanced Aggregate Techniques."

Notes

1. Sachs 234
2. Chalmers 103
3. Sachs 224
4. Ibid. 225
5. Ibid. 244
6. The line without a notehead represents a missing pitch.
7. Ibid. 240

8. For more information beyond modulation see Johnson, William A. "New Instrumental Music from Graeco-Roman Egypt." *The Bulletin of the American Society of Papyrologists*, vol. 37, no. 1/4, 2000, pp. 17–36.
9. Ibid. 240
10. Chalmers 100
11. It is also of note to consider that synesthesia is a condition one is afflicted with whereas shade is a physical aspect of the relationship resulting from the tempering of pitches
12. Guido 42
13. Ibid. 47n1

Greater perfect system as aggregate

As we have come to know in our development of the basic structure of a tetrachord and its role in the creation of an octave species, the octave species and its tetrachords are distinct units in abstracted forms that only encompass themselves; that is, despite the pure construction of the basic species as a result of pitches related to one another by a distance of a perfect fourth or fifth, the reality is that those individual tetrachords are still separate units, not always self-similar, related to one another through coincidence only. This is opposed to scalar operations within standard tonal and post-tonal contexts that presuppose a spectrum in which the scale, as an intrinsically self-similar structure, exists within the space of the lowest and highest possible frequencies, notwithstanding human perception. Thus, the individual tetrachord must then be seen as a subset of the octave species, which is a subset of the greater perfect system, which itself offers a finite space in which the double octave acts as an aggregate of fifteen pitch positions, within which an octave species acts as a gamut that supplies pitch content.

The nature of the aggregate

This aggregate must be differentiated from the standard chromatic aggregate of twelve tones as, again, a chromatic aggregate presupposes no differentiation of octave space; that is, *c4* and *d3* exist within the chromatic aggregate. A row does not delineate a fixed pitch, but a series of pitches that are concurrent within all octaves; that is, a set written as *f3 g♯3 a♯3 b3 c4 eb4* is not always expected to exist within that range exclusively but might shift into

any octave as long as the defined pitches are still in use. Thus, in theory, this infinite nature ensures that scales, modes, and pitch collections retain their octaving function. The interest that then lies within the engaging of the greater perfect system is its finite nature, that it does not octave at a certain point—this space being a void—and that the tetrachords are separate entities that, when combined, create an artificial modal unit.

It is the same as Guido of Arezzo's medieval hexachord, in which the structure *ut re mi fa so la* exists within the context of itself, and to traverse beyond the *ut* or *la* requires the singer to modulate to what is essentially a different hexachord. The result of such a modal system is that its range, when written on paper, belies the modal units' integrity, and one perceives relationships that are, in truth, the result of an artificial superimposition; therefore, they appear similar, yet they are not equivalent. To the monk who studies from the Guidonian Hand the practice requires one to consciously reflect upon the modulation between hexachords; *ut-la* must become equivalent to *fa-re* to approach the *si* outside the original hexachord. To the monk who studies solfege in tonal, scalar context one consciously understands that *do-ti* must become *do-ti* in a new octave.

	la re		re
	sol ut		do
	fa si	ti	
la	mi la	la	
sol	re so	so	
fa	ut fa	fa	
mi		mi	
re		re	
ut		do	

Example 37. Medieval hexachord and scalar hepatchord octaving

When one pictures musical relationships in this manner,

abstracted from standard notation, they realize the printed material obfuscates performance practice, as one system privileges the hexachord over the heptachord—or, rather, the scale—and one either must step down to *fa* or octave after *ti*. Though it might seem to be nothing more than theoretical conjecture to discuss disparate practices of composition and performance—all the more so as, within a perfect performance, the result is not defined by such—this structural practice is what makes music rather unique, as it is not always an audible trait, yet it is not hidden in the same manner as underpainting; rather, it is simply not apparent to the untrained. The standard complaint concerning dodecaphonic practice is that, unlike tonal practice in which the construction is audible—relationships within a tonic-dominant harmonic framework—the ordering factors are purposefully non-audible, as the constructive factors do not assume a functional role; that is, the row is a method of creating relationships, yet the relationships within the row are not functional guideposts, as if the row is a progression, but are instead methods of organizing material. In tonal music this audibility allows for perception to be decisive: the framework facilitates a system in which the listener understands direction, knows an end goal, and can anticipate it. In music built around non-perceptive structures the result assumes a situation in which what is true in the construction and the practice—the objective nature of the pitch relations—as opposed to what is accepted as true in audibility—how the listener perceives the pitch relations—is the defining factor: the listener might understand direction, but cannot discern, and cannot anticipate, an end goal.

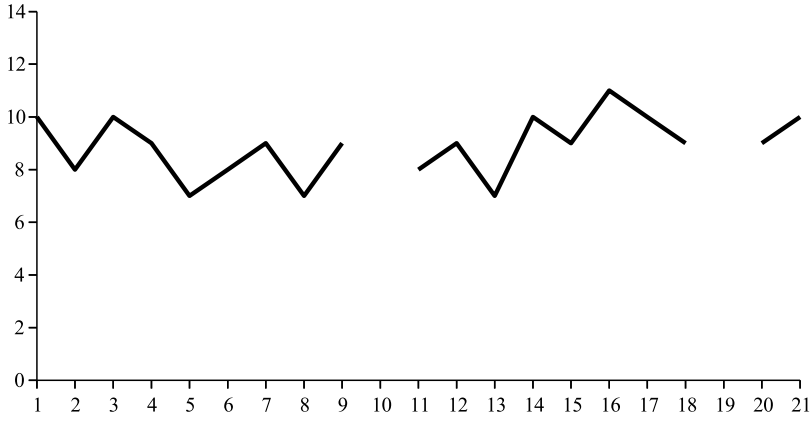
For example, the truth in the constructive practice of the tetrachord is that it favors the perfect fourth; thus, in the greater perfect system, the mese, *a*, is a perfect fourth in the original Dorian *e′-e*, and in an octave species the dynamic mese is the perfect fourth of the lower tetrachord. These two points are from which a melodic line in ancient Greek music is structured, as

Sachs distills it:

> every melody had two foci; every note or group of notes gravitated toward two different centers at once, toward the center of the individual key and toward the center of the immovable perfect system. The first bearing was called dynamis or 'mobile force,' and the second, thesis or 'stationary force.' A note changes its dynamis according to the key; its thesis was immovable... The mobile and the stationary functions coincided only in Dorian.[1]

And one can view this by plotting the melodies of our earlier fragments through viewing the greater perfect system in the manner of set theory, *a'-A* being 14-0.[2]

For example, in the Cairo fragment (example 38) the range is *g'-g* (13-6), with the dynamic mese, *c'* (9), as the focal point of the line.



Example 38. Cairo fragment

Yet, despite this, there is no audible delineation as in the situation in which the tonic and dominant pitches create tension between two points in functional tonality; instead, because its primacy is not audible—the mese is heard, but within a sea of pitches that draw attention away from it—the practice surrounds the privileged interval of a perfect fourth in construction, but not in perception. If one is aware of construction, then one can find the mese, but this is similar to knowing the row of a dodecaphonic piece; thus, audibility for the standard audience member is impossible, but the lack of understanding of construction should not be the factor that disengages the listener. The listener should be, in truth, freed from the problem of perception and allowed to experience something as it is without being worried about knowing what it is. Just as there is a difference between knowledge and wisdom, there is a difference between perceiving and experiencing; that is, the difference between the situations in which, when a chord appears, we engage it as part of the structure—a signpost that signals direction—or engage it as nothing more than coincidental sound—a point, of interest or otherwise, in space.

It should then be elaborated that perception of form is not what should engage the listener, as that moves the moment from experience into analysis, as the listener is, through parsing the material and seeking formal connections, missing the sounds for the sake of the structure. The metaphor of hexachord modulation as being an inaudible experience, so that the experience of the performance is perfect despite the performers' methods being different from contemporary scalar method, is as Schoenberg wrote concerning the work that goes into a composition: "the finished work gives no indication of whether... the cerebral constituents have been determinant."[3] That is, the work that one puts into the music—the respect to the framework, the deference to the mese, the modulation of the species—is not the final result, but a means to that result; thus, it allows for coherency, but does

not need to be perceived to be coherent. The monks used the Guidonian hand as their mnemonic device, and when they encountered music they possibly reflected upon the modulation of the hexachord, but in performance the listener was never aware; instead, through focusing on the experience, the listener hears the sounds alone, not the mental work that goes into the act of creation.

The mental work that is put in place—the method in which we conceptualize sound—is an abstraction: it does not encompass sound; rather, it places the composer and the performer in the state of mind to create sound in the manner that it must exist. This is, naturally, the reason organization exists: how something is organized has a clear effect on how it is conceptualized and how it is written—not simply the music itself, but also the manner in which it is notated—and this defines how it is experienced. The manner in which we experience chant, in performing and in listening, is directly tied to the hexachord and the manner in which the structure of a hexachord is related to others; likewise, this is true for tonality, dodecaphony, or any other method: each organizing of pitches promotes a way of thinking about those pitches and their relationships with one another, whether they are hierarchical or equal, and practice—such as the manner in which we apply implicit and explicit harmonic relationships in a single line—materializes out of function, so much so that without an initial method of organization there can actually be nothing of substance at all.

The constructed relationships within the aggregate

It is clear to us that the totality of the aggregate exists within a finite spectrum; that, in regards to performance practice, the upper and lower octaves, *a'-a* and *a-A* respectively, are unique entities; and furthermore, they are conjunct structures of

tetrachordal entities. In a scalar conception, because the scale is expected to octave, and thus repeat itself, *A2* and *C4* are always members of the same scalar entity; that is, they always retain a direct relationship with one another as members of the same scale and are merely separated by octaves. However, the greater perfect system itself is no more than four tetrachords. In an explicitly octaving structure the scale is defined as a whole: *do-ti*; however, in this tetrachord aggregate each tetrachord itself is defined as a whole in itself, and thus the combination of conjunct and disjunct tetrachord aggregates does not presuppose relationship, but a decision by the aggregator to combine them in the same manner that the Guidonian Hand aggregates hexachords. Though there is a point of connection with a shared pitch at conjunct points, the only relationship is that shared pitch of a conjunct tetrachord that is otherwise built from two distinct and unrelated structures, just as *ut-la* and *fa-re* share pitches yet are unrelated units.

				d
	la re	re		c
	sol ut	do		b
	fa si	ti		a
la	mi la	la		g
sol	re so	so		f
fa	ut fa	fa	e	e
mi		mi	d	
re		re	c	
ut		do	B	

Example 39. Medieval hexachord, scalar hepatchord, and aggregate tetrachord octaving

Thus, because *B2* and *C4* are not treated as members of the same scale in different octaves, but each a member of a separate set of disjunct tetrachords, united by the system in arbitrary fashion,

not by natural congruence, then one cannot view them in the same manner as if encapsulated by a scalar entity; therefore, despite our knowledge that the resulting sound is the same, these forms are not worth comparing, as there is no functional relationship to the system.

This relationship among tetrachords as superimposed units is further so when one takes into account the naming system that the Greeks applied to the system (example 35), which does not deem the octaved *A* pitches—*a'*, *a*, *A*—as equivalent; indeed, *A* itself, "proslambanomenos," simply translates as "addition;" *a*, "mese," is "middle;" *a'*, "nete hyperbolian," roughly translates to "highest" within the context of the tetrachord. Each pitch position is defined in the context of its tetrachord, and the entirety of the structure, with the exception of the mese, is defined by the joining of separate, unrelated tetrachords. As a consequence of this naming scheme, the manner these pitches are defined is not by their function or their relationship, as one would define "tonic" and "submediant," but instead by their position within the holarchy of pitches. The system is then no more than a grouping of pitches that one might freely permutate into any form, sharp or flat, while still retaining a foundational structure.

In viewing these translations, one understands that what otherwise might be interpreted as degree names are not pitch names but position names. This should be clear as the names are constant in the *E* and *F* tunings of ancient greek practice, despite the difference of a step. It can be assumed that the only reason for the *a'-A* structure is because the system was originally built around the *e'-e* octave species, expanded by adding a diatonic tetrachord to the top and the bottom of the species; thus, there is no reason to assume that the system cannot be built from any other octave species, and even if it were built from *d'-d* originally, the position names would remain identical; consequently, there is no other purpose of the *A2-A4* range other than that is the range

Nete hyperbolaion	"Highest;" fourth pitch in hyperbolaion
Paranete hyperbolaion	"Next to highest;" third pitch in hyperbolaion
Trite hyperbolaion	"Third;" second pitch in hyperbolaion
Nete diezeugmenon	"Highest;" fourth pitch in diezeugmenon/first pitch in hyperbolaion
Paranete diezeugmenon	"Next to highest;" third pitch in diezeugmenon
Trite diezeugmenon	"Third;" second pitch in diezeugmenon
Paramese	"Next to middle;" first pitch in diezeugmenon
Mese	"Middle;" fourth pitch in meson
Lichanos meson	"Index;" third pitch in meson
Parhypate meson	"Next to lowest;" second pitch in meson
Hypate meson	"Lowest;" first pitch in meson/fourth pitch in hypaton
Lichanos hypaton	"Index;" third pitch in hypaton
Parhypate hypaton	"Next to lowest;" second pitch in hypaton
Hypate hypaton	"Lowest;" first pitch in hypaton
Proslambanomenos	"Addition;" added pitch to the bottom of the system

Example 40. Rough translations of pitch positions

that the ancient Greeks are believed to have performed within, and the greater perfect system might span any double octave space. This underlines the importance of the void in which the system operates as an abstract entity, not as a functional member of scientific pitch notation, of a physical space, but as a floating form that might be interpreted in the context of any frequency if superimposed.

Concerning the question of function, the diatonicism of the original system defines some functional relationships, the most noticeable being the distance between the proslambanomenos and

hypate hypaton—*B-A*—and mese and paramese—*b-a*—being a whole tone, and the affixing pitch in tetrachords—*e'* and *e*—being shared; however, the only true functional relationships are localized within the tetrachords, and though the conjunct forms possess similarities to an octave structure the functions are not equivalent. In viewing the system as a skeleton in which permutations of diatonic forms yield a variety of possible pitch content one can picture the structure of the double octave as an aggregate, in which there is a totality of pitches from which octave species and their modulations are derived. For example, the Dorian, *e'-e* as an octave species is a "derived set," a modal structure derived from the location of the species within the structure. These derived sets of octave species may be defined as "active species;" that is, a set of pitches that are in use at any point in time, and, as we understand through the act of modulation that there is only a single species at any point in time in a line, only such a species in use might be termed as "active," as it must be true from our understanding of the octave species that any series of notes outside the species is rendered nonexistent in compositional conception. For example, the entirety of the Cairo fragment (example 44), the pitches and their range are defined by the active species, which, through modulation alone, changes to encompass the different pitches in the melodic line. No other pitches outside of that original active species may ever be put into use unless they are found through the modulatory process, and it would be inconceivable to write *f*, a pitch that is outside the *g'-g* species, despite being a note within the total aggregate, because it simply does not exist within the abstracted entity of the octave species.

Thus, as a consequence of the concept of "similar, yet not equivalent," within the totality of the aggregate, the tetrachordal structures can be seen as identical, inverse, complementary, or different to one another; that is, they can fill roles in a manner

that an octaving scalar form cannot. For example, *F* major:

f g a b♭ c d e f

must continually be:

f g a b♭ c d e f

it cannot become equivalent to *B♭* Major:

f g a b♭ c d e♭ f

two octaves above and then return to:

f g a b♭ c d e f

in the following octave for two reasons that preserve harmonic functionality: first, that in tonality, due to the manner in which it is initially constructed, the change in accidentals requires a change in the tonic to *b♭*; second, that the scalar entity is intrinsically an infinitely octaving structure that must retain total equivalence in every octave according to such a key. In the chromatic aggregate of dodecaphony combinatoriality solves the problem of uneven scalar forms by allowing for complementary hexachords, but it requires excessive evenness and still supposes the infinitely octaving system outside of personal applications of fixed registration.

The tetrachordal structures, being free from relation to one another, may possess any form without any effect on the tetrachord an octave higher. With fourteen available pitches—the proslambanomenos an outside, fixed unit—there is an opportunity for combinatorial functions without an octaving structure and without the artificial evenness of a dodecaphonic system;

moreover, the ability of an octave species to modulate freely allows for a perpetual shuffling of pitches in the same manner as reordering twelve tone rows.

On the relationship of the abstracted octave species to the aggregate

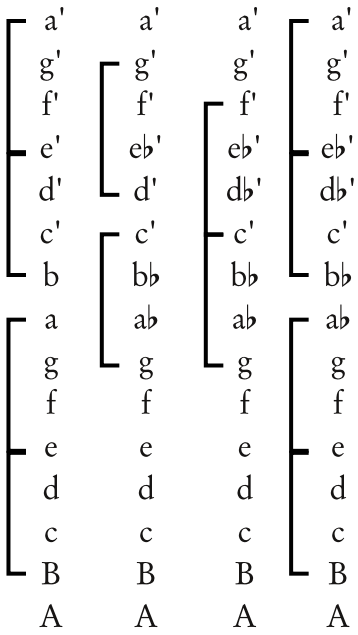
In discussing the octave species the question arose whether the pitches of the greater perfect system transposed with the octave species. Of course, the answer was that in the context of the octave species alone, the outside pitches were of no value; however, as the discussion at hand has turned to the greater perfect system as an aggregate, and not simply the octave species as an abstraction of the system, there is value in discussing this concept. The answer to the assumption posed is that despite the understanding that transposition of the octave species discussed in the last section changes the pitch content, because the system is explicitly non-octaving and is built from similar, yet not equivalent, units, it should not.

Furthermore, as there is an assumption that no collection of pitches in use would be greater than the octave species, only a select set of pitches are to shift through modulation. For example, if one placed the Cairo fragment, in which the active base octave species is a diatonic set, within the context of an aggregate structure and underwent the first modulation, the conjunct form created would exist within the aggregate in such a manner that if the active octave species shifted down a pitch, the resulting disjunct form would be *e*♭'-*f* and the conjunct would be *b*♭.

As one can see in the aggregate set provided (example 41), the first is the base greater perfect system. The second is the Cairo fragment's octave species within the context of the aggregate, having been transposed from Dorian to Phyrgian, and transposed up one semitone to the *F* tuning, and this is provided in such a fashion because the transformations done to an octave species are

assumed to be done to an abstracted form of the *e'-e* octave species, but not done to the aggregate itself. The octave species transpositions (example 20) are nothing more than transpositions of the Dorian species, and by this point the greater perfect system serves as an indicator of the range of musical pitches—the reason for the Hypomixolydian being cut off at *a'* when it should octave at *b'*, a pitch beyond the system. This contextual placement is a superimposition on my own part, as I have made the choice to take an abstract pitch collection and fit it into the system; therefore, despite the *g'-g* being *f♯'-f♯* in the *E* tuning that the greater perfect system is originally tuned in, the various transpositions have given it a new place within the context of the system and one cannot place it on *f'-f* because that would create two instances of *g'* within the system, or rather, two instances of the paranete hyperbolaion, which in the context of the tetrachords, *a' g' f' e'*, cannot contain repeating notes, as this would damage the integrity of the tetrachord's construction. The third is the modulation to the conjunct form at *c'*, showing the transformation of the *d'* to *d♭'*, which marks the final change for the aggregate in the fourth, where the octave species designations are removed and the original tetrachord designations are reimposed.

It is without question that the modulation of an octave species between disjunct and conjunct tetrachords is a localized phenomenon because the nature of the system is non-octaving and what influences *b* in our example is not reflected in *B*, as, unlike the phenomenon of an infinitely octaving aggregate in which *B4* and *B5* reflect one another, the content of the system is not *b* and *B*, but the paramese and hypate hypaton, two pitch positions that exist within separate tetrachords that are artificially combined into an aggregate set. The artificiality of the aggregate allows for these superimpositions along aligning pitches, providing a newly transformed aggregate from which a new *e♭'-e* species can be



Example 41. Cairo fragment modulation within the context of an aggregate

generated and transposed according to the transposition rules derived from Sachs. The base, diatonic system is transformed in a new manner as result of natural permutations, and as long as one acts in a manner that is according to the transposition and modulation rules already understood, then no action might be considered negative to the integrity of the aggregate.

In addition to this method of permutation by modulation of octave species, there is the opposite approach through building the aggregate. Because the greater perfect system as an aggregate is the result of four diatonic tetrachords there is no reason to believe that one cannot build an aggregate from any of the various tetrachord forms already known. For example, example 42 is an aggregate in which the bottom tetrachord is diatonic, the middle two are enharmonic, and the top is chromatic.

From this one might pick the diatonic *e'-e* and transpose it in the manner of the octave species, or pick an octave species from

a'
g♭'
f'
e'
c'
c𝄫'
b

a
f
f𝄫
e
d
c
B
A

Example 42. Freely constructed aggregate

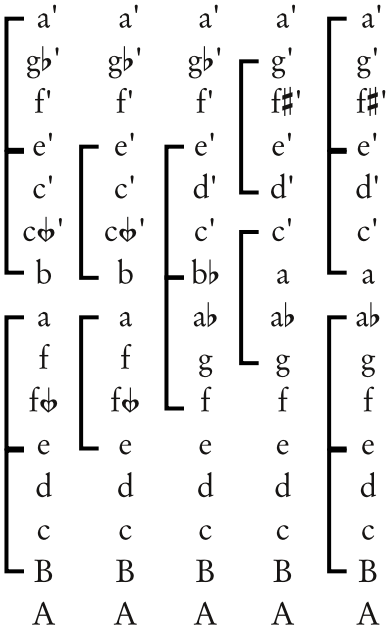
the aggregate to work with freely, as if one is picking a church mode. Example 43 details the transposed forms of the diatonic of this aggregate.

From this set of octave species I have placed the Dorian, an example of an octave species without the effects of transposition, within this built aggregate and put it through two sets of modulations to again show how one might superimpose the octave species and its modulations within an aggregate structure (example 44).

The first of the set is that of the original aggregate set, and the second is the delineation of the Dorian octave species within that set. This species undergoes an eklysis modulation at *c𝄫'*, becoming the *b♭* within the aggregate in an augmented/shuffled diatonic species. This new species undergoes a metabole at *d'*, which becomes the bottom pitch of a retrograde diatonic with the

Hypermixolydian	*g′ f𝄪′ f♯′ e′ c′ c𝄫′ b*
Mixolydian	*a′ f′ f𝄫′ e′ d′ b♭′ b𝄫 a*
Lydian	*g♯′ e′ d𝄪′ d♯′ c♯′ a g𝄪 g♯*
Phrygian	*f♯′ d′ c𝄪′ c♯′ b g g𝄫 f♯*
Dorian	*e′ c′ c𝄫′ b a f f𝄫 e*
Hypolydian	*d♯′ b′ a𝄪′ a♯ g♯ e d𝄪 d♯*
Hypophrygian	*c♯′ a g𝄪 g♯ f♯ d c𝄪 c♯*
Hypodorian	*b g f𝄪 f♯ e c c𝄫 B*

Example 43. Transpositions of central *e′*-*e* in the freely constructed aggregate



Example 44. Modulation of the *e′*-*e* in the context of the freely constructed aggregate

bottom tetrachord of the new species being chromatic. The final is the delineation of the original aggregate relationships on the result. Again one must take note that the aggregate permutations are always along the lines of the octave species various modulations, only changing according to what is being done to the relevant pitches. This visual form allows for one to better understand the consequences of the octave species beyond its abstract nature. It is true that one might ignore the aggregate and only view the abstract octave species within the context of modulation, yet the distinct results of octave species modulation on a larger form are more fascinating in developing a structure that is perpetually in flux. The great boon of the octave species recontextualized within the aggregate is that each transformation of the aggregate itself allows for the octaves species and its transpositions to always be in a state of flux outside of the modulatory act. The troublesome nature of the octave might be done away with or it might be placed into a new context. This implementation of the aggregate is the modal structure elevated to a new form, acknowledging the integrity of the tetrachord as an entity, as a method of construction, and as a form for modulation.

The conundrum of the proslambanomenos

One final question, fitting to the subject as an addition, is the question concerning modulation of *A*, the proslambanomenos; that is, can one do so? We have already proven that, because the greater perfect system, as an aggregate, is an abstract musical space, and that the octave species is an abstracted entity from the aggregate, thus any permutation is permissible if it aligns with precedents set by tetrachord construction and modulation; what then is so important that we have frequently set *A* aside as an outside, fixed variable? Though the answer should be obvious this far along, it is worth stating explicitly.

The nature of the proslambanomenos as an additive pitch means that it represents a pitch outside of a tetrachordal structure that is unaffected by permutations; that is, if the pitch is *A*, and it is outside of the tetrachord, then it is always *A*. Any outside pitch is impervious to the factors that define modulation by tetrachord, even if the pitch is included within an active octave species, because the act of modulation requires a tetrachord. If the double octave functioned in the fashion that it would in tonal theory, as a series of pitches within a functional landscape that defines the entire octave space as a single unit, then there would be no separation of tetrachord units, and thus no opportunity for a non-octaving structure. Consequently, *A* would not exist as a distinct unit, but would be affected by any permutation performed upon *a*, which would also affect *a'*.

Notes

1. Sachs 234
2. See the section on composition for a discussion of this method of analysis
3. Schoenberg 178-179

Section II.

Concerning composition

Composition within the context of the octave species

Whether one calls oneself conservative or revolutionary, whether one composes in a conventional or progressive manner, whether one tries to imitate old styles or is destined to express new ideas—whether one is a good composer or not—one must be convinced of the infallibility of one's own fantasy and one must believe in one's own inspiration. Nevertheless, the desire for 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."

Arnold Schoenberg, *Style and Idea*, 106

We have spent the previous sections making the point that structurally this system has very little, if any, relationship to the current manner in which we interpret music, consciously or otherwise. Therefore, it is not an overstatement to argue that one cannot convincingly write music in the same manner that we have grown accustomed to in the tonal system; that we cannot apply the same musical syntax, as music possesses a form of medium-specificity defined by means—the capacity of the instruments—and by the method of organization—the pitch relationships favored—so that the result is ultimately determined by the materials prior to the invention of the composer.[1] If the materials and their method of organization in a tonal system

produce a result, it cannot be retrofitted upon a modal system that does not share the same materials and method of organization; that is, one finds in Gamelan that one cannot simply write in the same manner that they are accustomed to, but must write according to the means given by the materials: the range of the instruments and the nuances of slendro and pelog tuning practices; likewise, the listener cannot judge the Gamelan with the same values that they judge tonal music, because the inherent material differences mean that the expectations cannot be met at even the most basic level of aesthetics and tuning that define tonal melody, harmony, and forms.

Thus, there might be a clear split in engaging with the types of musical construction among readers; those who understand medieval modal organization and chant procedure perhaps might find an easier path; yet, for those who are deeply entrenched in tonal organization it is just as Schoenberg remarked in his "Composition with Twelve Tones": "The introduction of my method of composing with twelve tones does not facilitate composing; on the contrary, it makes it more difficult... Nothing is given by this method; but much is taken away."[2]

To compose properly, one must begin at the fount of all music in the construction of a line, and learn how to effectively compose a such with the means allotted to them. Concerning this, the manner in which the fragments utilize mese revolution, discussed in earlier sections, should be of great interest to us.

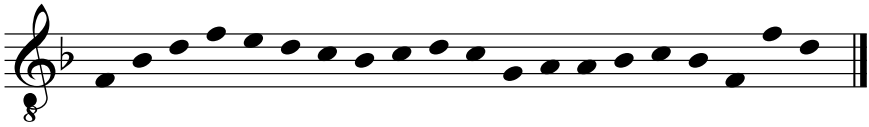
Composition according to the mese

As already discussed prior, the structure of the tetrachord, octave species, and the aggregate privilege the perfect fourth. This pitch, the mese, in both its thetic and dynamic forms, defines the musical line, as understood in the earlier example of the Cairo fragment (example 38). In knowing that the mese colors the

melody, one can view the contour of the fragments to understand the role of the mese as a point of polarity.

In charting melodic contour we will look at four fragments—each of which chosen for the fact that they are appear extant in their entirety with no lacunae—in a transcription from Sachs and a chart of the line according to the set 14-0, *a'-A*. The charts are composed according to the method defined by James Tenney's theoretical work in *Meta | Hodos*, in which the x-axis is time and the y-axis is intensity; thus, in this context, pitch number and distance from 0, respectively. The numbers should be compared to the names in the greater perfect system (example 40) and thus do not represent specific pitches but positions, therefore a pitch and any of its accidental forms may be represented by the same number because they sit in equivalent positions. The thetic mese is 7, the central *a*.

The first fragment of note is Bellermann's Instrumental Piece, though the date of composition is unknown.[3] The octave species is *f'-f*.

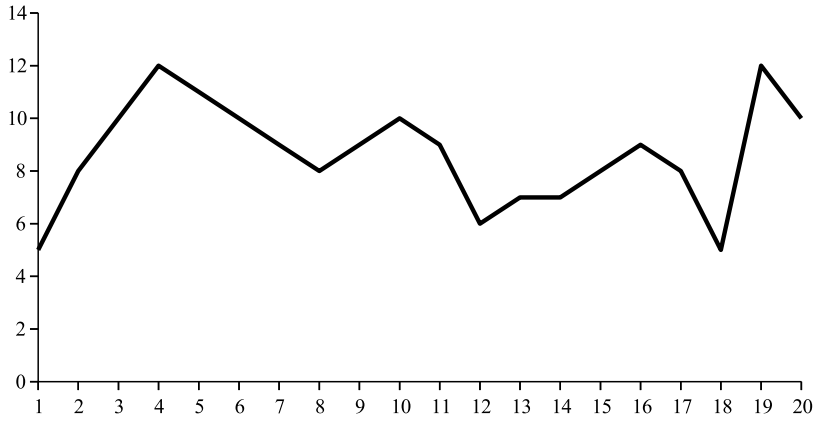


Example 45. Bellermann's Instrumental Piece[4]

The line is dominated by the initially outlined space of a fourth, *b♭-f*, and a fifth, *f'-b♭*, with the conjunct motion of the music existing within the shadow of either the lower or upper interval. Of note is the third leap, a third, *f'-d'*, which is mirrored in the final two pitches, which, separate from the second section, provide a thematic relationship between the beginning and ending of the conjunct sections

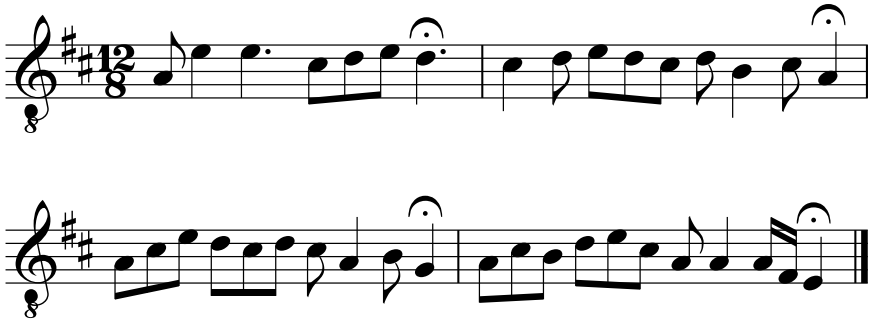
When charted, the dynamic mese, *c'*, is clearly the focus of the line's motion. Though the first four note octave motive outlines

the two stepwise sections, they are clearly driven in content by the dynamic mese. The first section finds it way to *c'* and rotates around it several times before the second section begins with a descending fourth. A notable feature of the second section is the highest pitch being the mese, outside the otherwise defined melodic space.



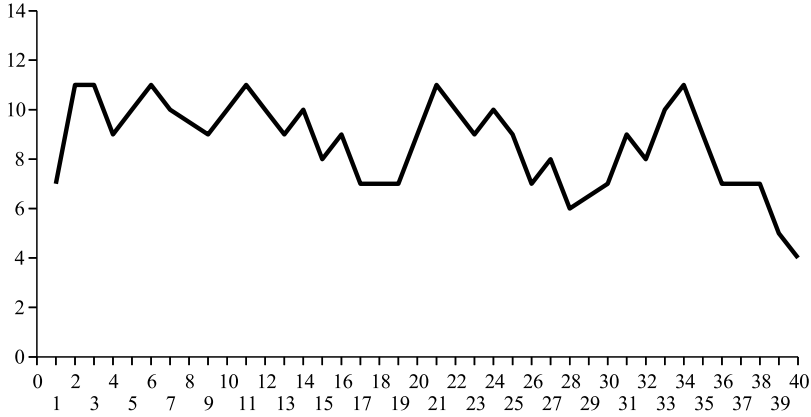
Example 46. Bellermann's Instrumental Piece

The next of interest is one of the oldest fragments, Seikilos Skolion, from the second or first century B.C.[5] The octave species is *e'-e*.



Example 47. Seikilos' Skolion[6]

First to note is that the mese is thetic in this piece, as it is of an older style than the other fragments. The thesis drives much of the motion of the piece; acting as an anchor, it is the initial pitch in three of the four sections, and, in the section that it is not, is the ending pitch. The majority of the pitches, thirty-two of thirty-seven, are within a perfect fourth of the thesis; though, this is, and is not, a substantial observation. The Dorian species is perfect for thetic composition because a is the dynamic mese as well, making it the center of the scale with no pitch being greater than a fifth. If it were a more lopsided species, perhaps *g′*-*g*, there would be a clear shift in a strict mese based line, which would probably gravitate towards the lower end of the species.

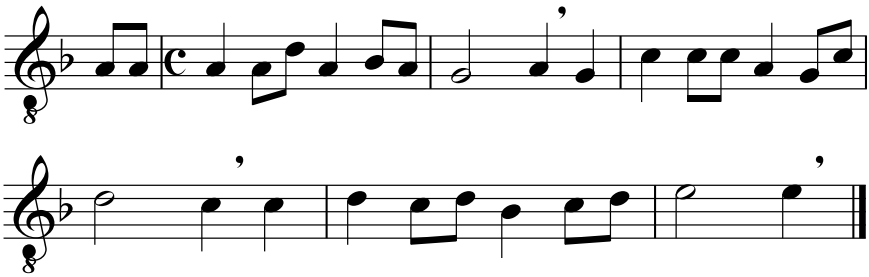


Example 48. Seikilos' Skolion

However, the value of this observation is as a closed environment that reveals how prominent pitches are based upon distance. The high *e'* only appears five times, despite being a perfect fifth, a favorable interval, only acting as a ceiling for rising and falling lines. In contrast, *d'* appears eight times, and *c'* nine; both play an important role in the melodic line, comprising a majority of the conjunct motion.

The majority of the pitch content exists within the space of the *e'-a* perfect fifth, with only the final notes of the last two sections, *g* in the third measure and *f* and *e* in the fourth measure existing outside the space defined in this opening interval.

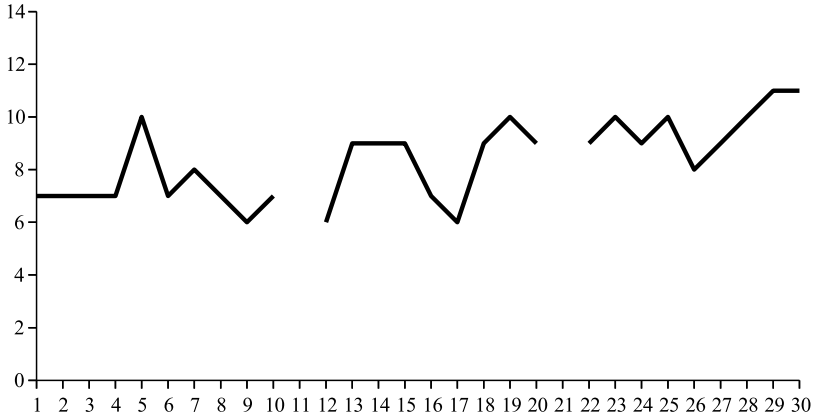
Another primarily thetic fragment, The Hymn to Helios, is from the second century A.D.[7] The octave species is *f'-f*.



Example 49. Hymn to Helios[8]

The mese in this hymn is somewhat unclear. Its age would suggest that it should focus on the dynamis, as Sachs notes that the dynamis was "not considered in preclassical times," and that the thesis "disintegrated in the postclassical epoch;"[9] yet, the thesis, *a*, is the prominent pitch, though in the second half it appears that the stress begins to move to the dynamic mese, *d'*, with the thesis below the line. Mese stress generally appears in both directions, balancing the melodic line around the pitch. When we see the first half travel from a high point of *d'* to a low point of *g* we know, even if there was no repercussive stress on *a*, that the mese is somewhere within the frame of that interval space. The mese, in essence, pulls the line toward it, as if it were a point of polarity, and each motion should cause a reaction in the opposite direction; thus, a large interval jump begets a large interval jump in the opposite direction. In the second half, it is initially unclear whether *a* or *d'* is the mese, as *a* might be pulling the line down to *b*; however, it is much more clear when the peak pitch, *e'*, appears, as that may provide some evidence for the dynamis, *d'*, pulling the line from the thesis.

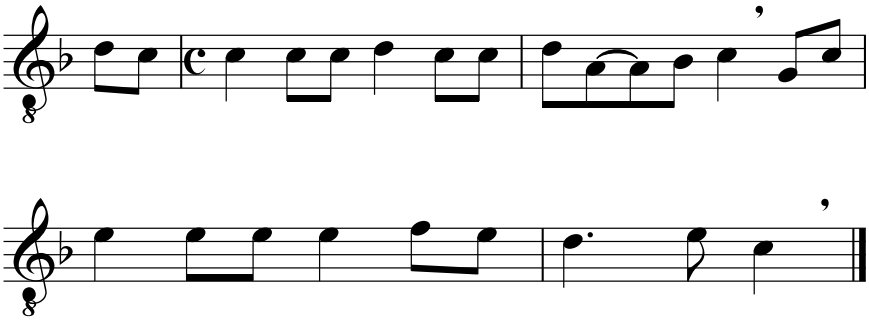
Upon consulting the chart, the leap of a fourth in both directions is prominent in the first half of the fragment, on the x-axis: 4-5, 5-6, 6-9, and 17-18.



Example 50. Hymn to Helios

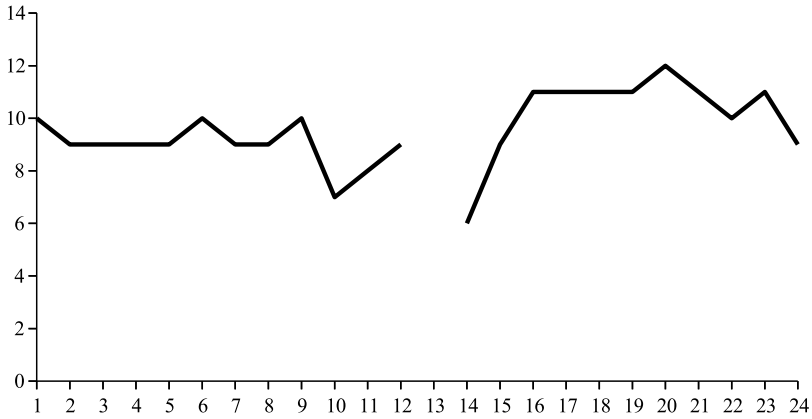
In this situation, it appears as if, unlike strict counterpoint, the spaces left by leaps are not filled in. In Palestrinian, and subsequent common-practice counterpoint, these leaps greater than a third would be filled in with a descending stepwise pattern. However, in this fragment, and others, the leaps of a fourth are seemingly left open in the following set of pitches. However, this is not entirely so, but is instead more subtle. Take note of the charted contour following the first leap to 10 on the y-axis, *d'*. Though the immediately following pitches do not fill in the space left open, through the remainder of the fragment the contour is focused on this space of a fourth within *d'-a*. Just as in Bellermann's Instrumental Piece, the initial leap outlines a narrow ambitus for the rest of the line to travel through; however, this is ultimately broken by the final pitches at *e'*, outside the defined space.

The final fragment is the Hymn to Nemesis, from the same set as the Hymn to Helios.[10] The octave species is *g'-g*.



Example 51. Hymn to Nemesis[11]

The hymn features a dynamic mese of *d'*, and the majority of the piece exists in the space of *d'-c'* in repercussive fashion, widening to *d'-a* before the end of the first section. A final section widens the ambitus to *e'-g*, the role of *d'* as the mese becoming more obvious by the end of the fragment.



Example 52. Hymn to Nemesis

The Hymn to Nemesis reveals an inversion of the previously understood function of leaps as providing an ambitus. Instead, the

narrow ambitus is provided initially, hovering around the mese, *d'*, and the second section outlines the lowest and highest points as encompassing the first section's pitch content.

Many important observations should develop from viewing the lines in the context of a chart as opposed to a staff. The line itself becomes more apparent, and actual compositional quirks are easier to define because the chart provides an abstract line that directly connects the actual pitch relationships. Thus, in the same manner that James Tenney was able to study the intervalic waves of Carl Ruggles' melodic line,[12] we are able to study the contour of a melodic line around the mese. It is best for us to reflect on these results in the context of his own definition of form from *Meta | Hodos*:

> That aspect of our perception of musical gestalten (whether these be clangs, sequences, or larger configurations) that involves shape and structure, and gesture and movement-as its "static" and "dynamic" attributes, respectively. In Section II, the statement is made that "the form of a musical configuration is primarily determined by the effective differences between its successive parts." At the perceptual level of the clang, this means the changes in parametric values from one element to the next. For the sequence, two factors are involved, because "effective differences" between successive clangs may be perceived in two different ways. These are (1) as changes in the statistical features of the clangs, from one to the next, and (2) morphological relations (similarity, partial similarity, and dissimilarity of form) between clangs, yielding in some cases distinct sequence-types.[13]

This definition allows us to transform the idea of form as a way of ordering music in blocks of time and distance into contrasting moments of self-similarity or difference. In context of the fragments studied, each, in possessing up to three distinct sections—statement, elaboration, and cessation—the melody reflects these moments of similarity and difference.

Similar to how a leap is balanced by a line filling in the empty space in strict counterpoint, a leap is often balanced by another according to its distance from the mese. This is generally seen in two ways: the first, a direct "zig-zag" of a large interval, greater than a third, such as in the Hymn to Helios 4,7 to 6,7 (example 50) or Hymn to Nemesis 9,10 to 16,11 (example 52); the second, a transition from large to small intervals, as seen in the narrow ambitus within a defined space, as exemplified by Bellermann's Instrumental Piece (example 46).

In both of these situations the pull of the mese directs the line. The larger intervals are always reined in by the presence of the mese, and there is seldom a second large interval leap from the mese, instead usually back toward the mese, whereas the smaller intervals tend to rotate around a distance of a third or fourth from the mese, and there is generally very little motion at intervals of a distance greater than a fourth.

This narrow ambitus appears in each piece, though standard conjunct motion is not the rule; in fact, in the pieces studied, with the exception of Bellermann's Instrumental Piece, conjunct motion is rarely more than three successive pitches, and the conjunct motion is often the distance of a second, with movement toward a third from the starting pitch less common. In most examples, a conjunct motion is broken by leaps of thirds and fourths, such as the shift at 9,10 to 12,9 in the Hymn to Nemesis (example 52) or the descending thirds at 14,10 to 17,7 in Seikilos' Skolion (example 48). It is often more than not, an elaboration or ornamentation of a line, especially in the repercussive lines at 1,10

to 9,10 and 16,11 to 23,11 in the Hymn to Nemesis (example 52).

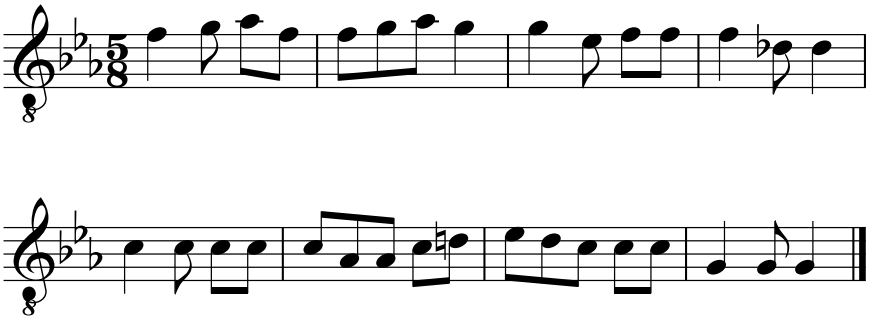
The narrow ambitus directs the functional needs of a melodic line within the tight space of the octave species. As there is very little space, a compact method of composition through defining the space for the line facilitates a coherent result that is not only motivically significant, but also, in its self-contained fashion, endlessly fruitful, possessing greater possibly variety than elaboration of tropes or melody types; that is, it is neither freely composed, nor an elaboration, but a development of a motivic idea to the fullest extent.

In this manner of composition, melodic form, as we have defined it, is clear and concise. The pitches that follow, conjunct or disjunct, exist in relation to the original opening statement, the motivic relationship being a generative space for free melodic declamation, an elaboration that eventually ends in some motivically significant manner; that is, "An idea is born; it must be molded, formulated, developed, elaborated, carried through and pursued to its very end."[14]

In light of this idea of a narrow ambitus based upon an opening interval leap, we can assume the Cairo fragment (example 38), supposedly a piece in media res as we understand it, is the ambitus of an already defined intervallic space; yet, it should be without saying that simply because these traits are concurrent along four fragments does not mean that we can then apply them to all ancient Greek music without having proper evidence. The narrow ambitus theory does not apply to the first section of the Hymn to Helios (example 50), as 9,6, 12,6, and 17,6 are all *g*, a pitch outside the initial leap from *a* to *d'*; furthermore, there is simply not enough evidence to argue that this compositional quirk belongs to the whole of ancient Greek compositional technique, but is instead an interesting, perhaps coincidental, method; indeed, of the fragments not studied, the First Delphic Hymn, section B, previously viewed in the section on modulation (example 22), is

apparently outside the scope of this argument, as it does not contain a large interval leap prior to the major melodic line; likewise, sections A and C of the same piece do not feature the aforementioned features.

However, a caveat concerning Sachs' transcriptions is that he presents the First Delphic Hymn sections out of order and as separate fragments instead of as a cohesive and motivic whole. If we instead attempt to piece together the sections, we might find a more convincing compositional structure from what is essentially a long-form piece in the context of our studied fragments.



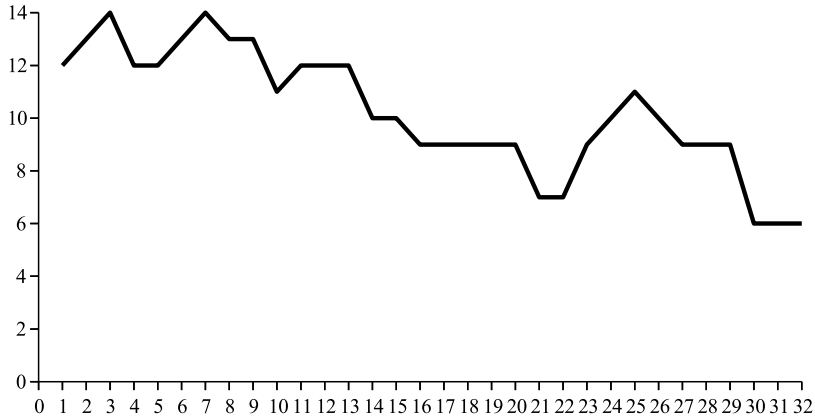
Example 53. First Delphic Hymn sections A and C[15]

The dynamic mese in these sections is *c'*, and it clearly drags the line down from its highest point, in which there is no motion beyond a third until the final descending fourth from *c'*-*g*.

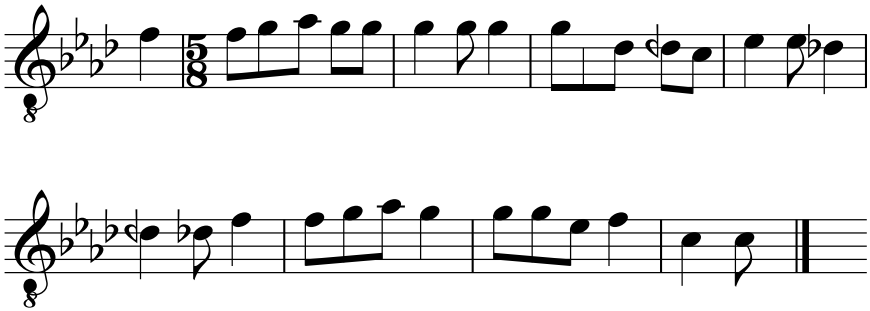
Also of importance is to note in example 54 is the motivic *f'*-*g'*-*a♭'* sequence at 1,12 to 4,12 that then appears in a variation at 5,12 through 9,13.

This section is actually of little value on its own; in truth, its only value seems to be as an example to refute the initial narrow ambitus theory, as, again, there is no space created in which a highly focused melodic line might unravel. However, if one uses this selection as a glass to view section B (example 55) through, there are some observations of interest to us.

Note that the range of the line is within the space of



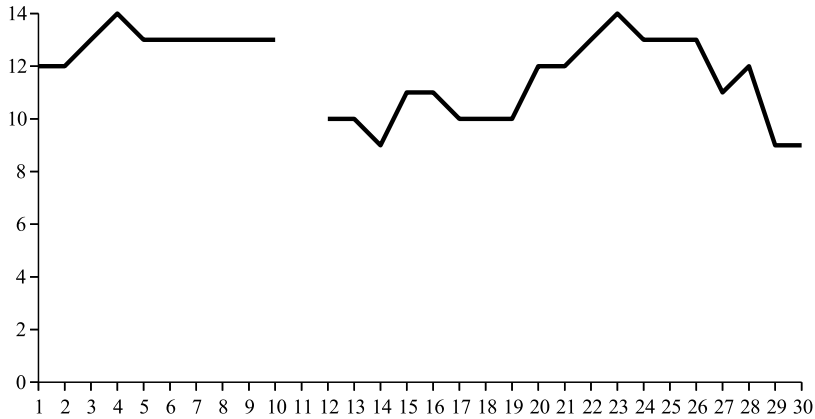
Example 54. First Delphic Hymn sections A and C



Example 55. First Delphic Hymn section B[16]

a♭'-c', a smaller range than the previous section; moreover, whereas the first section is mostly comprised of a slowly descending line, the second section, in which the dynamic mese is *f'*, the line revolves around the mese at the distance of a third, with only three instances of *c'*, a fourth below. There is some compositional substance in this piece as well, the sequence noted in sections A and C appearing prominently; however, now it is placed within the context of the dynamic mese being *f'*, ingeniously formatting the original sequence into an integral part of the mese's melodic line. It would be far too much of a supposition to state that the

composer planned this smaller space to make use of the motivic value of the initial sequence; yet, if we take a closer look at the melodic line in chart form, there might be more to this than expected.



Example 56. First Delphic Hymn section B

The two contrasting observations are then: sections A and C possess a wide range of up to a ninth, if one chooses to acknowledge the outlier pitches of *g* in a species otherwise clearly *a♭'-a♭*; yet, section B exists within a range of a sixth, and the lowest pitch of the range of section B is the dynamic mese of sections A and C. In addition, section B reflects the motivic emphasis on the sequences of pitches *f'-g'-a♭'*, the pattern appearing in whole and through variation at 1,12 through 10,13 and at 20,12 to 26,13.

What this then appears to be is the narrow ambitus, but instead of in the context of a simple interval leap, it is in the context of the previous musical idea. In this situation, the long-form piece expands the idea of creating a space via a large interval by making the large interval a line with inherent motivic value beyond its range. Through deliberate repetition of key elements of

the line in sections A and C, a relationship is established in a situation that otherwise could be nothing more than two parts put together, and the structural relationships in range and mese are not simply visible on the page alone, but audible in performance. The musical form, equivalent to ABA, is coherent, concise, and fascinatingly clever, especially in comparison to the shorter fragments available; yet, its value is only apparent when juxtaposed properly. The structure otherwise consists of a fascinating idea that remains without elaboration or contrast, and thus it can be nothing more than an idea. The strength of the music is in how it moves beyond the idea and in what manner it does so, how the idea itself becomes both a tool to move forward and also a result of a larger whole.

Bellermann's Instrumental Piece posits this same practice in a smaller package. The opening idea is clear: 1,5 to 2,8 to 3,10 to 4,12; *f*, *b*♭, *d'*, *f'* (example 41). It is breathtaking in its simplicity, almost sublime; yet what next? If it ends now it is fascinating, but it is empty; it is not so much a full piece than it is like a scalar form, an idea that exists as a generative body, but the interpretation of which only matters in the context of what the next idea—the composition—is. An opening statement has meaning, but it is also given new meaning by what follows. The two conjunct sections that follow then give weight to the opening statement, and this is then a piece of music, not just an idea sketched on paper. The length is not important as much is the manner in which each subsequent section, and idea, alters the way we experience and comprehend those before it. Influence travels in both directions, and perhaps what appears as motivically significant might appear as nothing more than a dead end, and what seems insignificant is instead the point which defines the piece itself. The opening fourth in Bellermanns' Instrumental Piece is deceiving in the same manner it is elucidating; one might believe that it will be the focus on the final cessation, yet the

third, *f'-d'*, is of actual value.

Thus the value of a line in this manner is like that of a life: in the time that it persists, its meaning is not easily understood, yet in the context of how it has been shaped by the lives of the past and how it will shape the lives to come, its value is clear. A life acts in its own time, but it takes the life after it to define what those actions mean. Thus, a line is not defined in the moment; that is, though we believe we can judge a line in a present form, but we really cannot, because it has no context; instead, the fruit of the line, as it ripens, alters the perception of the line; our memory of the line in the past, consciously or otherwise, is altered as each pitch has some relationship to another, as it has been placed there for that purpose. When a composer generates a line, it is not simply making something aesthetically pleasing—that concern is secondary—instead, his goal is to ensure all things are in their proper place as defined by the motion of the line. His method is, of course, formulaic, as it follows a pattern, yet his result is not that of connecting dots or computing an algorithm; there is a pattern, a focus, a prescribed form, but the result is in how he acts according to the pattern; that is, how are the chosen pitches acted upon, how will they be acted upon, and how have they then been acted upon?

One might assume this is just the quality of the fragments' compositional process and question the role of the mese. However, in any piece of music in which there is a mese, or rather, a point that is deemed as polar, it will draw the line to develop this type of statement-elaboration-cessation form, even in the context of a shorter line. For example, *Et nox ultra non erit* (examples 32 and 57) was written according to a mese, yet prior to studies of melodic contour and subsequent formal structures in melodic lines, instead being built upon Palestrinian counterpoint of rising to a peak pitch and descending.

The opening statement is a series of descending pitches

Example 57. *Et nox ultra non erit*

outlining a fifth, *e'-a*, the first of which, *e'-c♯'* is motivically significant, which confirms a motivic vacuum in which the remaining composition is contained, the only outside pitch being *f'*, set as a peak pitch. There is a short elaboration within this space, built upon the same *e'-c♯'* interval that gives way to the cessation, a four note reversal of the highest pitch, *f'*, to a *c♯'-e'*. In this process, a motivically significant section acting as a defining factor in all three parts of the line, without planning, appears as an organic response to the limited space of the octave species, giving form to something that otherwise might be amorphous. This similar pattern appears in a mese composition by virtue of the means available to the composer: the mese allows the line to possess functionality and the formal aspects of these pieces give an otherwise stagnant octave a sense of motion by setting up something that can convincingly transform according to the space provided, which, if delineated immediately, signals that the music will move in this direction.

Consequently, if there is a structural dialectic in music of similar-dissimilar, then the fragments portray it on two levels. The melody is always defined by idea-development, not by idea-idea II,

which would be a similar-dissimilar situation; or, in other terms, a parent-child paradigm: one gives rise to the other, but they are different beings in their individual natures; that is, one has already developed, and the other will develop in a new direction. As there is no contrast in melody, but growth, it is much more like the child-adult paradigm: the individual himself/herself is not two different beings as a result of the change brought through growth, but the child-self develops into an adult-self, retaining a more nuanced form of the essence possessed in youth.

In contrast, the similar-dissimilar aspect of the fragments are the modulations that change the shade of the line. Modulation is defined by contrast, it is always the relationship of point a in comparison to point b. Though the melody does not change, it is not boring by virtue of the line being placed in the context of a shifting harmonic field. In the fragments, modulation, as we understand it, is a subtle act, and often the ancient composers seemed to have preferred to change only one or two pitches within a tetrachord. Contrasts are not bold and obvious, but precise and nuanced, thus defining a backdrop for the line that transforms the octave species from a pitch generator into a contextual tool. Moreover, modulation, as this parent-child paradigm, is possibly an unending chain: each parent begets a child, which may in turn beget one of its own; yet, a melody, as the child-adult, will at some point reach its telos.

What we see in comparing the short form line to the long form structure is that this method is not simply a tool for composing a single melodic line alone; instead, the longer the piece is, the structure found in the single line composition expands in a manner that a whole line itself becomes a statement, and that subsequent lines might all be elaborations. Thus, as it is with all idea based melodic composition, the simplicity of the result betrays the rigor of the method, as the result should always show nothing of the construction.

Unfortunately, there are no other long form examples with which we can test this proposition, as the Second Delphic Hymn's sections are riddled with lacunae. Many of the longer pieces are in poor form, unsuitable to proper analytic study, not simply due to the amount of pitches missing, but the inability to confirm whether or not the lost pitches are of motivic importance to the musical line. What has been proven here, if anything, is that there is a shred of self-referential and self-similar compositional techniques to confirm that those who wrote or improvised these musical pieces, and hopefully many more, imagined music in the same manner we appreciate it today as a highly idea based art form; therefore, their ideas and methods are of great value to us today, not inferior to our current modes, but equivalent.

Notes

1. Artistic interpretations such as "breaking the rules" require a thorough understanding of said rules, and require one to make use of materials in the context of the method of organization; thus, personal idiosyncrasies in a tonal system are the result of the boundaries being crossed, but not dismantled and created anew; on the other hand, to completely fabricate a new method of organization changes the paradigm of musical composition through the different relationships of the same set of pitches, which then creates new boundaries. It should be understood that if extended tonality is moving the goalpost, something such as dodecaphony is building a new stadium.
2. Schoenberg 114
3. Sachs 199
4. Ibid. 244
5. Ibid. 199
6. Ibid. 245
7. Ibid. 199
8. Ibid. 243

9. Ibid. 251
10. Ibid. 199
11. Ibid. 243
12. Tenney, James. “The Chronological Development of Carl Ruggles' Melodic Style.” Perspectives of New Music. Vol. 16, No. 1, 1977, pp. 36-69
13. Tenney 89
14. Schoenberg 49
15. Sachs 245
16. Ibid. 240

Advanced aggregate techniques

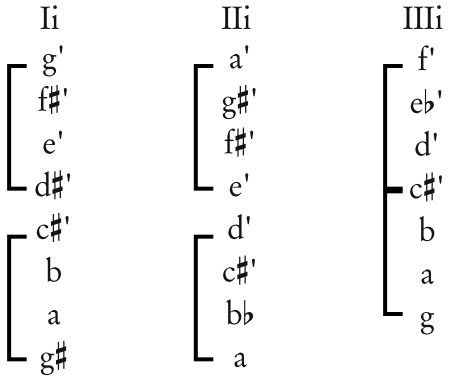
Beyond melodic inventions within the context of strict octave species composition, there are obviously many other uses for the aggregate and the octave species, including overlapping octave species that modulate together or separately, the combination of separate octave species to form new aggregates, and "species hocketing;" yet, these are techniques individual to compositional practice, not a strict theoretical discussion. Of course, because these are unique possibilities drawn from the structure of the system, it would perhaps be beneficial to elucidate several of these techniques, not as an argument that they should be applied at all, but one for the variety of opportunities available within aggregate based organization. Of course, I should not wish to argue that any method is the only way of organizing musical ideas, and simply because I have highlighted these does not mean that they are in any way superior, they are nothing more than those that came to my mind as I composed the studies. One must not forget that the organization is not the result, but a means to the result.

Separate octave species and their combination into aggregates

A simple technique, relevant to the discussion of the construction of the aggregate, is the combination of separate octave species to form new aggregates. This idea is developed from the *Study Score B*, in which two groups possess different octave species, yet share material in a manner that allows for harmonic relationships otherwise unavailable in a piece of music written with a single

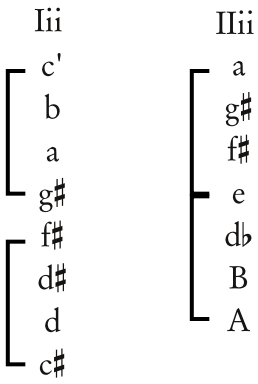
octave species. The groups are divided by range, the upper and lower tetrachords are split from another and act as unique entities, yet come together in the second modulation as a singular aggregate. In this situation, the music is not built form a predetermined aggregate, but from abstracted octave species from which an aggregate exists following modulation, which disappears as the upper species passes into a new modulation, allowing for moments of similarity and dissimilarity, as well as freely overlapping pitch content as a consequence of permutation.

The upper octave species (example 58) is the Lydian transposition of the Dorian species. It modulates in a parallel fashion up a semitone, the results being retrograde diatonic/shuffled chromatic. This modulates one more time at *c♯'* into a chromatic/augmented conjunct form.



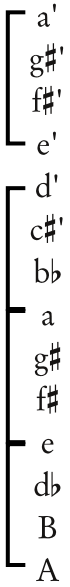
Example 58. Treble octave species modulations

Example 59 details the lower octave species, a freely built form of a shuffled chromatic/chromatic octave species, which modulates into a deliberately broken conjunct form that descends from a, the top tetrachord being a retrograde diatonic and the bottom being a non-functional tetrachord in the same manner as the Michigan Instrumental Papyrus' augmented modulation, built from the distance of a fifth, *e-A*.



Example 59. Bass octave species modulations

From these, one may put together the full aggregate of the first modulation, species IIi and IIii (example 60).



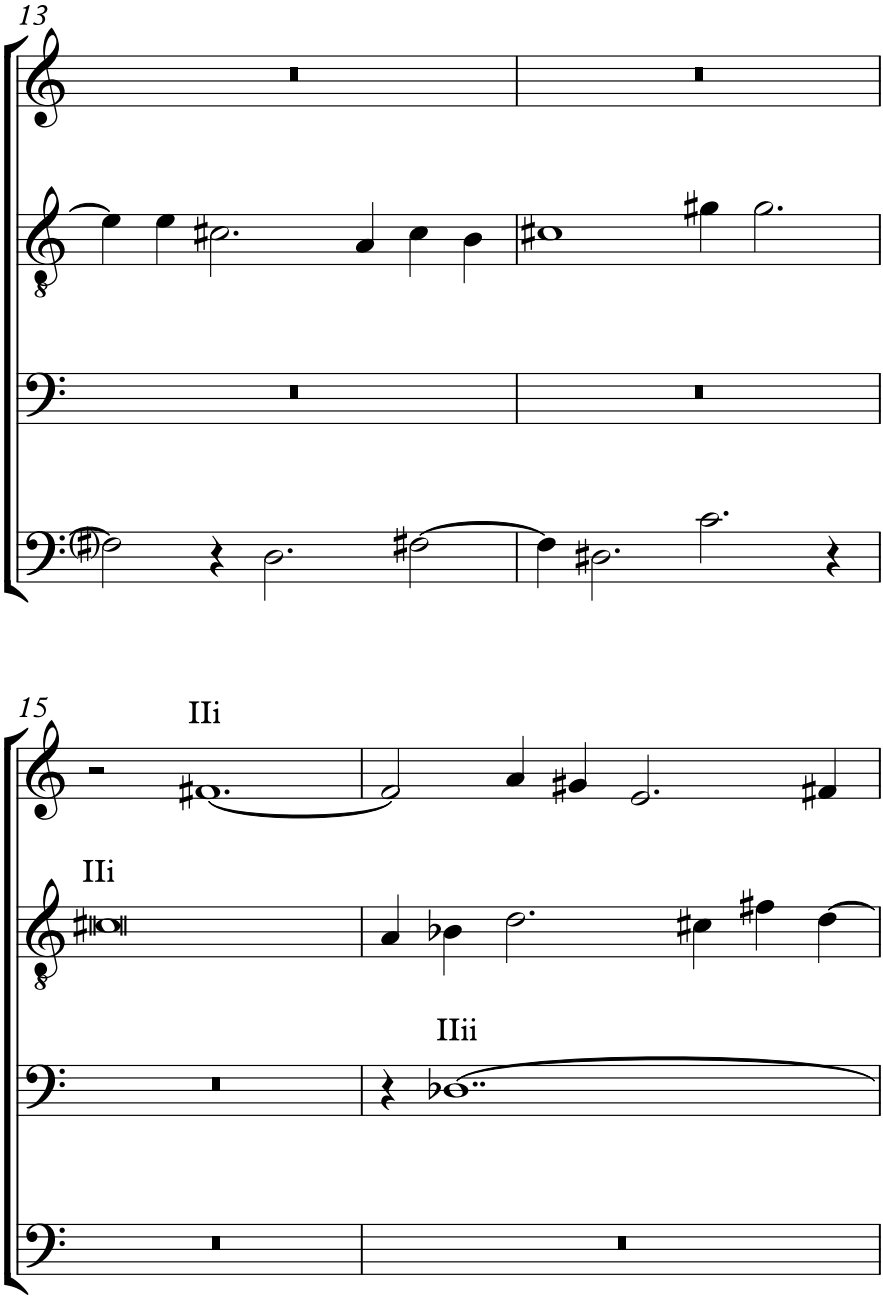
Example 60. Aggregate created through octave species superimposition of IIi and IIii

Of course, the reason for this application of multiple octave species is that the octave is useful for only one subset of voices—either high, low, or somewhere between—something that one might have noticed in Study Score A for the modulation of octave species. In the polyphonic practice so important to music, making use of a single species limits the functions of the voices in the same manner the medieval hexachord limited polyphonic development; certainly, as we found in *Study Score A*, one may modulate to a lower or higher species, but that then removes the voices outside that range, still limiting the polyphonic possibilities. Thus, making use of several octave species, all derived from a single aggregate or from separate aggregates, allows the composer to engage all available voices. The result appears in these examples from *Study score B*, mm13-22 (pages 87-89).

The interest in this technique is the shift from disparate material that overlaps—as in the lower tetrachord of Ii, *c♯' b a g♯*, and the upper tetrachord of IIi, *c' b a g♯*, in which the material grows from a single pitch but gravitates away in the method the tetrachords are built—toward united material that forms the whole of the aggregate. The materials are no longer haphazardly related, only so because they exist within the same piece, but now thematically, encompassing a single organic unit, something broken when the upper voices modulate away from that relationship to IIIi, a species completely unrelated to the past form.

"*species hocketing*"

Another possible technique applied in the study is the act of "species hocketing," or the free movement of melodic material between modulated forms through adjacent pitches either stepwise or at consonant intervals. For example, view these following measures from *Study Score B*, mm58-66 (pages 90-92).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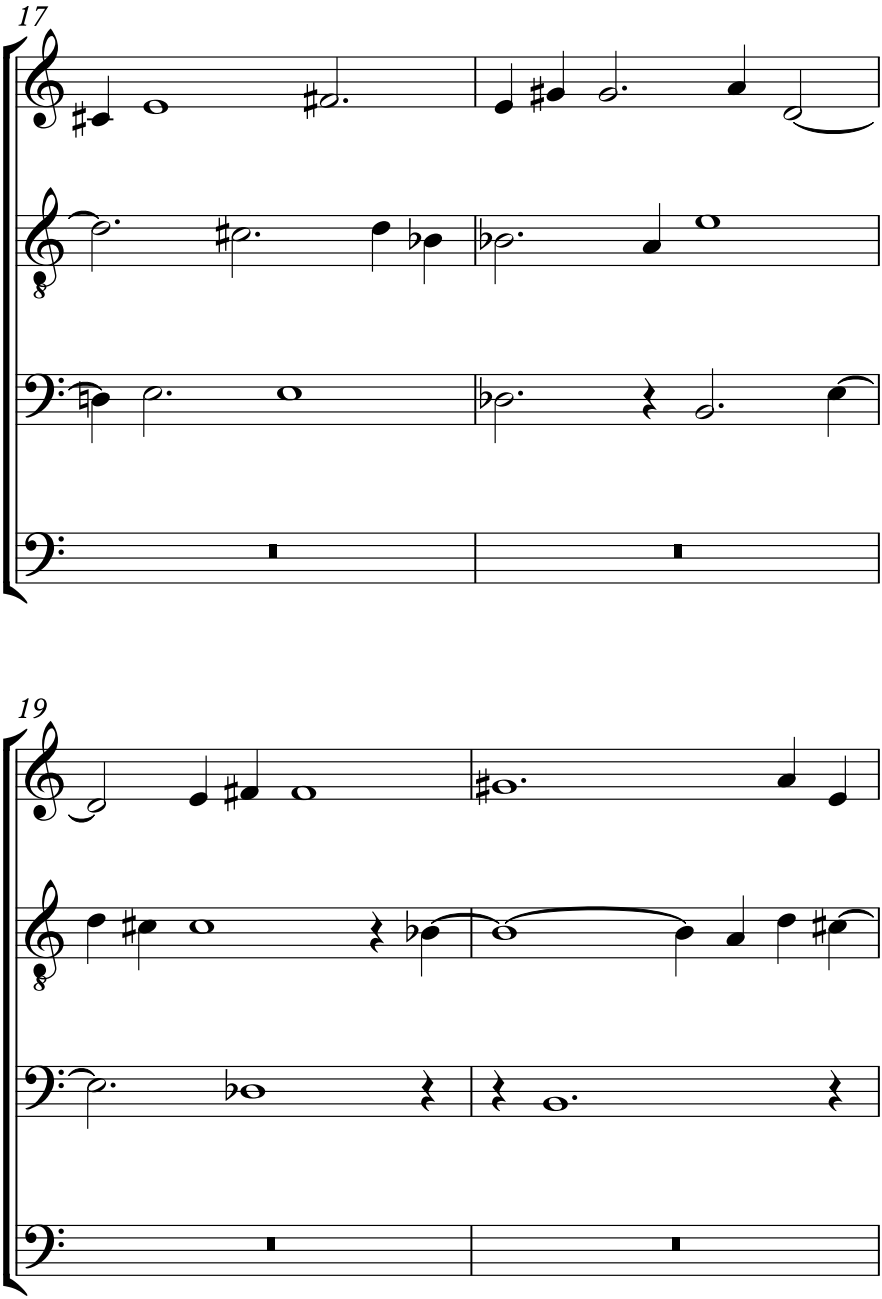
15
IIi
IIi
IIii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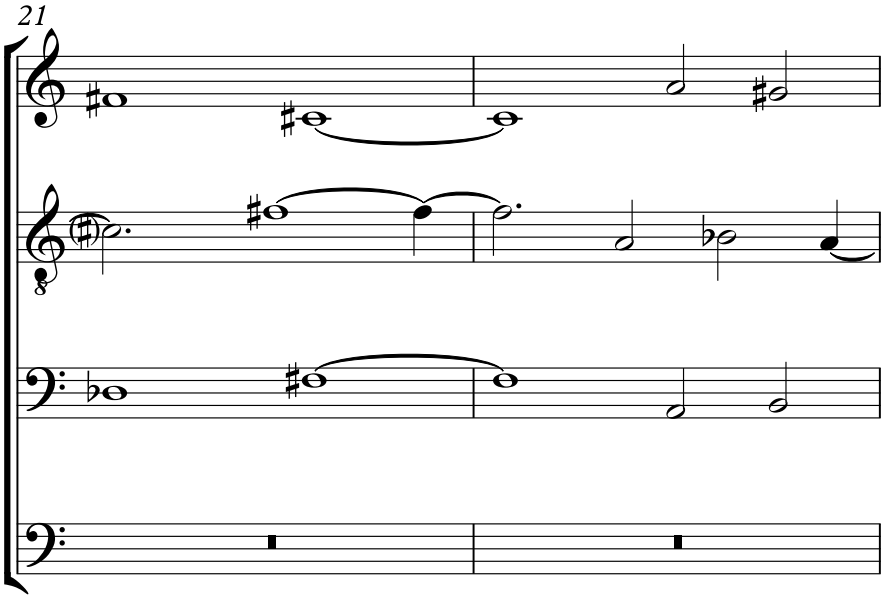
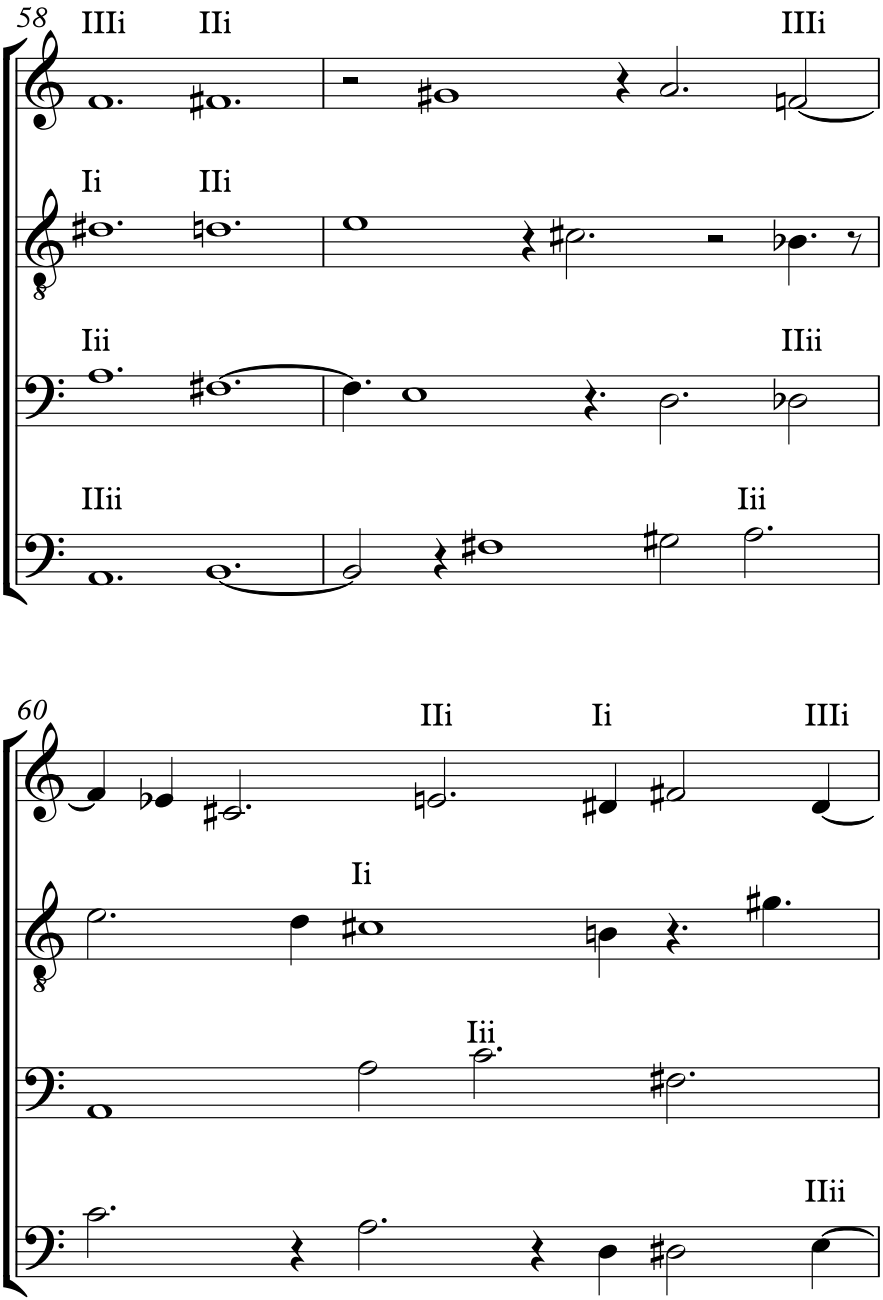
19



The trouble with the limitations of the octave species, as one might already understand, is that the melodic and harmonic content is limited by the range, which is the reason for constant modulation in ancient Greek music. To make use of a single octave species is to confine oneself to a harmonic palette that is, thanks to the non-directional aspects of modality, largely static. However, the hocketing removes the expectations of static harmonies from a single octave species, allowing for strictly constructed—yet, to the ear, free—melodic lines and harmonic consequences. In this situation, the end of the piece, the music travels through permutations already defined by the earlier modulations of the base species, a summation of the melodic and harmonic landscape contained within the musical landscape

In fact, it is so because the development of modulations within a piece of music are never fully predetermined, but defined by the base species and the modulations that came before, that each piece possesses its own self-generating soundworld; thus, the developments are the result of organic growth: it can never sound


58
IIIi
IIi
IIIi
Ii
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Iii
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Iii
60
IIi
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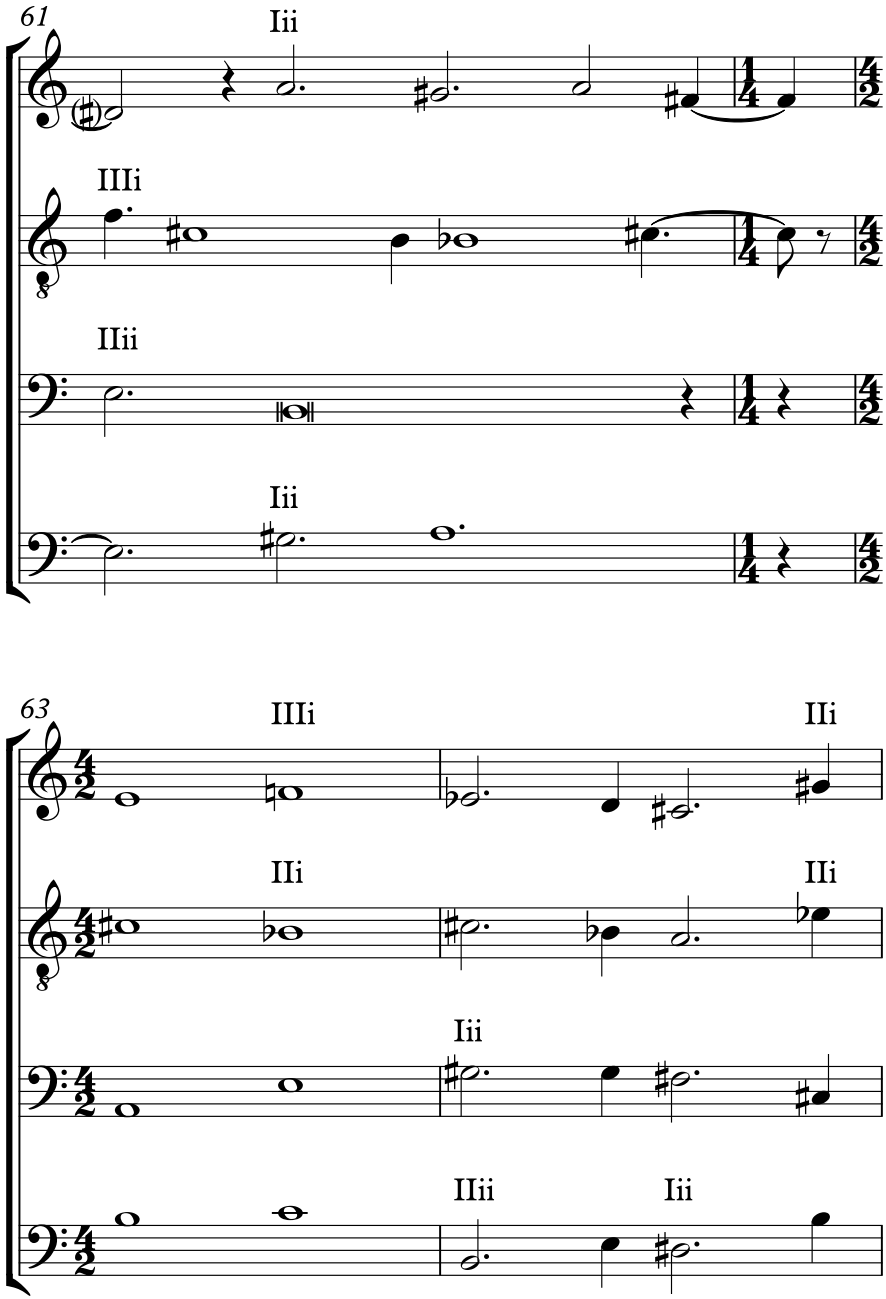
IIIi
Ii
Iii
IIii


61
Iii
IIIi
IIii
Iii
63
IIIi
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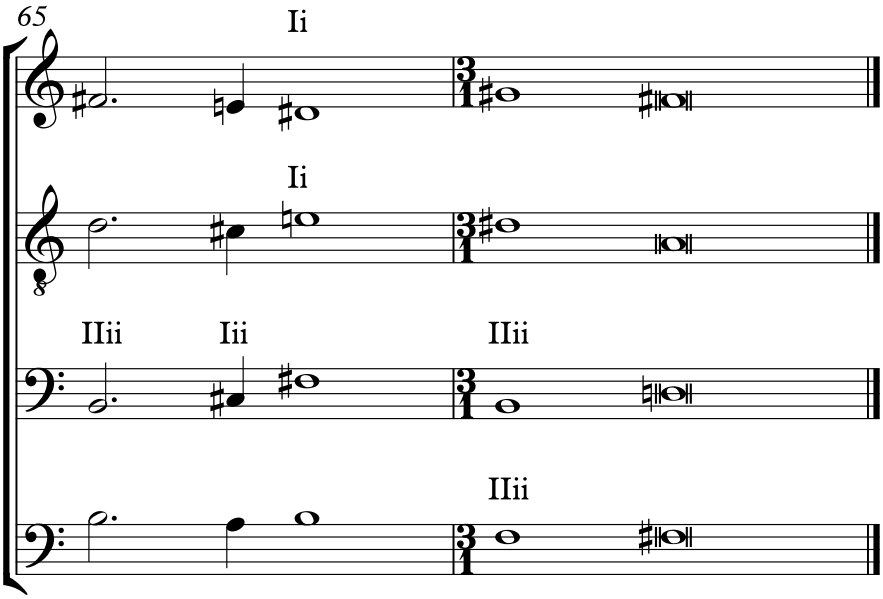
Iii
IIii
Iii



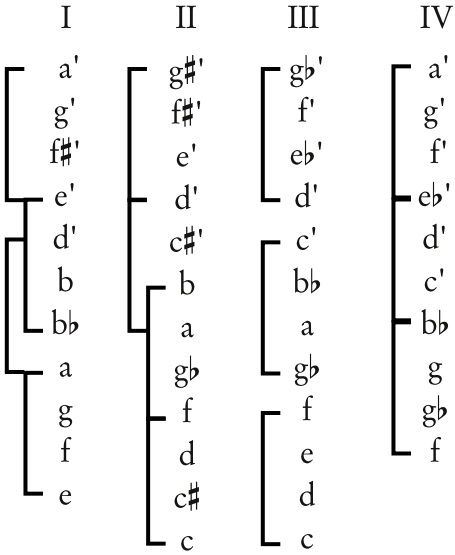
in the same manner as any other piece of music, because what shapes it cannot always be the same.

Overlapping octave species

Expanding upon the act of combining separate species, overlapping two species into a larger form can act in a manner beyond two tetrachords sharing a root pitch. For example, take note of the set of octave species in example 61. Note that it is not a total aggregate, as there are not fourteen pitches plus the proslambanomenos, and that it is instead a set of superimposed octaves species that are built in a manner in which they are intertwined, so that the construction of one partially defines the construction of another.

In it we have two different versions of overlapping species. The first is an irregular overlap, in which the lower disjunct tetrachord, *e′-e*, and the upper disjunct tetrachord, *a′-a*, both overlap at *e′-a*. This modulates to two conjunct tetrachords that

overlap at *b-a*. The third and fourth modulations are examples of a more regular overlap, in which the central tetrachord is shared by both outer tetrachords. As both species share pitches, the results are much more subtle than two separate species in *Study Score B*, Ii and IIi (examples 58 & 59), that are not built to overlap, but are arbitrarily superimposed upon one another. Moreover, the superimposed structures in *Study Score B* are separated by different voices in practice; that is, the upper and lower voices are unrelated, and the differences between the two affects not only the vertical harmony, but, more importantly, permutes canonic relationships.



Example 61. Modulation of overlapping species

For example, take note of the opening bars, mm1-6 (pages 95-96), of *Study Score B*, in which a direct white note canon and a black note mensuration canon derived from the tenor voice appears in the upper and lower bass voices, respectively.

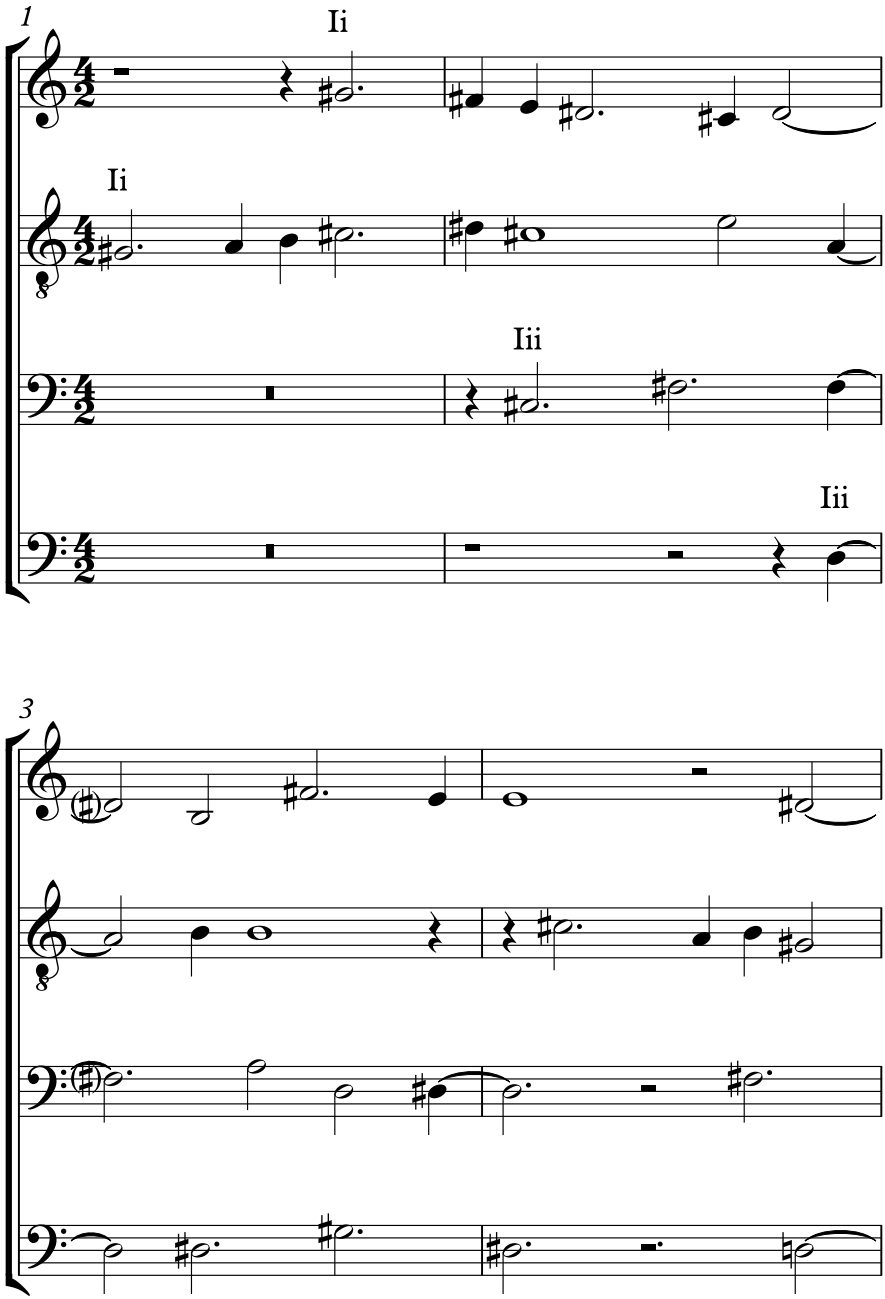
These are 1:1 canonic relationships, that being g♯ in Ii is equivalent to *c*♯ in Iii; thus, in octave species set notation—the base

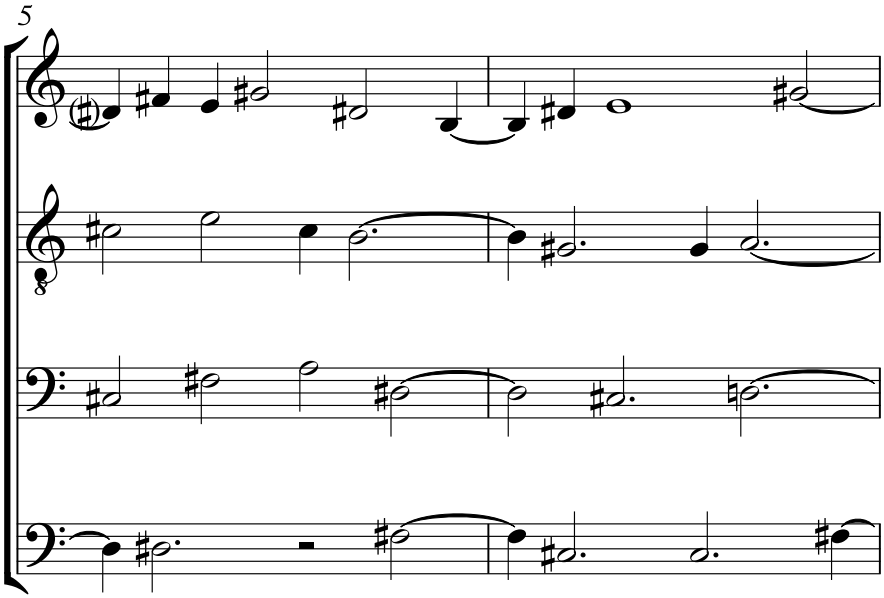
pitch being 0 and the octave being 7—the white note line in the upper bass—*c*♯, *f*♯, *a*—spans 0, 3, 5, this set being equivalent to the first three white notes of the tenor line, and the black note line of the lower bass—*d*, *d*♯, *g*♯—spans 1, 2, 4, this set being equivalent to the first three black notes of the tenor line. In this technique, as the species are different from one another, the canon is not equivalent pitch, but relative pitch—or rather, relative position in the octave species, as tetrachords are distinct units; consequently, an octave species canon would generally be one of two options: relative position or equivalent pitch with missing notes.

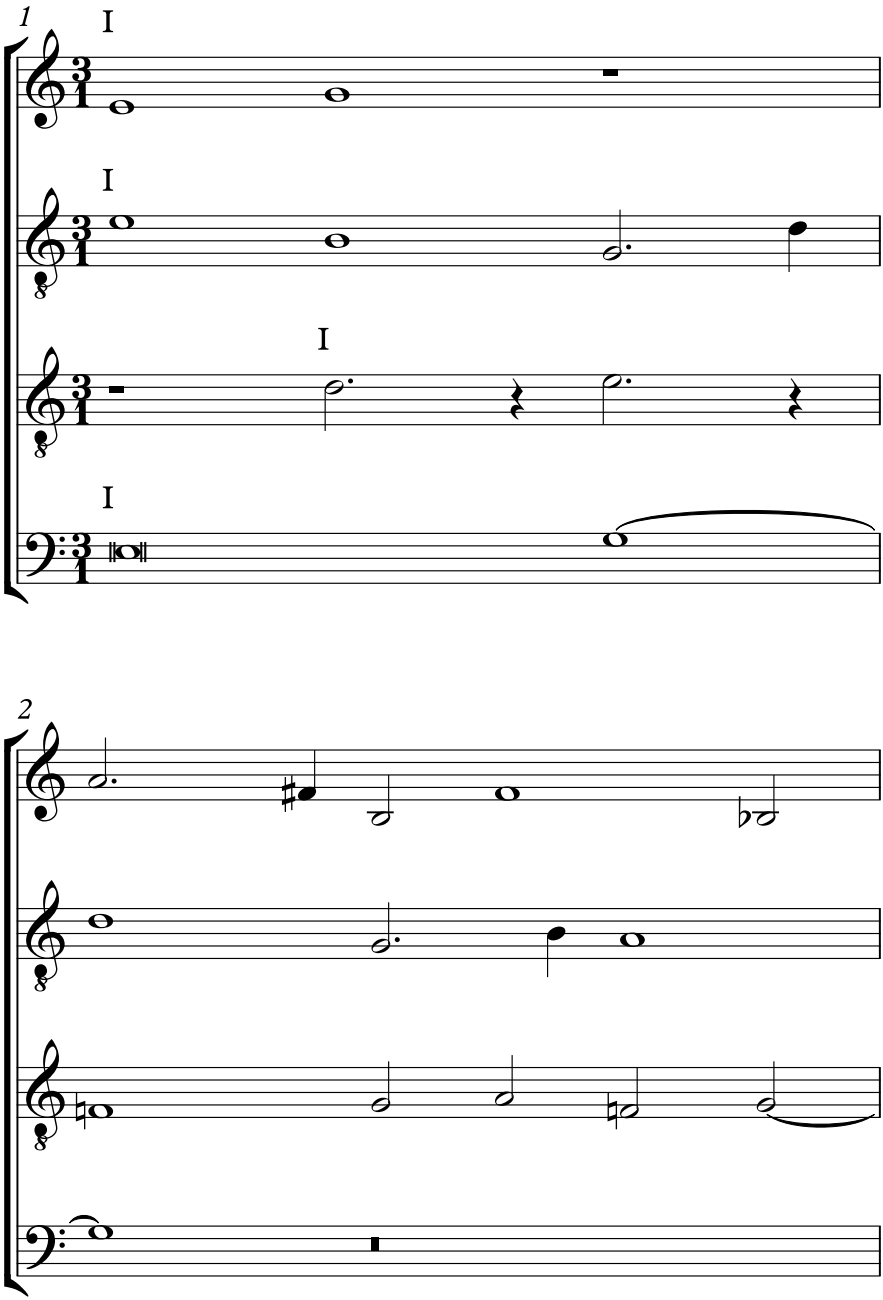
Compare this canonic relationship to the opening bars of *Study Score C*, mm1-4 (pages 97-98), in which the alto voice is the source of a mensuration canon in the bass voice.

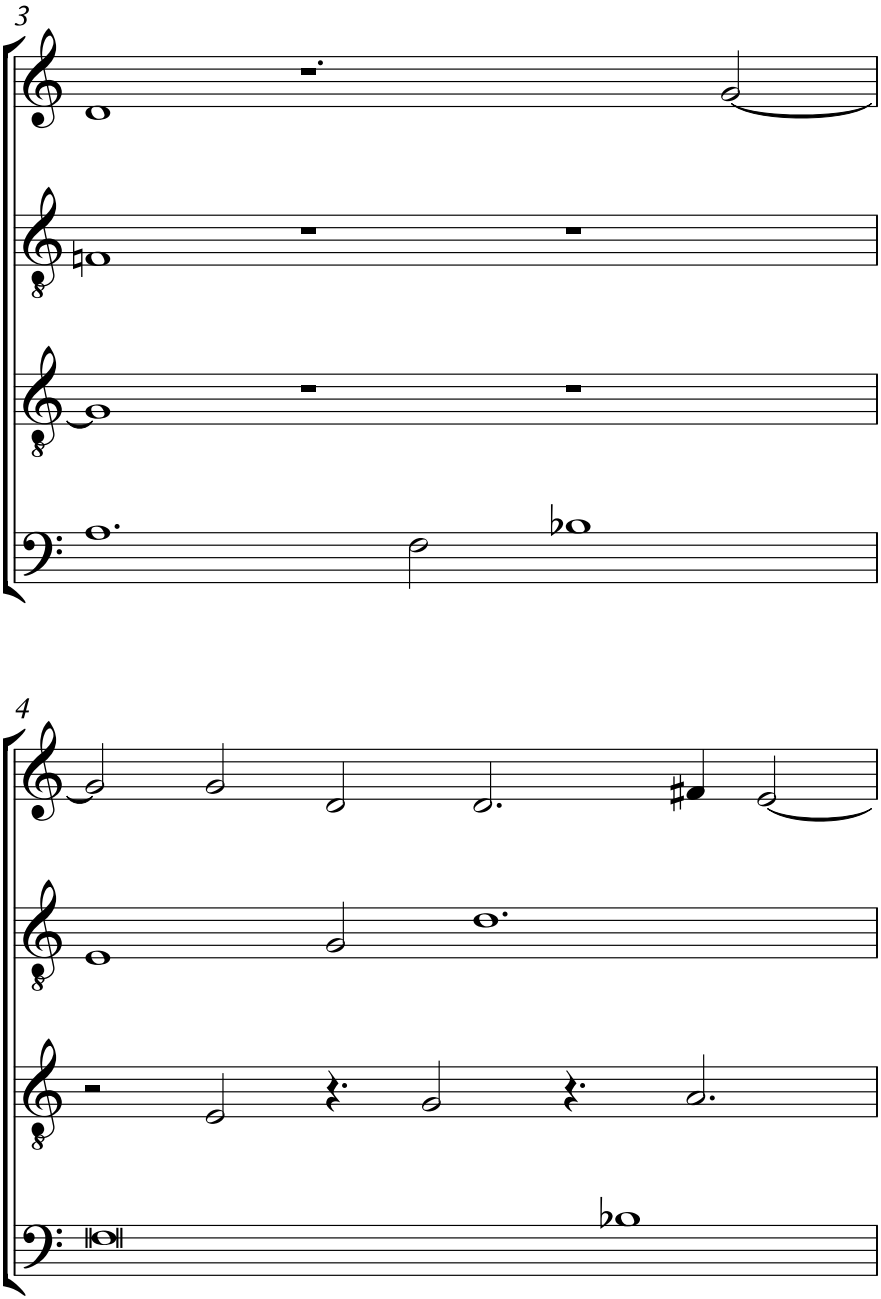
These relationships are 1:1 along tetrachords; that is, the upper and bottom tetrachord of I are providing the pitch content of the canon in a similar manner to how the superimposed octave species share pitch content by position. As the tetrachords in the overlapping are built in a manner that fosters similarity—*e'-e* in I causing the top and bottom tetrachords to span *a'-e'* and *a-e*—this canon is relatively equivalent in actual pitch content aside from accidental differences, such as *f*♯*'* and *f*.

Of course, these results are also defined by the construction of the sets of octave species for each score, certainly one could build the superimposed aggregates in a manner in which they would overlap; however, the point of a superimposed aggregate is that the two are obviously distinct structures without purposefully identical construction, whereas the overlapping structure is built in a manner that engages the octave species as a united whole, and requires them to possess identical pitches and intentional similarity. Thus, even if one stratified the species according to upper and lower voices, the combined species provides a bridge to pitches beyond the respective upper and lower species. As a result, a line in an upper voice is not limited to the *a'-a* in the first

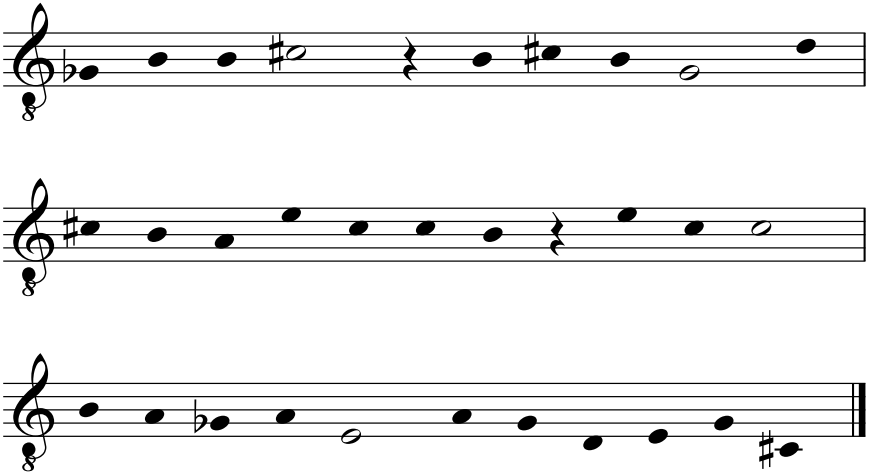

1
Ii
Ii
Iii
Iii
3


5


1
I
I
I
I
2


3
4

overlapping species, but might travel as low as *e*. This also allows for up to a triple mese set, the thetic a and the dynamic of each species. Thus, a line might be shaped in several manners, as these three are according to the mese of overlapping species II, *a*, *d'*, and *f* (example 62).



Example 62. Melodic line built along three mese pitches

Thus, the overlapping species, unlike a superimposed structure, allows for greater pitch range and overall pitch similarity if these traits are necessary or desirable.

Though these are only a few select ideas, they shed some light on the organizational properties of tetrachordal structures, which, thanks to the artificial nature of their construction, are much more flexible than traditionally applied triadic structures in the explicit and implicit harmonies of lines.

Apotheosis

Music for Nine Voices

In the analysis of the last two sections we have come to understand how a line functions in the octave species and how modulation within the aggregate shifts the shade of the line, but the two have seemed unrelated to one another; indeed, there is no deep discussion of modulation in the section on line, and the studies provided in the discussion of modulation do not make use of lines written according to the mese techniques derived from the fragments, but instead freely composed music.

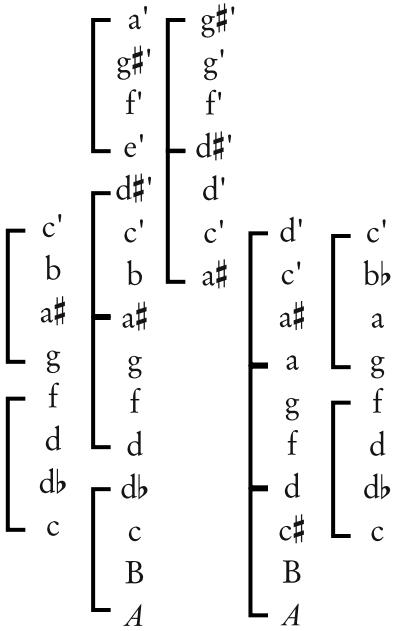
Thus, it should be clear that we have yet to look at both in practice, not simply in theory. To do so, this piece of music has been devised so that all its parameters provide a practical assessment of the ideas discussed in the previous sections, and these are as follows:

A. The arrangement of voices
   a. The stratification of voices according to melody and harmony
   b. Functional and nonfunctional harmony
B. Line as growth
   a. The use of a statement-elaboration-cessation structure
   b. The use of a narrow ambitus defined by a statement for an elaboration
   c. The totality of the line as related to the initial statement through motivic repetition, resulting in the actual line being completely composed of self-similar sections and variations
C. Modulation as contrast
   a. The use of a single octave species, a total aggregate, species that modulate separately but also together, overlapping species, species "hocketing"

b. The modulation directly changing the content of the line without touching the contour

c. The act of modulation as the "necessary" contrast in that the line refuses

What should be discussed first to help us understand the process in which the voices are stratified, and the method in which the lines are built, is the set of modulations for this piece, provided in example 63.



Example 63. Modulation set for *Music for Nine Voices*

The first species appears embedded within the aggregate, placed to its right, which modulates in two manners: first, the upper species modulates separately to form a conjunct species at *d♯'*; second, both this upper species and the aggregate modulate together to the next group of overlapping species, with the lower section being conjunct at *d* and the upper being built down into that set from *d'*. This overlapping species modulates a final time to a species similar to the first, the difference being the enharmonic *b♭/a♯*, expressing

the necessity that these two must exist as separate pitches to protect the differing shade.

Notes for internal interpretation

Though this is not a piece for performance, but study, performance notes are of great importance, more so for the good of the inner ear.

This music is enharmonic and cannot be properly understood in a twelve tone tuning, which would render the harmonies impotent. My own ear, and the manner in which I imagine this music, is adjusted to the tuning specified earlier in this work, but this is not a fixed rule. I believe in indeterminate tuning—shade as one in the ancient world would otherwise call it—and a world in which each interpreter knows what sounds are the sweetest for them and how their own temperament allows the music to be a living entity, not just static, multipurpose, reorganized, and found objects. All that is required is that the tuning respects and reflects the enharmonicsm inherent within the musical language.

Each voice is ideally a separate instrument, of any nature, naturally one that might play any pitch between *A2-A4*. Of course, it could very well be an orchestra if the voices are considered groups; however, the notion of different instruments is to privilege the exciting interactions between those of varying timbre. The exception to this is the set of voices III-VI, which should either be given to at least four instruments or an instrument capable of four voice polyphony. If there are multiple pitches, e.g. a four note chord, the four voices choose which pitch to play independently so that the full chord may or may not sound.

There are many possible sounds, and each experience may be different in such a way that we can enjoy the diversity of sound

possible even without extended techniques.

There are sections written according to Solesmes notation. All performance considerations are the same as chant: a note with a dot is longer, connected notes are legato, separate notes are percussive, a small line is a short rest, a longer line is a longer pause, a full barline is a complete stop. There are no static values, each voice regulates the group so that balance will always be reached; if this is not possible for whatever reason, one voice can be designated a cantor. The C before the staff represents *C4* at the line it cups. If there is one staff, all voices must choose whether to play or remain silent. If there are multiple, voices may choose, with the exception of one delegated to a specific voice. If one staff ends, the voice should turn to an existing staff according to the voices already sounding. The only points that line up are where the initial pitch is placed in relationship to one on another staff. Thus, this polyphony should be free, never exact.

A blank space or completely empty system should be considered a pause of great, yet undefined, length. It is best described as the same as the experience of one is holding in a deep breath for a long period of time. The subsequent music is as if exhaling.

Dynamics are flat, balanced in all parameters, to possess a clear sheen of a surface, as if transparent: the listener should be able to "hear" through the sounds, so to speak, no matter how thick the texture truly is, as if one is peering through a veil. Notes within hauptstimme brackets are more prominent, notes within nebenstimme brackets are less so; both should float above this surface.

The arrangement of voices

In this music there are two contrasting ideas, those being the function of the line—that which gives music direction—and the

function of the harmony—that which gives the music depth. The line is always melodic, never harmonic, and is often defined by a hauptstimme or nebenstimme; likewise, neumes are always melodic and never harmonic. Harmony is always a surface, as if a reflection of light: it appears not as directional, but as a property that shapes the line through shade. It is static, but it is functional in its own manner through the interplay between stable and unstable harmony.

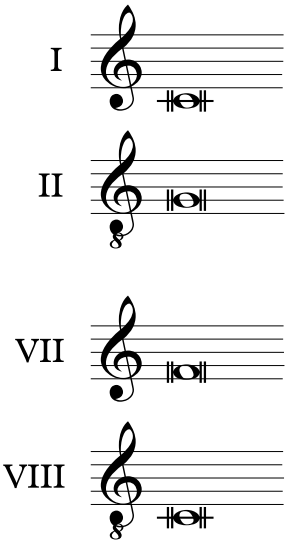
Stability is equivalent to the notion of consonance, yet when consonance is discussed hereafter it is not according to the standard definition of comprehensibility. Instead, consonant harmony is directly derived from structural features of the system of organization and is entirely an objective, not perceptive, trait; thus, the notion described in the Preface that only pure triads are functional and added notes disrupt this functionality is directly tied to this notion of consonance as the stability of a harmonic texture and the gradations of dissonance as one moves away from the foundations.

This notion of stable and unstable harmony is expressed by several examples of the two kinds of functional chords in a tetrachordal structure—that is, chords that are natural results of the construction of the tetrachord—outer fourths and inner fifths.

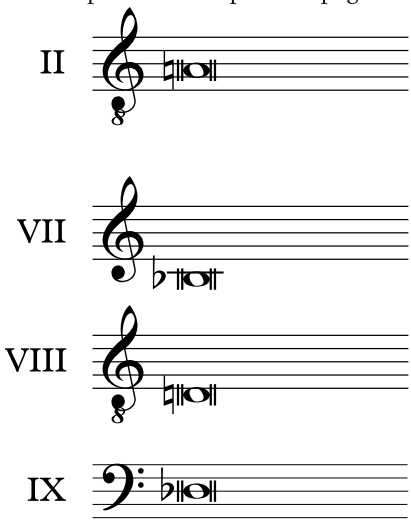
Outer fourths (example 64) are highly static, built upon two fourths, and by proxy, the distance of two fifths, a second, and an octave. Inner fifths (examples 65 and 66) are unstable, built upon two fifths, and by proxy, two seconds, a fourth, and a sixth. In theory these appear to possess the makings of a stable chord, but in practice, as the inner sections of a tetrachord are not always the same relationship to one another—in contrast to the consistent relationships of the outer sections—these chords become unstable as modulation changes the inner workings of the octave species.

Thus, it should be important to note that the consonant intervals within a tetrachord are unisons, seconds, fourths, fifths,

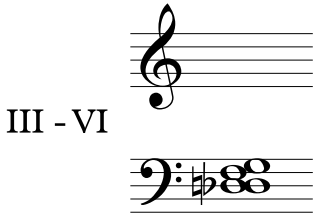
and octaves—major, minor, augmented, diminished, or otherwise. As these as the chords conceived as functional, a standard "progression" would be a series of outer fourths contracting into inner fifths and then expanding back out, as if breathing, though to discuss further an equivalent structure to tonal harmony in a modal form is impossible.



Example 64. Excerpt from page 2

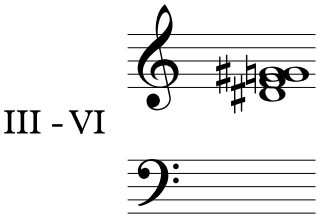


Example 65. Excerpt from page 10

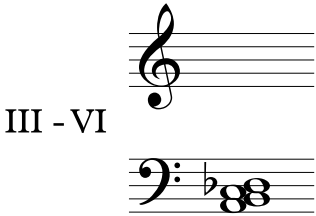


Example 66. Excerpt from page 11

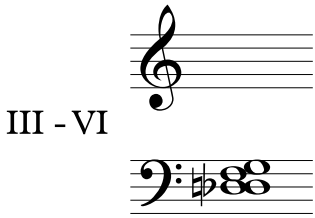
Another harmonic structure, neither functional nor otherwise, used simply as a thick texture, is nothing more than a tetrachord, as seen in examples 67, 68, and 69.



Example 67. Excerpt from page 5

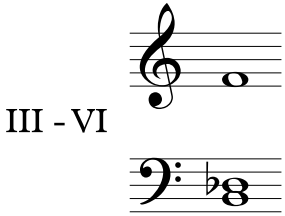


Example 68. Excerpt from page 11

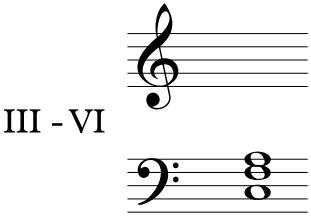


Example 69. Excerpt from page 13

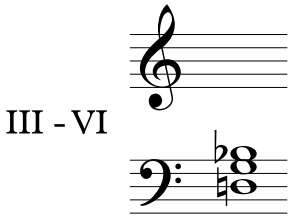
Other chords that are labeled non-functional are precisely that: non-functional in the context of a tetrachordal structure. These, in the context of the music, are often triadic structures (examples 70, 71, and 72) or mixed third/fourth (examples 73 and 74).



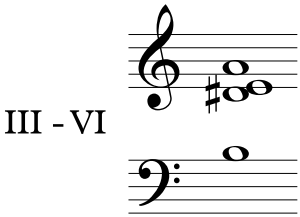
Example 70. Excerpt from page 4



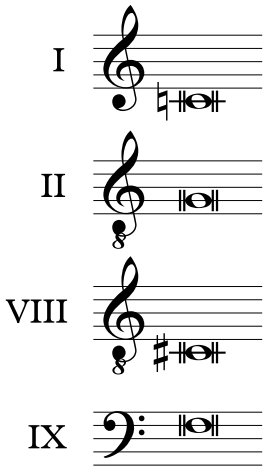
Example 71. Excerpt from page 8



Example 72. Excerpt from page 9

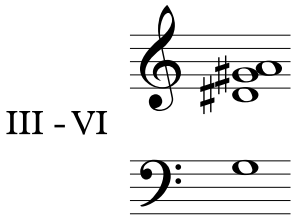


Example 73. Excerpt from page 5

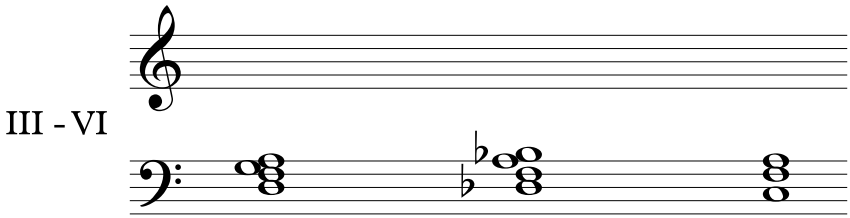


Example 74. Excerpt from page 8

At other points there are simple chords that omit pitches required for triads or tetrachords, no different than such chords in a triadic system, seen in examples 75 and 76.



Example 75. Excerpt from page 5



Example 76. Excerpt from page 8

Beyond this there might often simply be pitches or

intervals—sounds that have not been pushed around or forced into positions, as in the case of the forced triadic harmony or third/fourth mass, which are sounds that are constructed for their effects. These, peppered throughout the score in an almost nondescript manner, are not singular units in the case of the harmony expressed here, but instead are part of a larger texture in which they add a slight shade, nothing more.

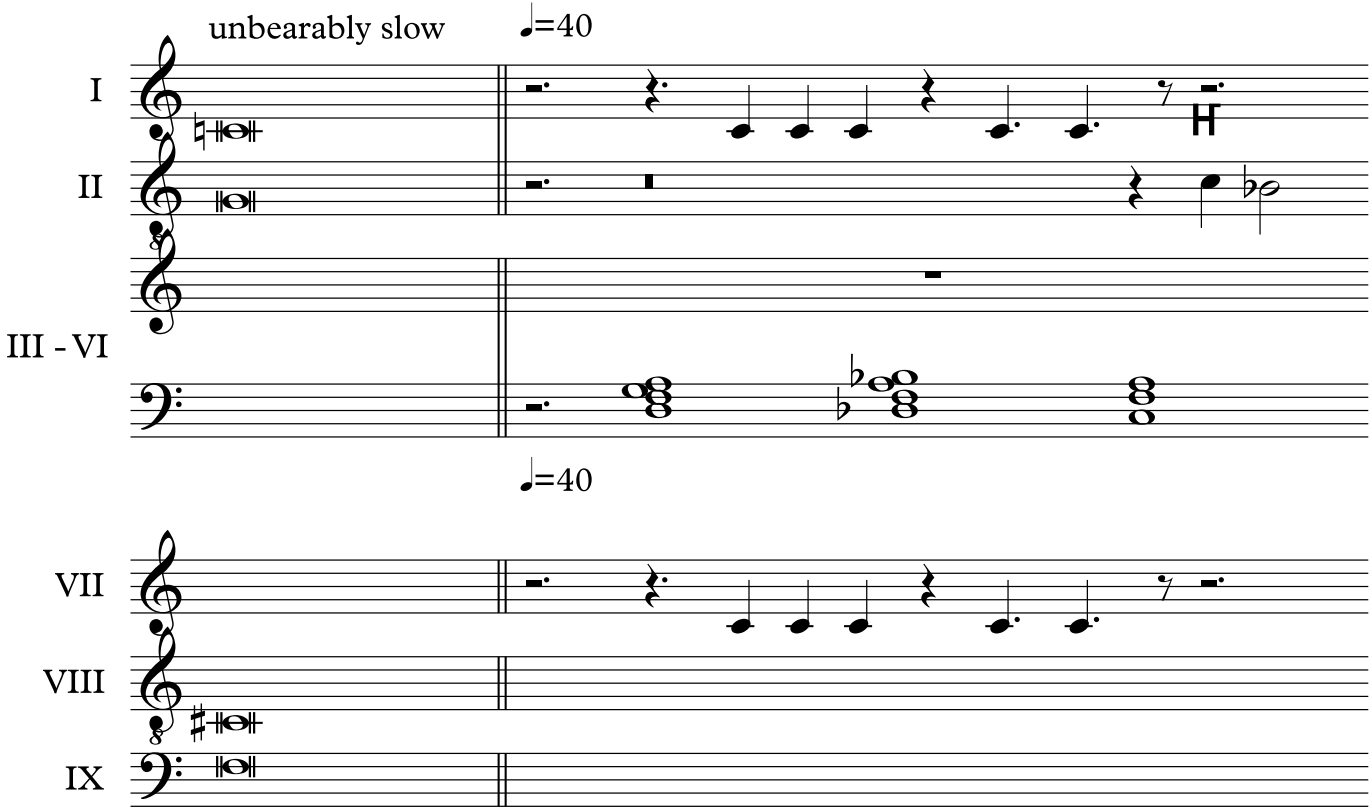
If it is not clear, what is being expressed as "functional" harmony is more or less "natural" harmony; that being structures derived from natural tetrachordal forms, whether spaced or clustered, always related to the species they exist within. Function, when one is not discussing it in the terms of the "functional harmony" of tonal theory, is determined by relationship to the structure. Thus, tonal harmony is indeed functional: it is defined by the triad, the very unit that creates the structure; equivalently, tetrachordal harmony[1] is functional as it is defined by the very structure itself. Likewise, non-functional structures in tonal theory are those that are not merely "outside" the scale, but those not naturally apparent in a triad; e.g. the very nature of a sus chord. They are, at the roots, unnatural; thus, adding pitches for desired effects is treated as artifice. A non-functional state is nothing more than one that the sounds would not organize themselves into—this natural gravity being the structure—unless otherwise pushed into those roles. For example, a particularly dirty trick is played on the listener on page 8 (example 77).

A third/fourth mass prepares the ears for what appears to be a tonal turn in the music. Prior to this section, much of the harmony is filled with widely spaced harmonies, e.g. open octaves with seconds; thus, the following section, comprised of a three note chromatic descent, *d-d♭-c*, consists of a lush, descending third progression: a *D* minor add 4, a first inversion *B♭* minor seventh, and a second inversion *F* major. This itself is actually a hidden octave species modulation: the first chord is the central tetrachord

of the overlapping species (example 63), the second chord shifts the top up pitches up according to the next species, and the final chord is firmly within the new species; furthermore, the descending chromatic line outlines the modulation according to a pivot pitch found in both species, *d*, to *d♭-c*, the bottom tetrachord of the new species *c'-c*. Thus, what appears as a natural tonal progression is in fact artifice, a well camouflaged modulation according to parameters beyond simply traveling along consonant pitches in a line.

Beyond the harmony alone, there is this sense of a strong fluidity to the dichotomy of line and harmony: the line is often harmony, and the harmony often consists of lines. With that in mind, it is of importance to discuss the basics of the line in practice. A line is defined by a mese or any sort of point of polarity. These are often marked hauptstimme for clarity or will exist as a set of neumes; however, simply because a point is a line, such as in that case of a set of neumes, does not mean that their role is purely melodic; for example, nebenstimme lines only exist within the context of hauptstimme, and are nothing more than lines written for the harmonic effect of being more prominent than the harmony itself. In this situation, it is not dynamics or structural roles that define a harmony; instead, a line without a clear mese, that mese being the primary mese—or rather, the mese of the active species—is relegated to harmonic functions, because it is often a series of pitches without any coherent relationship to one another, and a series of pitches cannot be considered a true melody without coherent relationships. Thus, in their aimless nature, they, and their results, are highly circumstantial.

This aspect of this composition, which, in all honesty, stems from my own personal artifice, is important to discuss. If one refers to the series of modulations in Example 63 again, one will note that there are five sets, but only four active species: the first *c'-c*, *g♯'-a♯*, *d'-A*, and the second *c'-c*. The aggregate that the first *c'-c*



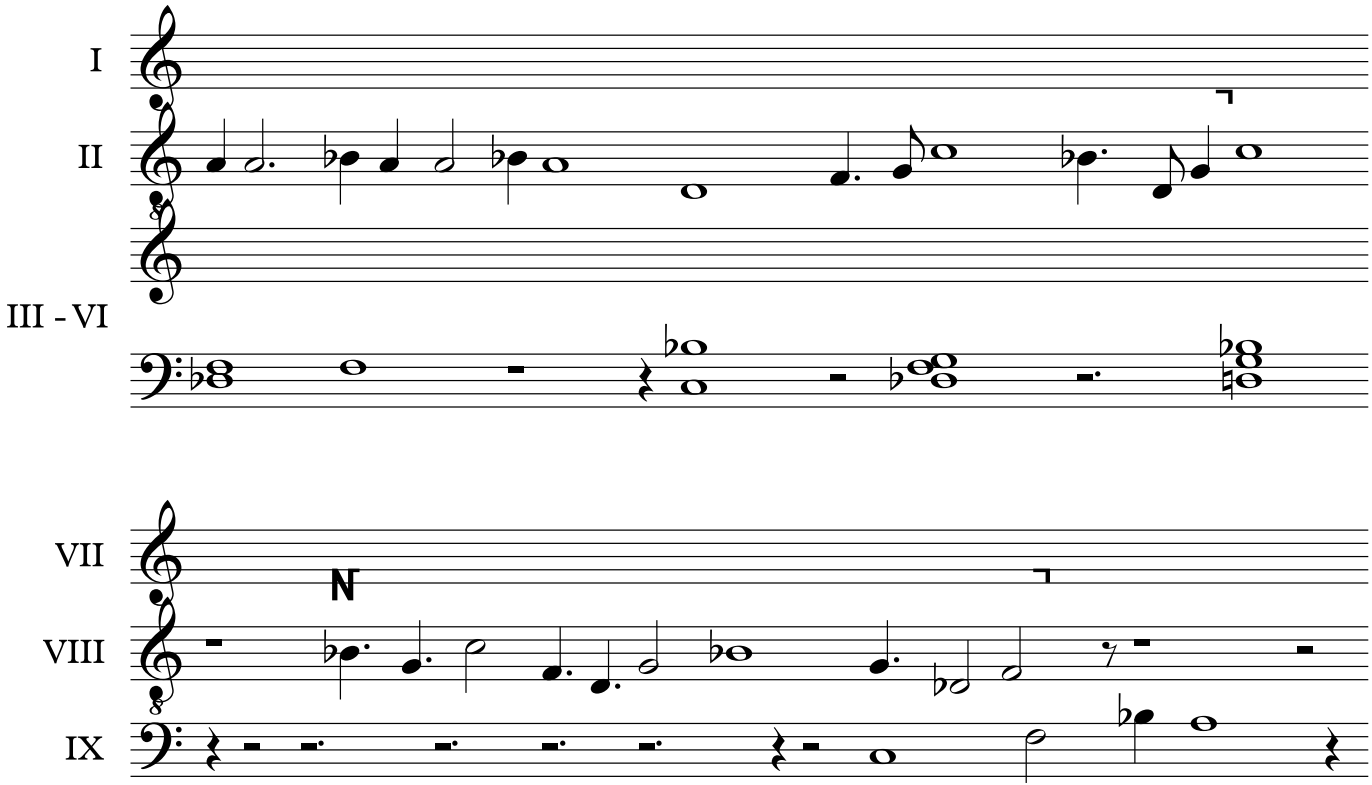
Example 77. Page 8

is embedded within has been left out for good reason: I use it simply for coloristic effect, as it allows me to span the range of every voice, an example being page 9 (example 78).

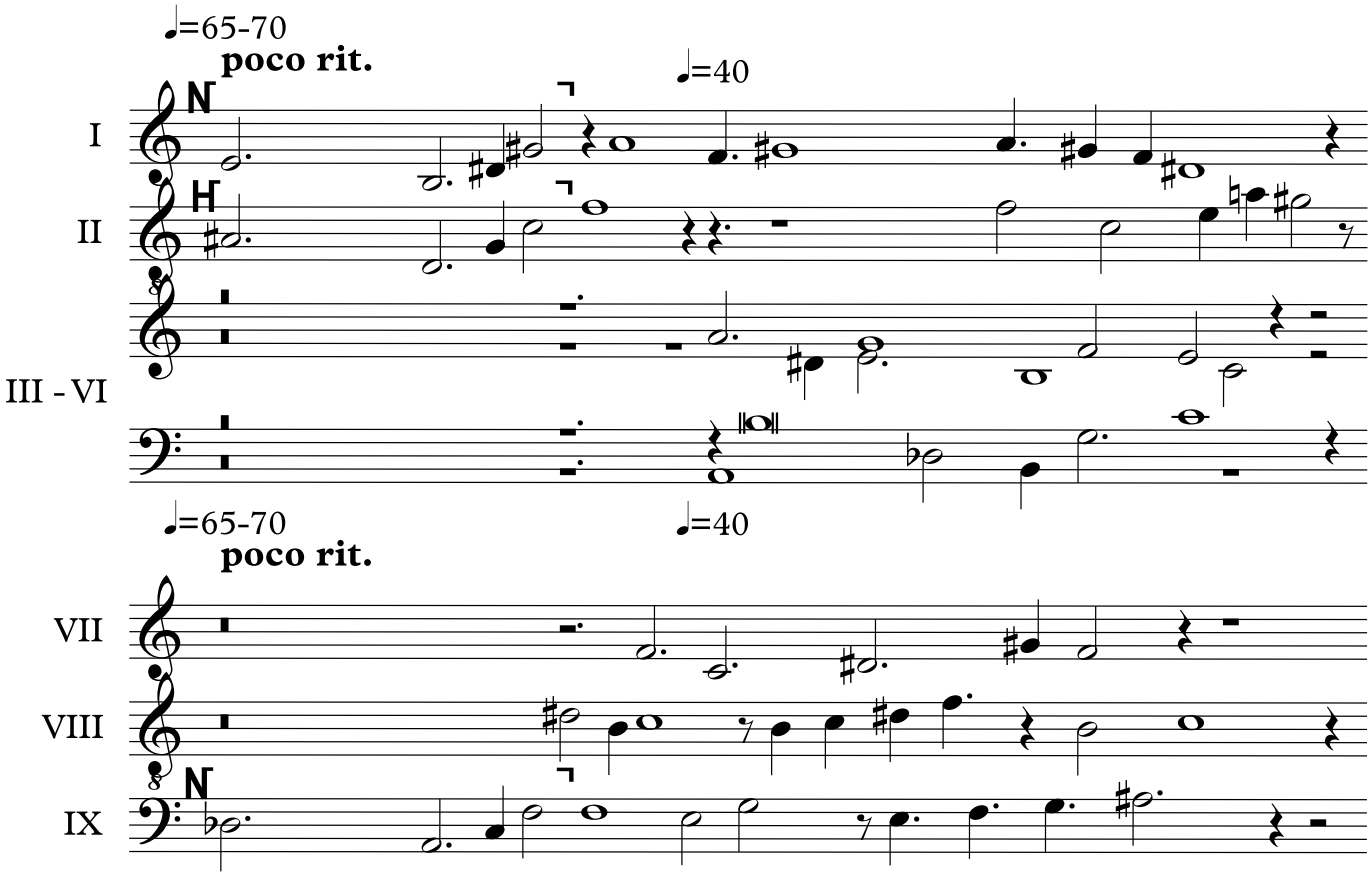
This page makes use of the second *c'-c* set, and the comparison of it to page 1 (example 79) makes the choice of a more ascetic texture clearer: there are simply less pitches to work with in the context of this species, whereas the full aggregate allows for more. Yet, the aggregate is not a species, it is a spectrum a species exists within, which gives rise to other species; thus, even without a hauptstimme marker, only one type of line according to one mese, either thetic or dynamic, is truly a line, everything else should simply be understood as harmony, no matter its motivic relationship or similar contour.

This might appear obtuse, and might border on the crime of an inaudible structure, but whether or not something is important is for the composer, not the listener, to decide, unlike in tonality where the composer decides nothing, as tonal functionality and the listener's perception of its movement is the arbiter of what is important.

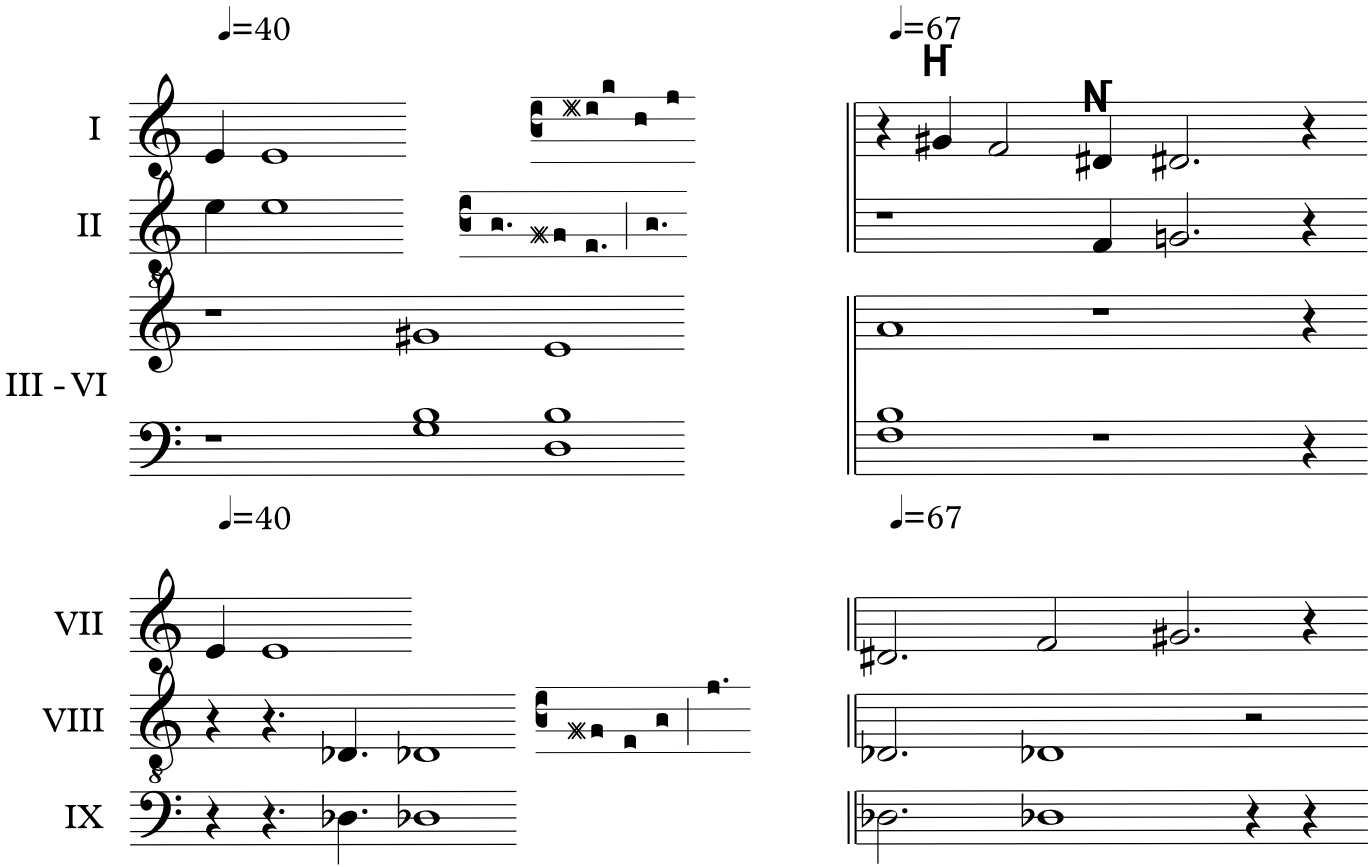
Moving forward, let us take a look at pages 1 and 3 (examples 79 & 80). The line is defined clearly by hauptstimme, not simply because it is important motivically, but because it is defined by a mese. Voice II, as the generative statement, is built around the dynamic mese of the first octave species, *f*. Voices I and IX, as nebenstimme, exist for a certain harmonic effect, thus follow in different registers along the aggregate the primary octave species exists within, all around their own dynamic mese,[2] but, as it is not the primary mese of the hauptstimme, they are not proper lines, simply harmonic color. After this two choices are made: first, every pitch not defined at the voice is an amalgamation of freely placed pitches within each voice, decided separately so that the harmonic result is not a parameter; second, never again on this page does the line of a descending fourth, ascending third,



Example 78. Page 9



Example 79. Page 1



Example 80. Except from Page 3

ascending fourth appear again with the exception of Voice II echoing its initial line in a higher species, which, because it is outside the active species, exists purely for harmonic effect, as well as confirming the trait of the statement as defining everything that follows either in its range or in its contour.

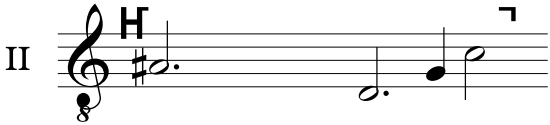
Here the harmonies fall upon one another in a very simple manner; they are static and are mostly comprised of intuitively, if not randomly, placed pitches. However, what follows is another form of line, less prominent than that defined by hauptstimme or nebenstimme; for, unlike those types of lines, these are not stressed. Instead, they possess the same dynamic profile as a harmony, but consist of pure line built around a mese: the topmost is built around *d♯'*, and the remaining around *a♯*. Though the brevity of the lines masks the intention, in this specific context it is the notation that, as hauptstimme or nebenstimme, defines the content. The transition, as the one from line to harmony, is fluid, as if there is no difference between these mutually exclusive sections of material.

This fluidity, of course, only applies to music in which the presence of harmony and line is intentional—that is, there is a strictly polyphonic or non-polyphonic element, as seen in the grand staff of III-VI. Monophonic and polyphonic music might only exist as line, and, likewise, chordal music might only exist as harmony, and there can be mutually exclusive sections of music, as can be seen in sections of chords, entirely harmony, and, in sections of neumes, often entirely line.

Line as growth

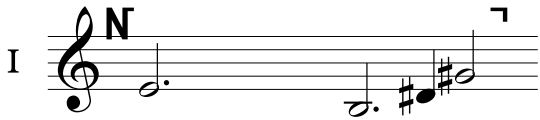
As already understood, a line is built according to a mese, otherwise it is nothing more than harmony. Therefore, it is without question that the most important aspect of a piece of music, the initial statement, is always built according to a mese.

When we view the statement, already known as Voice II, we see a simple structure built to provide a range, as in the analysis of the fragments:



Example 81. Excerpt from page 1

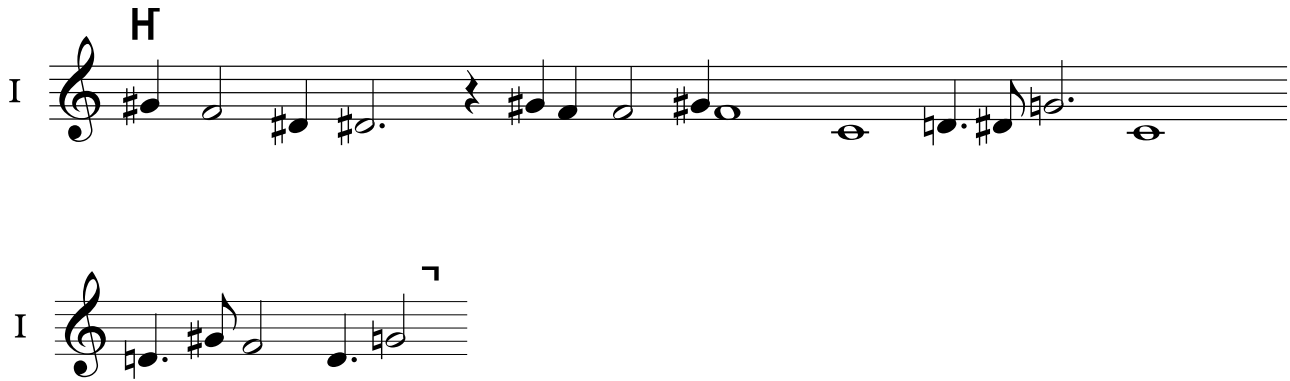
However, its elaboration does not appear in the same voice, but actually appears in Voice I, which, though not a line, in copying the statement, creates a space in which the elaboration (example 82) can operate according to the second active species *g♯'-a♯*, this space being within six intervals from the top pitch of the species; thus, in *c'-c*, the species of the statement, it is *c'-d*, in *g♯'-a♯*, the species of the elaboration, it is *g♯'-c'*.



Example 82. Excerpt from page 1

The elaboration, as the result of the statement, is also built according to a mese, which in this situation is the dynamic mese of the species, *d♯'*. Yet, more important than the elaboration itself is the role of the other voices that occur simultaneously. In addition to the rule of the mese as defining a line versus harmony, following the statement, any series of pitches that also ignores its ambitus is clearly harmonic, as if there is a line following a statement, it always exists within the space designated by the statement. Thus, there are very few sections in which there is a true elaboration.

This might bring up the question: where does the statement belong, and furthermore, where does the elaboration develop? In

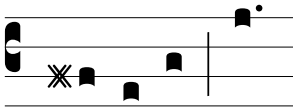


Example 83. Excerpt from pages 3-4

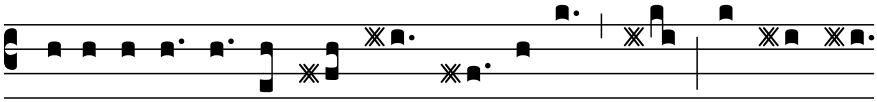
the practice of this piece, the ideal place for the statement is the same as in a fragment: the initial motive. Yet, unlike a fragment in a long form, polyphonic piece of music, the elaboration might not follow immediately. In contrast to a single melodic line, there is no need to either write a pitch or otherwise have to deal with silence; thus, one can forgo the elaboration for pure harmony as done so on page 1, and therefore the elaboration does not truly develop until pages 3-4. It is all about whether or not the elaboration appearing immediately or later is more effective in the structural concerns of the music.

Concerning the space and content of the elaboration, as understood in the fragment studies, development is carried out in two manners: elaboration within the space defined by the statement, and moments of motivic repetition, exact or varied, within the elaboration. Within the piece there are four types of motives, repeated either within a line or the harmonic field: based on statement, based on elaboration, based on new motives, and based on the nebenstimme.

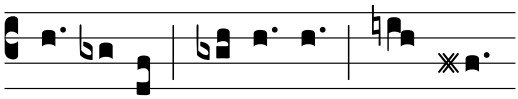
As the statement is the most important generative body in the work, it is best to begin with looking at the motives based on its upward curve. All motives developed from this pattern (examples 84-89) follow the same reflective contour, like light bouncing from a surface.



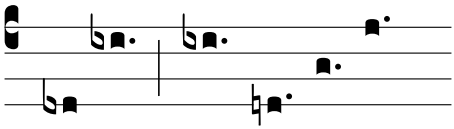
Example 84. Excerpt from page 3



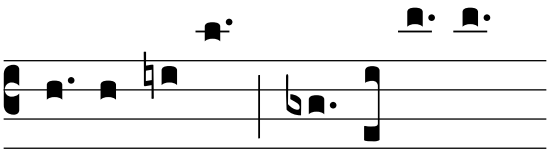
Example 85. Excerpt from page 5



Example 86. Excerpt from page 10



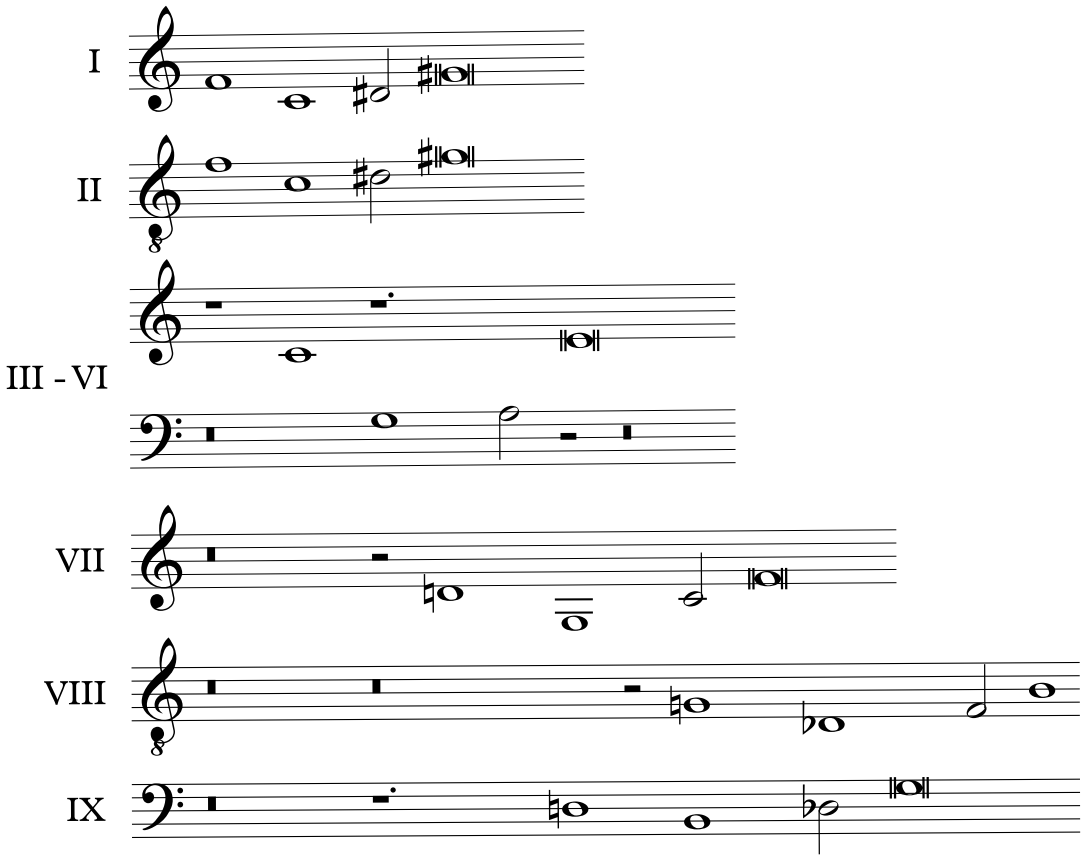
Example 87. Excerpt from page 10



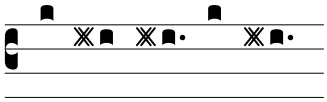
Example 88. Excerpt from page 11

Note that each of these is never exactly the same as the original motive, never being direct repetition, but instead are equivalent permutations, always being slung upwards from the lowest point and the final pitch always being a higher, if not the same, pitch as the first in the pattern; thus, some intervals are smaller and some are much larger. Increasingly, the average listener generally has no musical knowledge, and expecting them to notice exact intervals is unnecessary; however, what the listener lacks in musical knowledge they possess in the innate ability to notice patterns, and would most likely assume, if hearing two similar, but not equivalent, lines that they were related to one another in some manner.

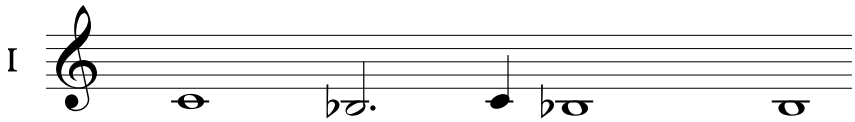
Next, let us turn to the series of motives based on elaboration, though these motives are not based on the elaboration as a whole, but of a small five note motive that appears midway through (examples 90-93,96).



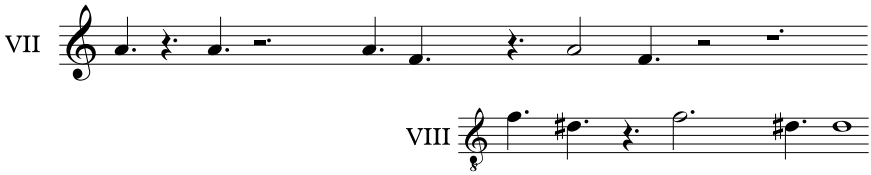
Example 89. Excerpt from page 15



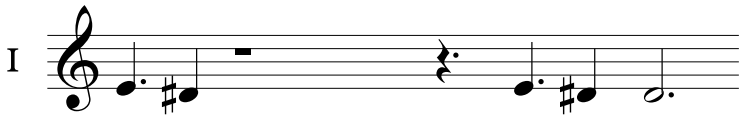
Example 90. Excerpt from page 5



Example 91. Excerpt from page 10



Example 92. Excerpt from page 11

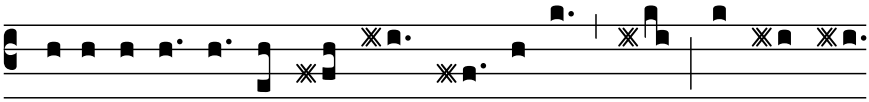


Example 93. Excerpt from page 13

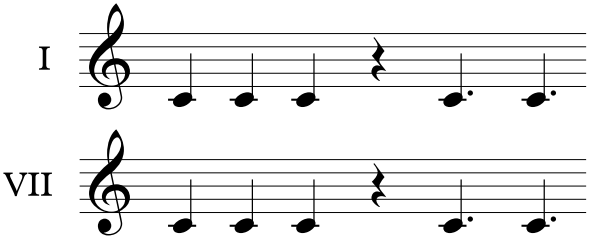
These, as the first pattern, generally follow the same amount of pitches, a two plus three or three plus two phrase, with the difference not being intervallic contour, but instead the rhythmic unit of each pitch. It originally appears in Example 90 as short-short-long-short-longer, but in some instances it appears as a long-short pattern (examples 91 & 93). The effect is the same either way, the listener should hear the repeating values in a certain pattern and realize that relation to the elaboration. Example 94 is interesting in that there are voices in which the exact pattern is cut, and voice IX echoes the missing pitches in voices III-VI.

Simply because the fragments reveal a simple statement-elaboration form does not mean that there cannot be two elaborations, and thus, more motives. On page 5 (example 94) a

new motive of repeating *c'* five times appears (also note that both the statement and elaboration motives follow it).



Example 94. Excerpt from page 5

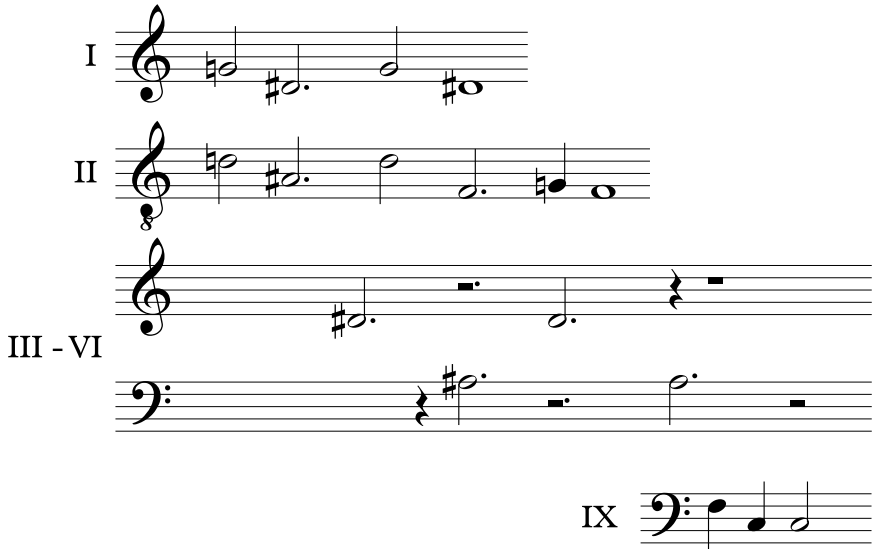


Example 95. Excerpt from page 15

It appears once more in an exact repetition in example 95, but other than that it is a small occasion, of lesser importance than the other motives. Of course, this is important in itself as an expression of an idea from the analysis of the fragments:

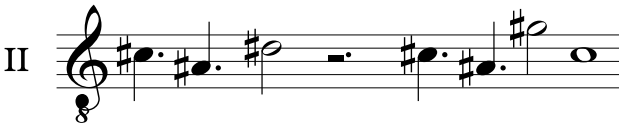
> Thus, a line is not defined in the moment; that is, we believe we can judge a line in a present form, but we really cannot, because it has no context; instead, the fruit of the line, as it ripens, alters the perception of the line; our memory of the line in the past, consciously or otherwise, is altered as each pitch has some relationship to another, as it has been placed there for that purpose.

Last, the nebenstimme, though it appears briefly in only two instances, possesses its own contour that appears each time a line is designated. Though the contour itself is vaguely similar to that of the statement—the second pattern in example 98 being the

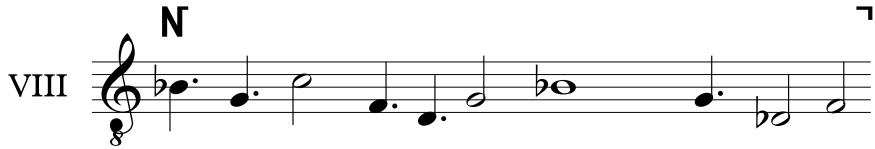


Example 96. Excerpt from page 15

closest—the pattern is not exact enough, as the third pitch should not be placed higher than the first if it truly was.



Example 97. Excerpt from page 4



Example 98. Excerpt from page 9

The final aspect of the construction of the line is the cessation, significant as small as it might be. As developed in the fragment analysis, a cessation pattern is entirely derived from something of motivic significance, whether it is the whole of the statement or

nothing more than half of it. This piece makes use of an extended, essentially double, cessation; first, the initial statement is repeated in several indirect imitations, and the elaboration motive appears a handful of times. Yet by page 16 (example 100), the music does not end until a second cessation takes place, this one being the five note elaboration motive.

Of course, the cessation is not treated as a line, but as an amalgamation of many transpositions of the motives to create a constantly growing harmonic field that finally gives way to the mese of voice IX's final cessation motive, *d♭*. The final act of cessation is given to something that has been planted into the mind of the listener, but is not the obvious ending otherwise expected, which might have been the series of imitations of the statement; instead, just as in Bellermann's Instrumental Piece (example 45), the cessation pattern is unexpected.

Concerning the manner in which the motives appear and develop, the music, in some sense, writes itself. This is not to say that it is determined by the role of the mese as gravity, but instead that, just as when one improvises a piece of music, at some point one no longer thinks of what has come or what will come, instead it merely happens. It is not something as simple as being focused on the present, but instead that at some point in time the statement and its elaboration become ingrained within the music itself, as, again, according to the statement-development structure, what comes after defines what came before.

Modulation as contrast

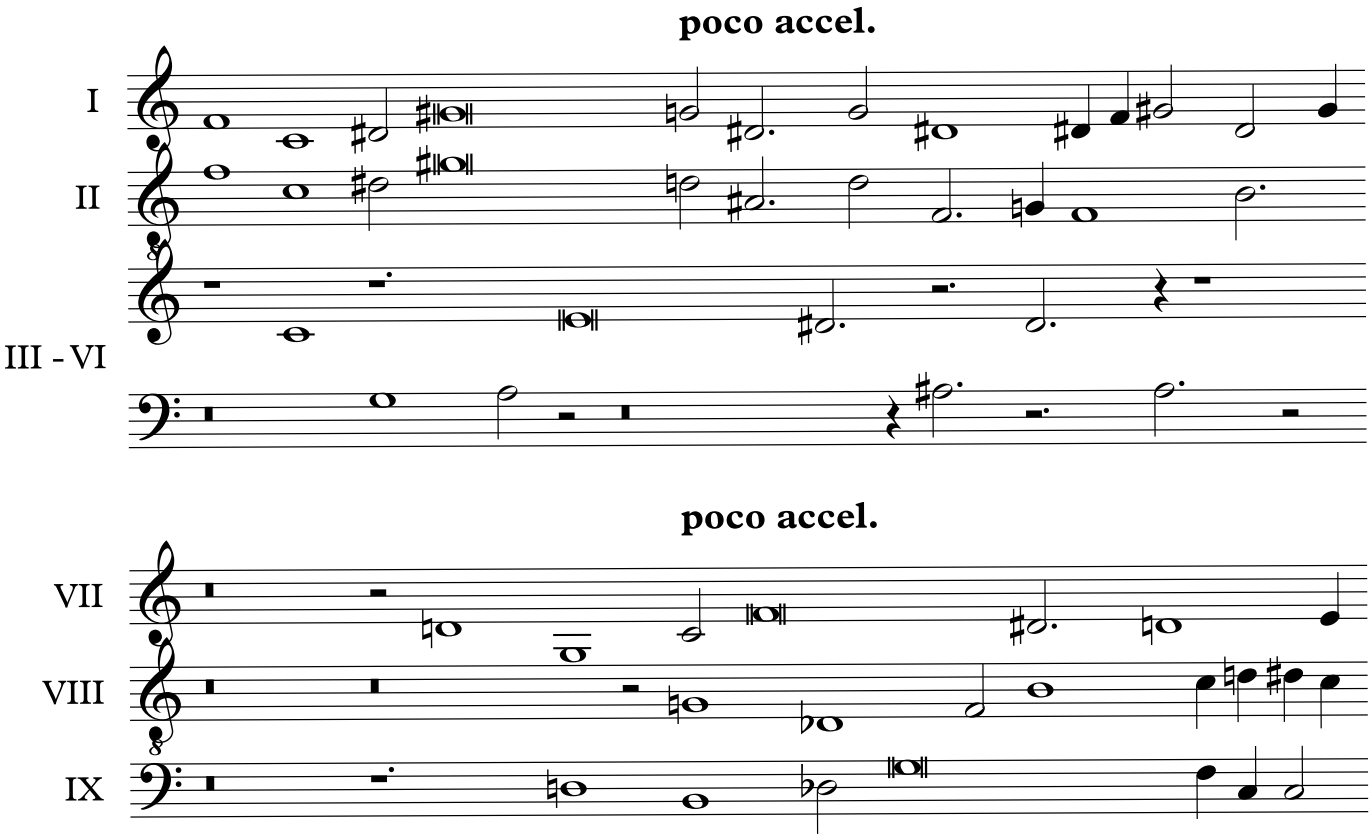
Perhaps what is more important in this study are the effects imparted upon the line, derived through the series of modulations, and how the difference of shade alters the harmony, as no previous studies properly applied this to the specific method of melodic composition according to the fragment analysis.

Certainly, we have noticed aspects of modulatory contrast in single lines, and in a polyphonic setting we have seen how the harmonic consequences between different structures in freely composed fantasies; yet, how are we to know for sure how it affects the totality of the work, that being themes, motives, and all their unifying factors?

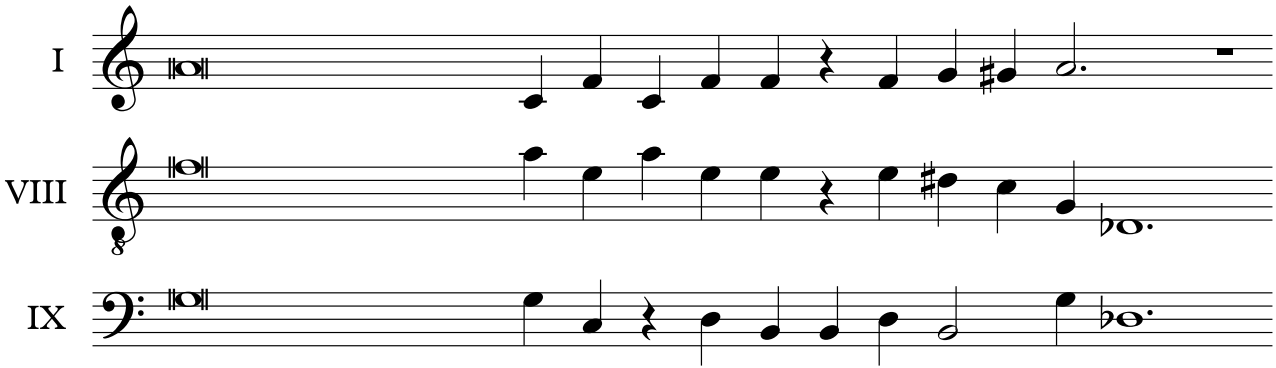
Modulation, in how it alters the shade of a line, is a response to the problem of harmony posed by James Tenney, who posits it as the only parameter not developed in musical history due to the ever stagnanting nature of harmonic function in twelve tone equal temperament since the early 20th century. In his notes on *Diapason* (1996), Tenney expresses:

> I would now suggest that the aesthetic revolution wrought by John Cage in 1951 is absolutely essential to any truly progressive evolution of harmony, because without its decisive shift of focus from the thoughts and feelings of the composer... to the immediate auditory experience of the listener... the future of music would remain mired in the past.[3]

Modulation applies our knowledge of the two shades: the specific temperament and the effect of the contour of a line. The former is intrinsic to the latter, as without the concept of temperament there can be no shade whatsoever because each note is an equal value, and thus when one modulates it is similar to tonality in which the music retains equivalency despite the different key. In contrast, with shade this manner is not absolute; rather, the freedom of an indeterminate temperament allows for each performance to express the harmonic field as a relationship between many shades. A set tuning turns the music into an object that is, as Toru Takemitsu once described western music,



Example 99. Page 15



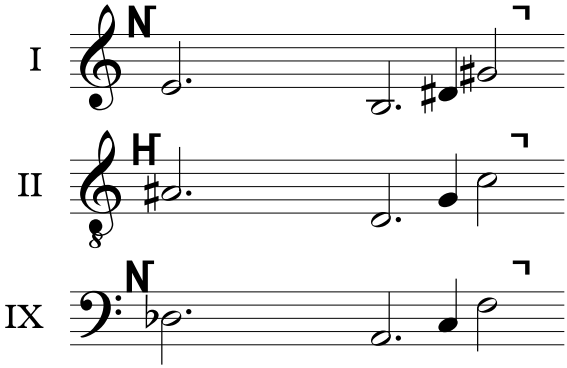
Example 100. Excerpt from page 16

"portable;" one can travel to any country—even any musical culture—and hear Beethoven's "Eroica" without any notable difference, as the shade of its lines and harmonies are objects that ensure equivalency wherever one goes.

Therefore, when Tenney uses the notion of the "thoughts and feelings of the composer" he means that in a tonal framework the composer has a set of tools that allows him to shape harmony in the manner that he needs it, knowing that the sentiment is granted universality through tuning. The series of chords in example 77, in tonality, are defined by their uses: their roots, whether or not they omit triadic pitches, whether they make use of added pitches, major or minor functionality, dominant functionality, the order in which they are placed, etc. In summation, they are found objects that can be placed properly to elicit emotion; furthermore, to otherwise ignore the standard use of tools and build according to one's own fancy leads to extended tonality, but at the end the structure is still familiar. Yet, when outside the twelve tone equal temperament, where the chord loses its functionality, even though it might still follow an order or logical path deduced by some manner of voice leading, it is no longer an object that can be placed, but is instead is some ephemeral sound that can only exist in that time and place, in that exact moment according to that exact temperament, and it expresses the "the immediate auditory experience of the listener;" therefore, the initial discussion of the aggregate as a series of pitch positions, not as definite steps, allows for an inherently open structure in which there are no defined scale degrees or any other pitch relationships, nothing more than the numbering of the pitches in an otherwise unspecified tetrachordal structure.

Modulatory development, as understood, acts in the opposite manner than that of line; whereas the development of line is built around self-similarity, all responses being the same pattern no matter how different they are, modulation is always developed as

different, as should already be understood in the discussions on how the octave species modulates. When one accounts for the differences between the statement and its transpositions, though the contour is equivalent, the actual sounds are unrelated.



Example 101. Excerpt from page 1

Likewise, if one compares the statement to its development, the contour remains the same, yet the sounds are new. Because the desired tuning itself is not equal tempered and is enharmonic, no pitch possesses equivalency to one another despite the contour, and each result is without question a different entity in the implicit harmony of the line and the explicit harmony of the harmonic texture. Thus, the variance of shade in the line is the form of contrast denied by the nature of self-similar lines. Modulation creates a sense of difference in this music that is otherwise a series of continual re-utterances of the same set of lines, following the same series of events, in the same order each time.

And, just as modulation plays no role in changing the contour of a line in any motivic form, it also plays no role on the contour of the ambitus. Compare example 83, the elaboration from pages 3-4, to the modulated form on pages 8-9 (example 103).

The line shifts along the species 1:1, the same distance, simply placed in the context of a new species. Nothing in the elaboration

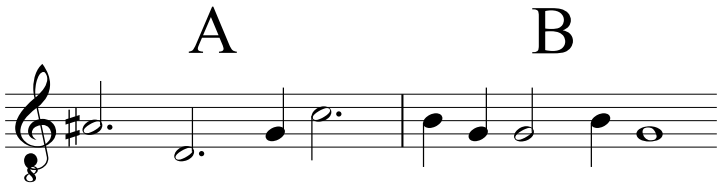
changes, it is exactly the same in content and rhythm, yet it is new, something not yet experienced, because the shade the octave species provides is new. We experience something familiar from such a different perspective that we cannot necessarily call it the same line as the one it receives its shape from.

Likewise, one can compare the statements from page 1 (example 79) to page 15 (example 99), and take note that each, shifting along the aggregate, possesses a unique sound. They are all related, but instead of timbre being the difference in texture, the shade itself defines it.

Of course, it is important to admit that timbre no longer plays a role in the conception of the piece of music. It is stated that the instruments should be different, but no longer is timbre and extended technique the defining factor of the musical idea. Instead, in a return to complete and total simplicity we can experience the truth of the natural world in the existence of any and all possible harmonies, as well as the possibility of endless textural differences in a world that otherwise seems static.

Concerning formal conclusions

When one steps away from the endless variations of the statement and its elaboration, one can begin to piece together an idea of how it is formed. If one places these in the context of the initial octave species, one sees, in rough summation, the statement-elaboration form appears as a single line.

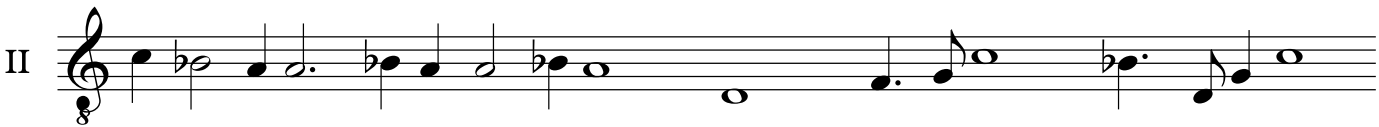


Example 102. The combined statement and elaboration motives

The formal layout then appears as a set of variations and transformations of this AB form, informed by the studies of motivic development in the fragments, but more akin to Schoenberg's notion of developing-variation, in which the entirety of the piece is defined by the initial statement, either through elaboration or development:

> No matter what the purpose or meaning of an idea in the aggregate may be, no matter whether its function be introductory, establishing, varying, preparing, elaborating, deviating, developing, concluding, subdividing, subordinate, or basic, it must be an idea which had to take this place even if it were not to serve for this purpose or meaning or function; and this idea must look in construction and in thematic content as if it were not there to fulfill a structural task. In other words, a transition, a codetta, an elaboration, etc. should not be considered as a thing in its own end. It should not appear at all if it does not develop, modify, intensify, clarify, or throw light or color on the idea of the piece.[4]

Thus, when we view the harmony as a series of lines in amalgamation, as in polyphony, and not some structural entity, as in accompaniment, then one notices that even the harmonic field, despite appearing as a surface, is important in relationship to other harmonic events. Formally, there are macro and micro statements: the statement is supreme in the construction of all line, as everything derives from it; yet, beyond that, the first page itself is a statement as each line might appear again in another form so that which follows always confirms what comes before. There is only one actual development, that being the elaboration,



Example 103. Excerpt from pages 8-9

otherwise everything else is merely that which has been provided before, simply in a new context; thus, formally, the line is not the focal point of development, as it might be in other forms of music, but is static. The development is through the modulation of the species that defines the context in which the line appears within the harmonic field.

This allows for us a new paradigm for musical structure, informed by Tenney's own work, in which the development of the line as a formal characteristic, as in the case of sonata form, is non-existent and the form that it takes immediately is its only possible final form so that there is an initial point of reference harmonic transformations. As in *Klangfarbenmelodie*, in which the parameter of interest for the listener should shift from the line to timbre and color, the parameter of interest should be the variation and development of the harmonic landscape alone. In this work the line is merely provided as a point of reference for the listener to appreciate variation of shade.

In conclusion, the final results, though overly conservative and pedagogical in their construction after the fragment analysis, should speak for the actual musical content inherent within the structural language more so than the act of construction, which merely allows for it to take place—in fact, it is simply the fact this this manner of stratification is effective that I chose to exemplify it—however, I should express once again that this is not a template, but rather an extreme example to express the innate qualities created by applying as many possible tools to the construction of a work. The only framework one possesses is the tetrachord and its expansions; the manner in which the music is given form, whether it is conservative or radical, is not of our concern.

Notes

1. It would be a mistake to classify it as "quartal," a tonal term, because the tetrachord as we know it is not simply stacking fourths; it is just as much a second, a fifth, and an octave as it is anything else. In tonality these might be the circumstances of stacking fourths, in a tetrachord they are the basis of all things.
2. It is of note that though in the ancient greek fragments the mese is stressed, I prefer to leave the mese as a point of gravity that the line implies for the subtlety that appeals to my own taste.
3. Polansky 395-396
4. Schoenberg 63-64

Afterward

The path forward and the requirements of the coming musical practice

If the reader has managed to accept my propositions so far, then it is my hope that they have been willing to suspend their disbelief and notions of what is "right" according to the conditions in which their ear has become accustomed to: the result of the indoctrination of the equal tempered system as the only effective, practical, and thus, valid form of musical composition and expression. Therefore, I hope that the preceding arguments ultimately are of value not in creating a rigid method of composition—though it should be said that if one does follow the methods that we have put in place their music cannot be considered "incorrect" by any formal standards, as it defines its own axioms and exists according to them—but in blazing another possible path according to the paradigm shift towards a new way of thinking about how to tackle harmony and musical thought beyond equal temperament, and it is my desire to show that an ancient method of pitch organization, and its compositional and modulatory quirks, provides a key to opening a door towards a freer harmonic world that, unlike the problems of early tonality and pre-well temperament, in which the structural foundations of the system rendered some keys as inherently in poor tuning compared to others, is constructed to allow for musical lines to sound coherent, as if they were always designed to sound in that manner.

Though it might be deemed by some as a “step back” because the initial resources were gathered from the ancient world, this method of organizing pitches simply according to a

holarchy—their positions within a system built around a perfect fourth—as opposed to a hierarchy—their relationships within a system built around a perfect fourth—visible in standard tonal and other scalar forms, allows for any possible pitch to exist merely because it is there; thus, its purpose is not defined by the system, it is merely given the space by the system to exist. It is due to this structural attribute that the contour of a line can be altered so that it is not based around its relationship to the tonic-dominant pitches and the gravity produced by its functions, but instead by its position in an abstract space to the mese; consequently, when one modulates in any manner, even if the temperament changes drastically, the contour will always remain stable, as the line will always exist according to its position in the context of the mese and the greater structure. With this factor in mind, the result is that the next step proposed in the development of harmony is not vertical, but instead horizontal, dealing with the unique nature of implicit harmony in the single line of modal music, as the neglect of the single line in favor of the chord has removed from our experience the organic universality of shape and shade in favor of the fabricated universality of functional harmony.

Thus, the incorruptible nature of music molded according the modal forms that we have discovered in our journey means that something such as Bellermann's Instrumental Piece will, no matter the intonation, always sound comprehensible. To follow this example, not that of any other music, regardless of time or culture, ensures that nothing will be lost, because it has been composed in such a manner that the line and its contour are paramount. Furthermore, the very nature of this incorruptibility means that there can be no notion of an optimized temperament, in contrast to the development of tonal music from Zarlino to Werckmeister in the search for the perfect equalized temperament.

It is without question that in a world in which all methods of music making are subsumed into the grey matter of equal

temperament, tonality, and its standardized instruments and tools that this attitude is absolutely necessary. In equal temperament the soundworld is carefully constructed so that there is nothing that the composer does not anticipate, and thus for the performer there is no intonational—and, perhaps, emotional—interpretation possible outside of the composer's intentions; yet, in the world that we have discovered and made our own in this work, symbols are positions that represent any pitch, so that a quarter tone pitch symbol is not explicitly equivalent to an equal tempered quarter tone pitch of 150 cents; thus, there is a world in which there are many possibilities that may shade the line without destroying its contour. In the tradition of experimental music as experiential music, the results are not based upon the composer's intentions, but the experience of the auditory reality, both objective and perceptive.

From this we view the practical realization—and the essential truth on which the thesis hinges—of Tenney's conclusion of Cage's efforts: no more is there the work of the composer as one who twists the emotions of the listener through tools and tricks, but the work of the composer as one who creates a space for the listener to experience the sublime nature of sound in all its shades. In the old tradition prior to Cage, such arguments are impossible: the composer writes *E*♭ and he means a *100 cent* unit; yet, after Cage's revolution the composer's notations are no longer specific, arbitrary units unless specified as *E*♭ + *7.82 cents*. Instead, *E*♭ means nothing other than being a position within the spectrum of *D* to *E*. The dictatorship of abstract notation as opposed to physical sound is overthrown and the interpreter is given the freedom to decide that *100 cents* is arbitrary and insufficient in expressing the nature of sound. This indeterminacy in questioning what notation means, how it should appear on the page, and the sounds that appear is the heritage that Cage has given us, and it is our responsibility to not throw away the gifts of the past, but

follow through with the trajectory of musical thought—especially so as it aligns with the theoretical and musical work of Partch, Harrison, and Tenney.

Yet, aside from the theoretical and abstract results of this revolution, there is the opportunity to recreate the global musical culture so that is not so foursquare without losing a sense of that portability inherent within tonality. Though the work laid out is nothing more than applied structural theory, there are highly aesthetic considerations that are implicit within the work, and in denying any further cerebralisms other than functional structure I am trying to move music away from the conceptual and toward the corporeal; that is, to shift composers from artists—those who create things that we may admire but cannot touch—to craftspeople—those who create things that we live with and make use of.

In my initial response to discovering Partch's life, I made the definitive decision to drop out of academic musical training not simply because I believed equal tempered tonality to be a dead end, but because in him there was, for me, the necessary attitude of handmade music, like that of Cage and Harrison, in which the mind does not simply think in music, but that the body lives in, and becomes a vessel for, music; thus, the use of the mind, the ear, and the hand are equivalent in the fabrication of music as a corporeal entity, whether it be the page or the instrument. Thus, my desire for this manner of living blossomed into a deep relationship with the ideas of John Ruskin and William Morris—and, as these trickle down, Bernard Leach and Soetsu Yanagi—for whom the morality of a handmade art, in connection to the natural world and the natural manner of living, would benefit not the artist, as in some sort of selfish, expressionist modernism that extolls using art to "force the listener to experience the pain of modern life," but instead facilitate the opportunity for us to develop a morally derived artistic

community that finds pleasure in the labor required in making music, not only the sonorous result.

Thus, it is due to these attitudes that I have developed that I would like this work of structural theory to become something much more than a textbook or treatise, and the music created according to these axioms to become much more than intellectual or conceptual exercises, so that music becomes a craft in which the forms and shapes are like that of pottery, wherein the structural aspects are equivalent, but the cultural communities that create it naturally produce results that are unique in comparison, and the manner in which these are made use of is clear, simple, and universal without conforming to an industrialized equal temperament.

In contemporary music, the great crisis is often exclaimed as the lack of an audience, thus a social and cultural irrelevance; yet, the crisis is rather this necessity of the audience, that a passive body filling empty seats in a hall is the reason to create sound, that music somehow serves a purpose for only those people, and that they are the only ones who listen. If this were true, then the only goal of music is entertainment, thus, whoever buys the ticket is there for amusement.

Yet, this notion itself is the crisis in contemporary life, as it transforms music into something that is done for a material end—money, career, status—as opposed to something that exists for the edification of the individual. In opposition to this, the reason for, and the result of, a performance must be as Ruskin deemed the reason for the practice of drawing: *not to draw, but to see*.

Thus, as the reason for performance is the experience of hearing, the user decides how they wish to use it, and it is then not the job of the composer to define how his music shall be used; therefore, the desire of new ways of structuring music should always reflect the need to give the act of music making back to

small communities, so that they are able to not simply make their own, but for them to also have the ability to comprehend, perform, and enjoy whether or not they are highly skilled or amateur musicians. The forms of music that should recieve the highest praise are those that are performed in a strictly communal manner: Christian chant, Gamelan, the Partch Instrumentarium; yet, it is not simply because they are non-exclusionary, but because they, as communual experiences, do not disconnect the individual from the source of music making, as being the audience or a listener of recordings does, but enjoins the individual and their peers in the in the natural act of musicality. The pleasure of music cannot come from passivity, but from activity. Though it might appear to us that in hearing we might be happy, this disconnection is alienating, as opposed to creating, which does not require *hearing*, but *listening* and *feeling*, or knowing first hand.

What we must then begin to see is that music making is not simply a pastime or hobby, but is instead a way of being connected to nature; for, just as looking requires one to open one's eyes, not copy blindly, listening requires one to attune one's ears, not simply perform what is on the page mechanically. Song in nature is thus a paradoxical dichotomy: singing and listening, giving and receiving, labor and pleasure.

If these values are proven valid, then in time there can be a true experience of music without any exclusivity: no recordings, no traveling virtuosi, and no requirement of direct communication with other communities and their cultural practices; there can be, without question, an experience of music as something other than art or entertainment, but instead as a truly visceral, corporeal force; thus, to invoke Ruskin: I would rather we create music for the sake of listening, rather than listening for the sake of creating music.

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Appendix of Selected Scores

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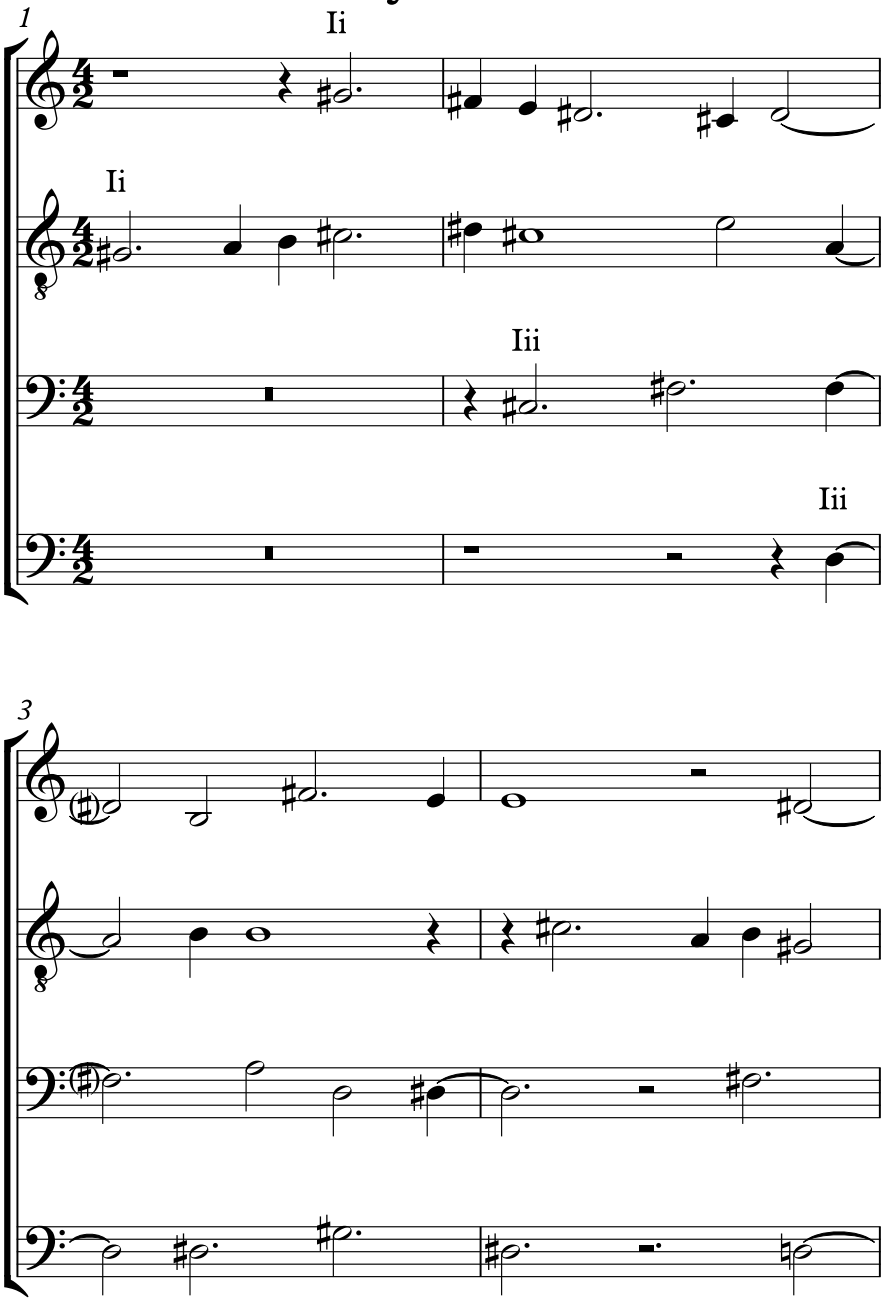

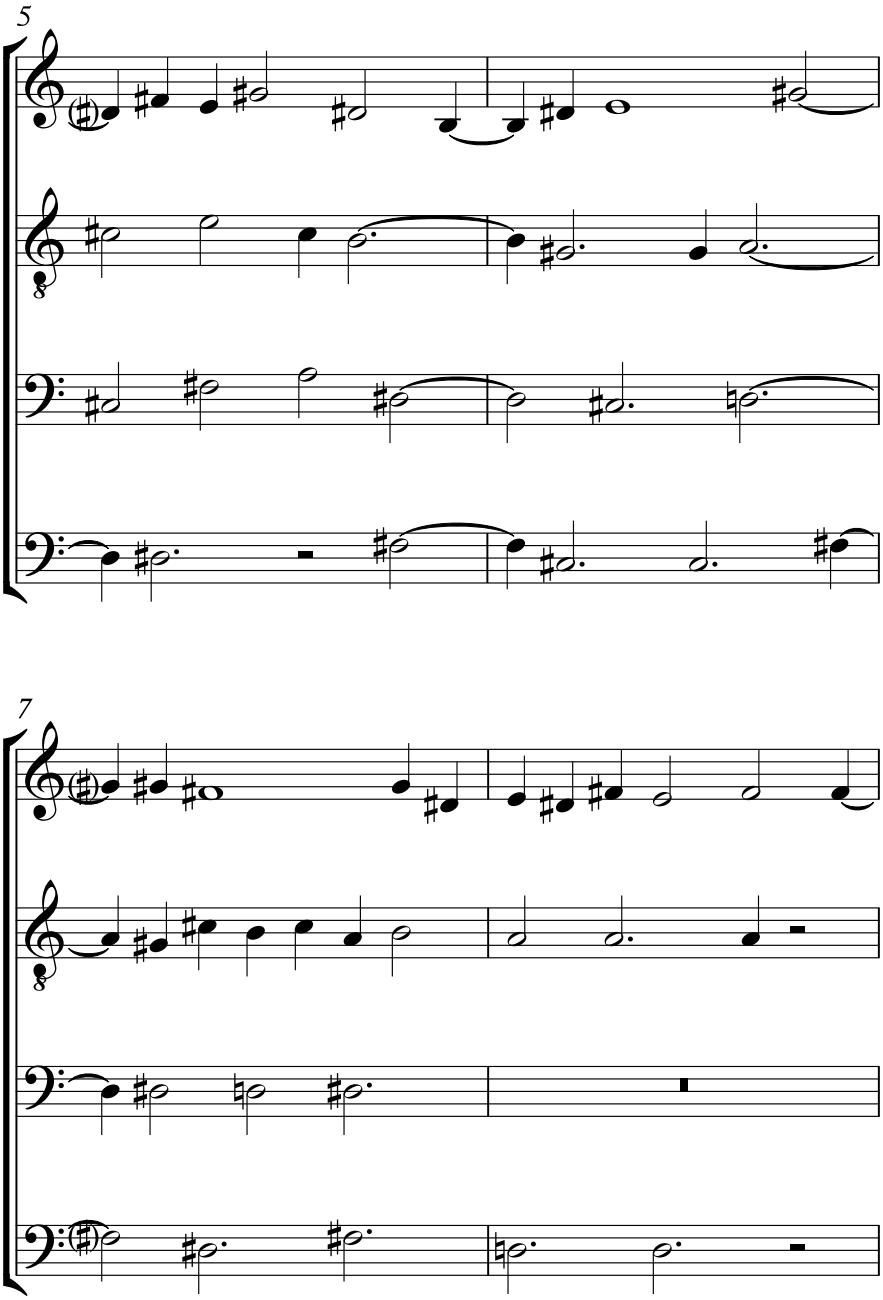
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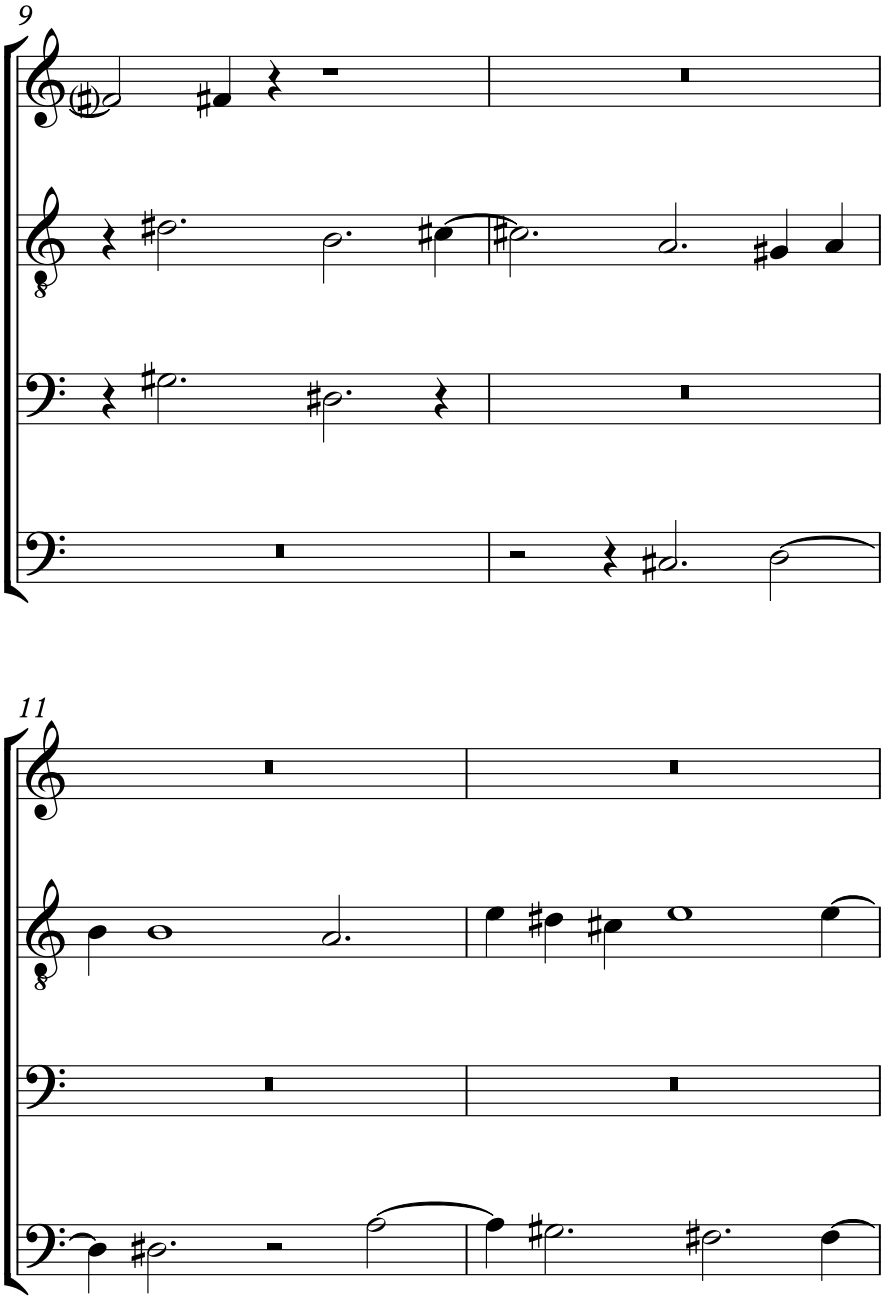
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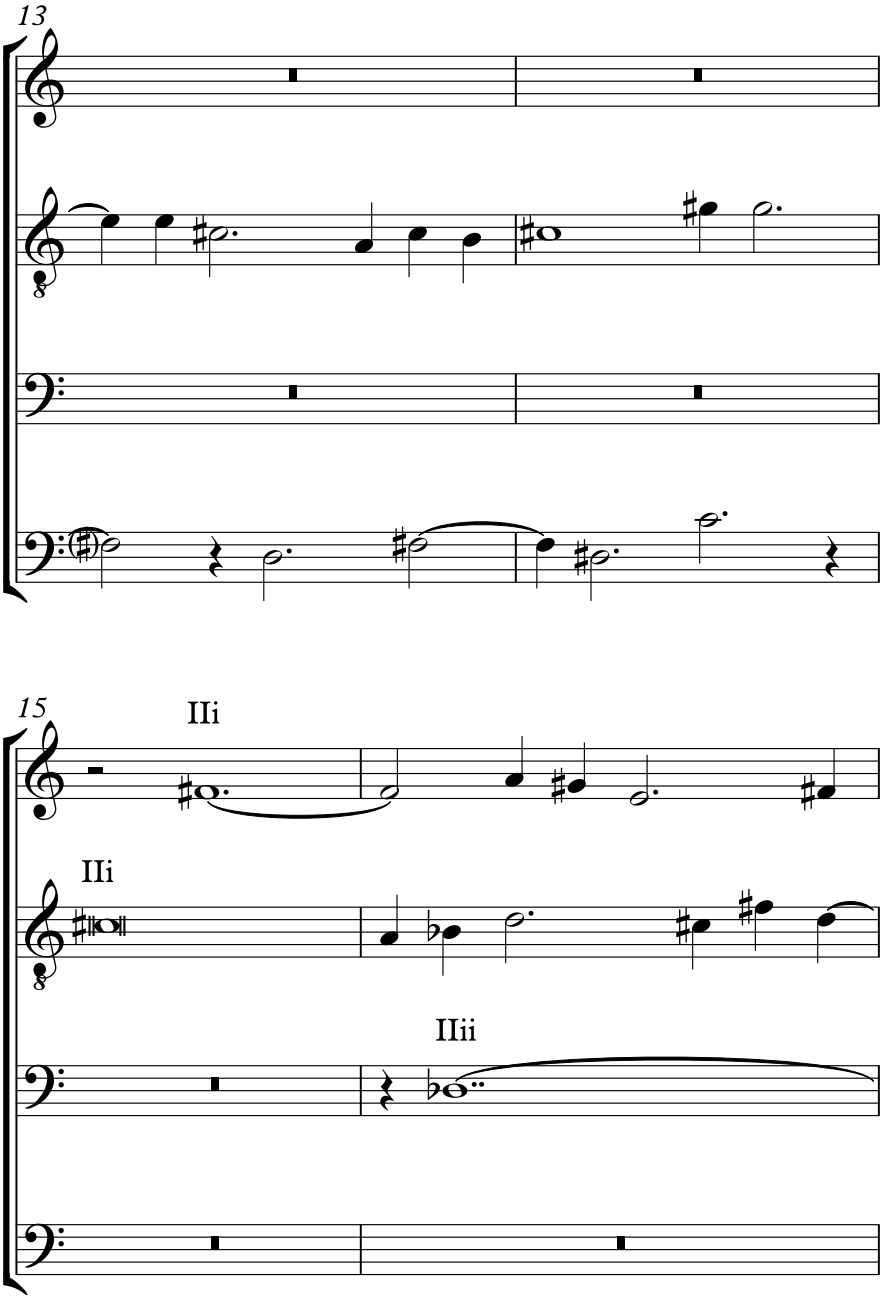
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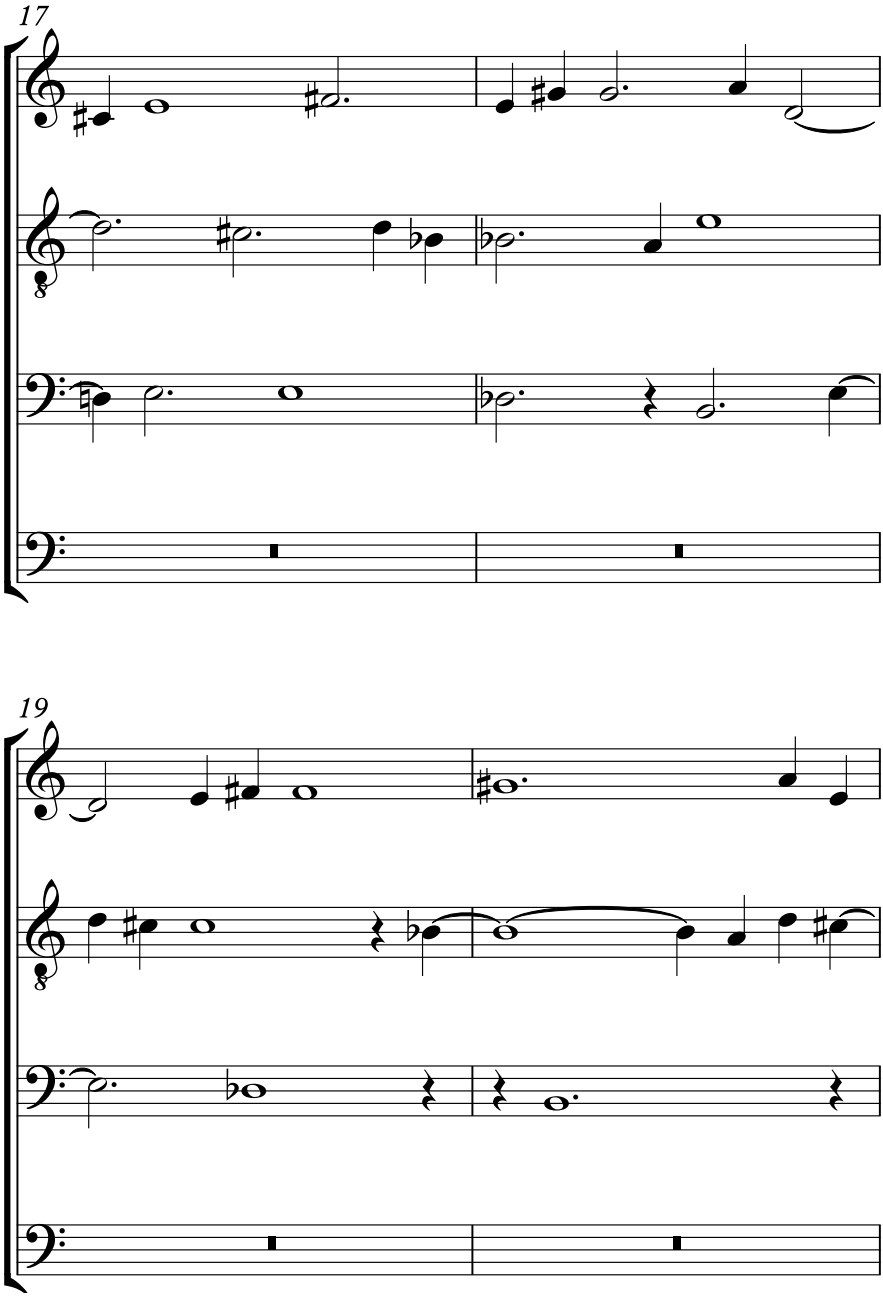
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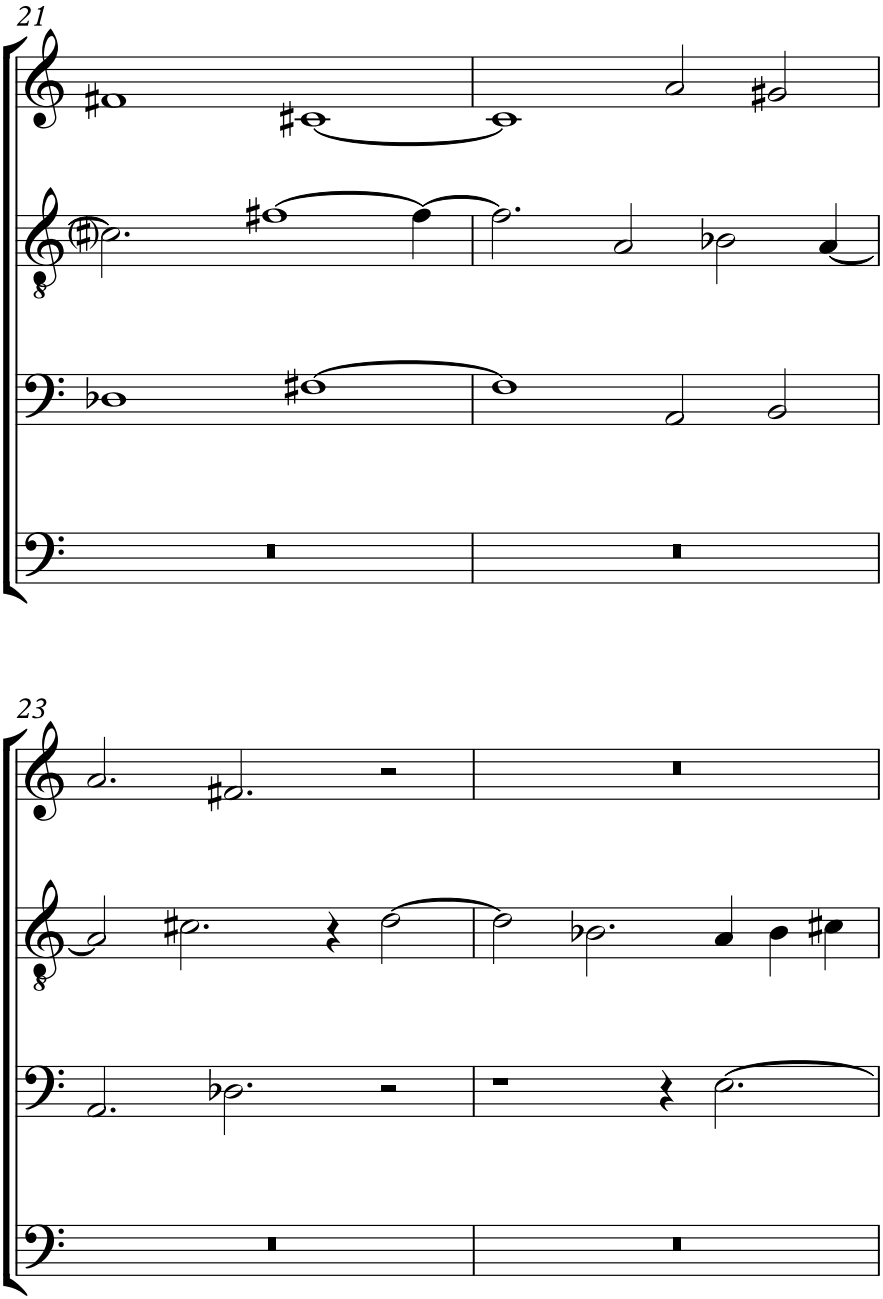
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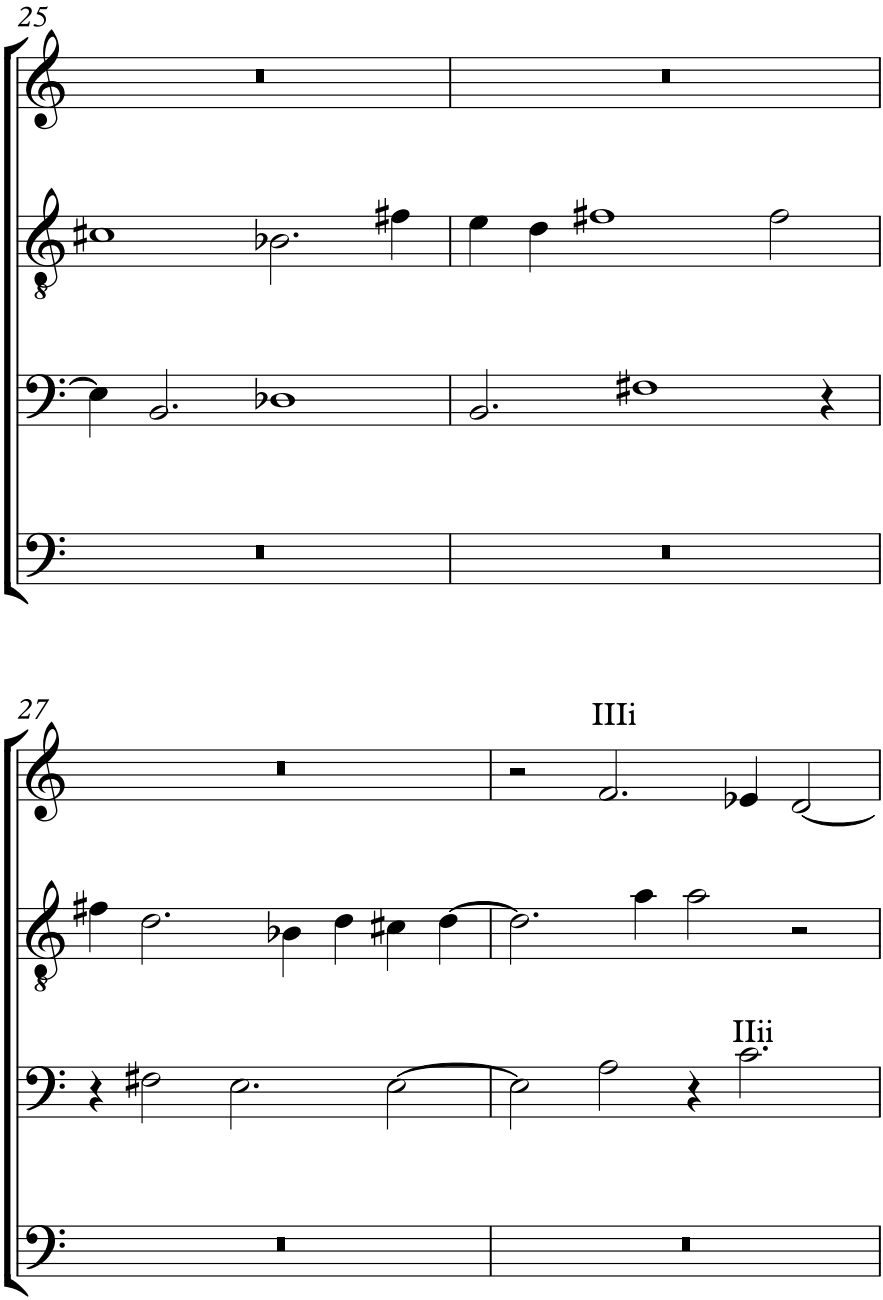
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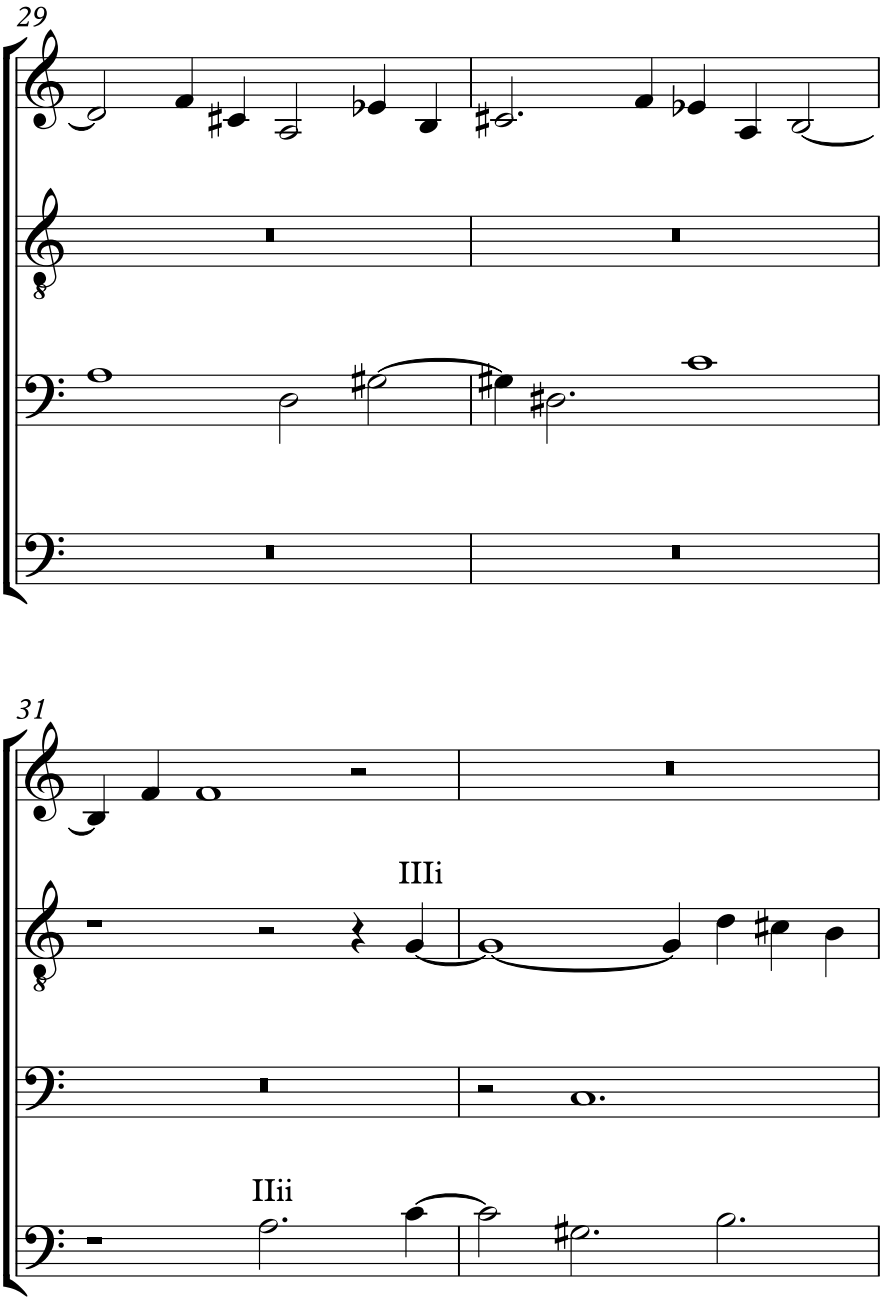
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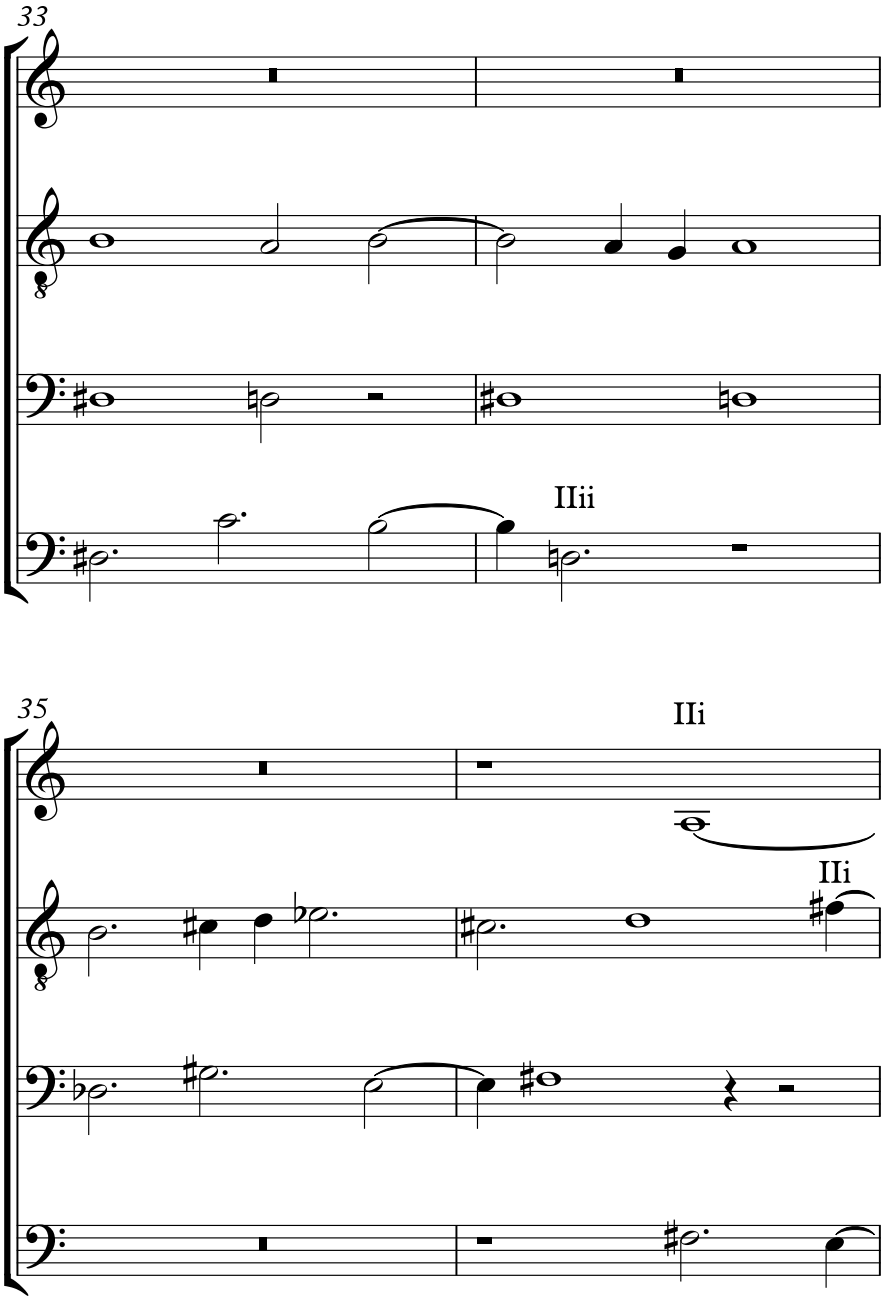
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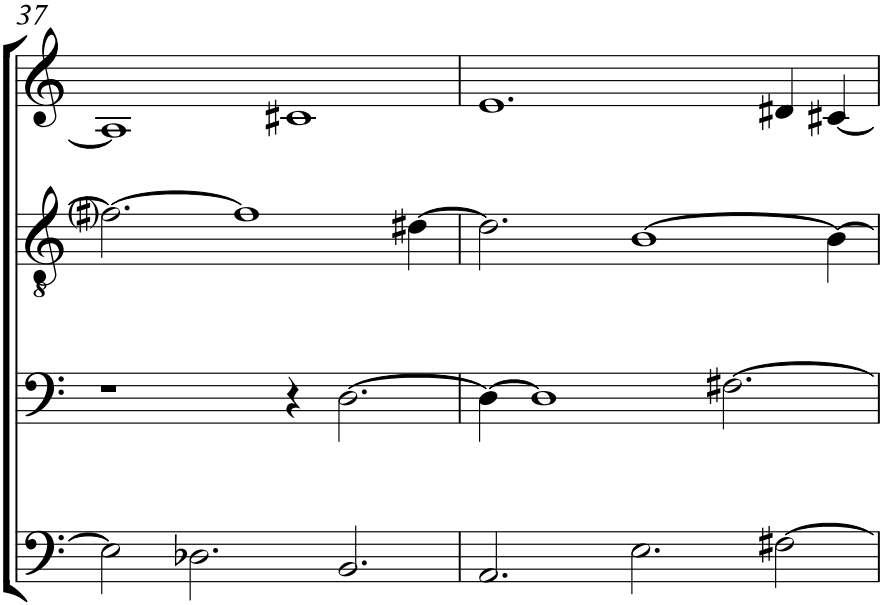
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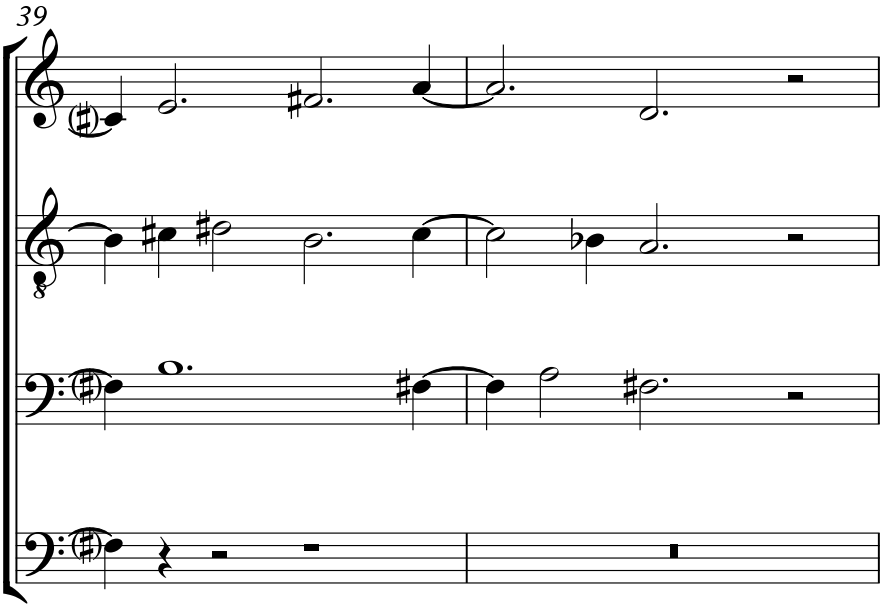
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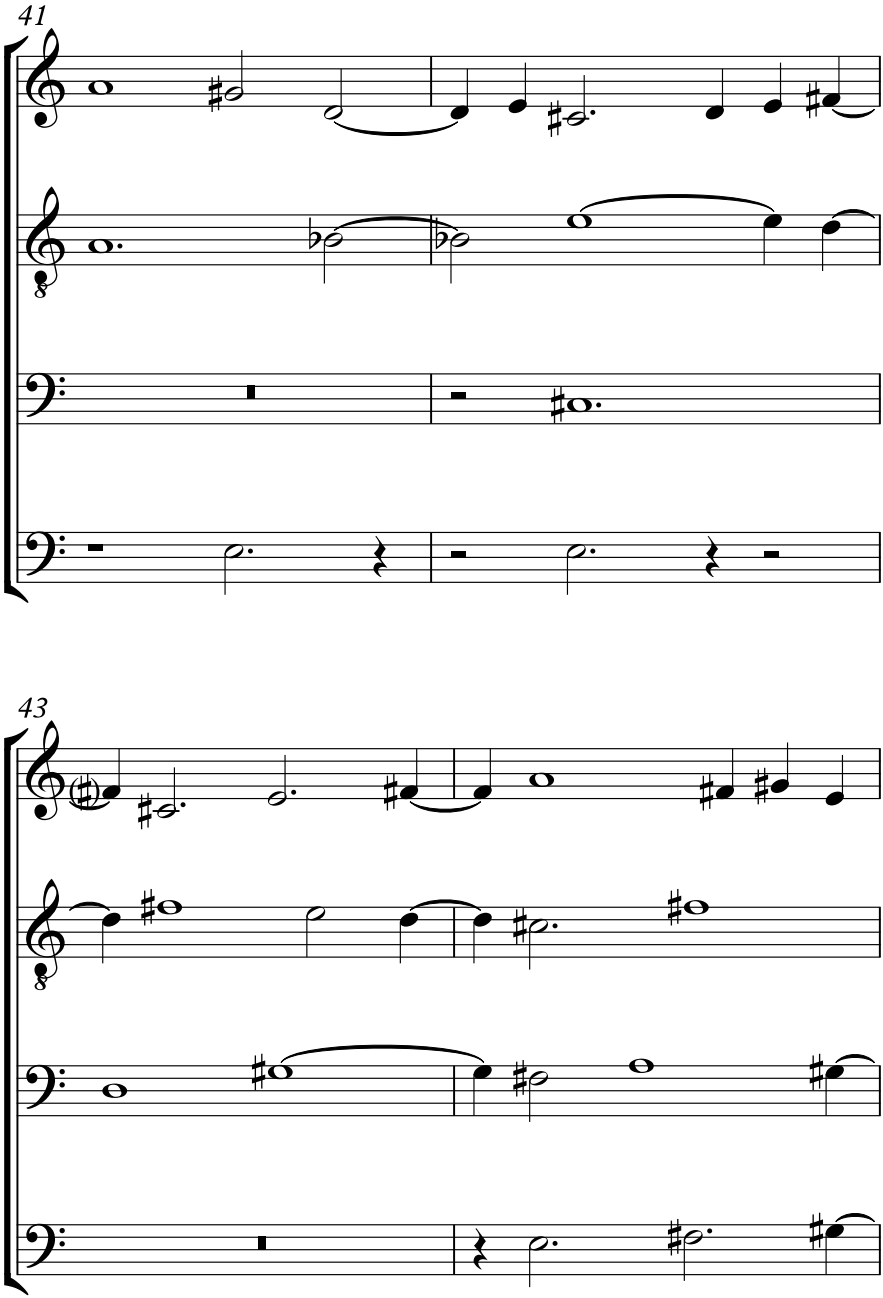
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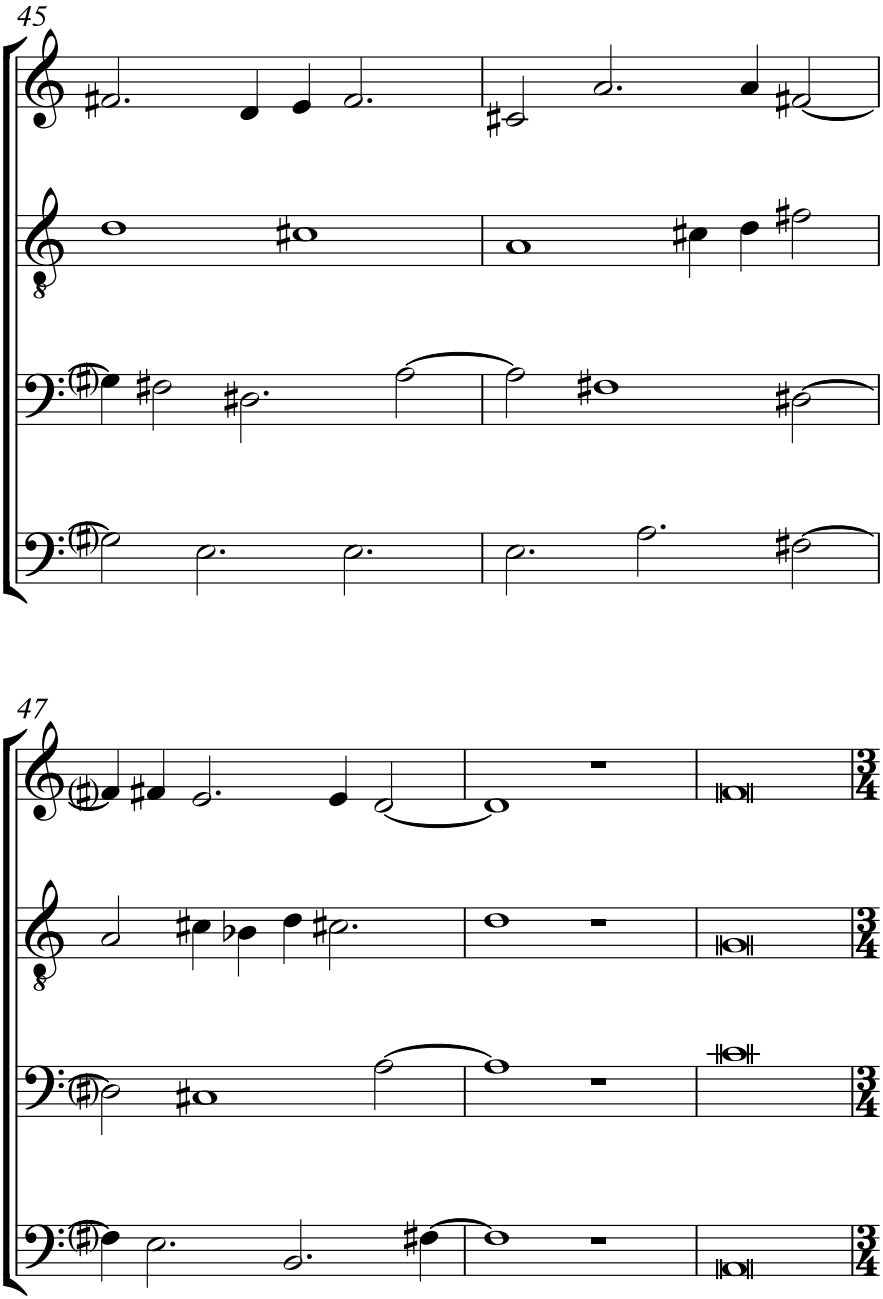
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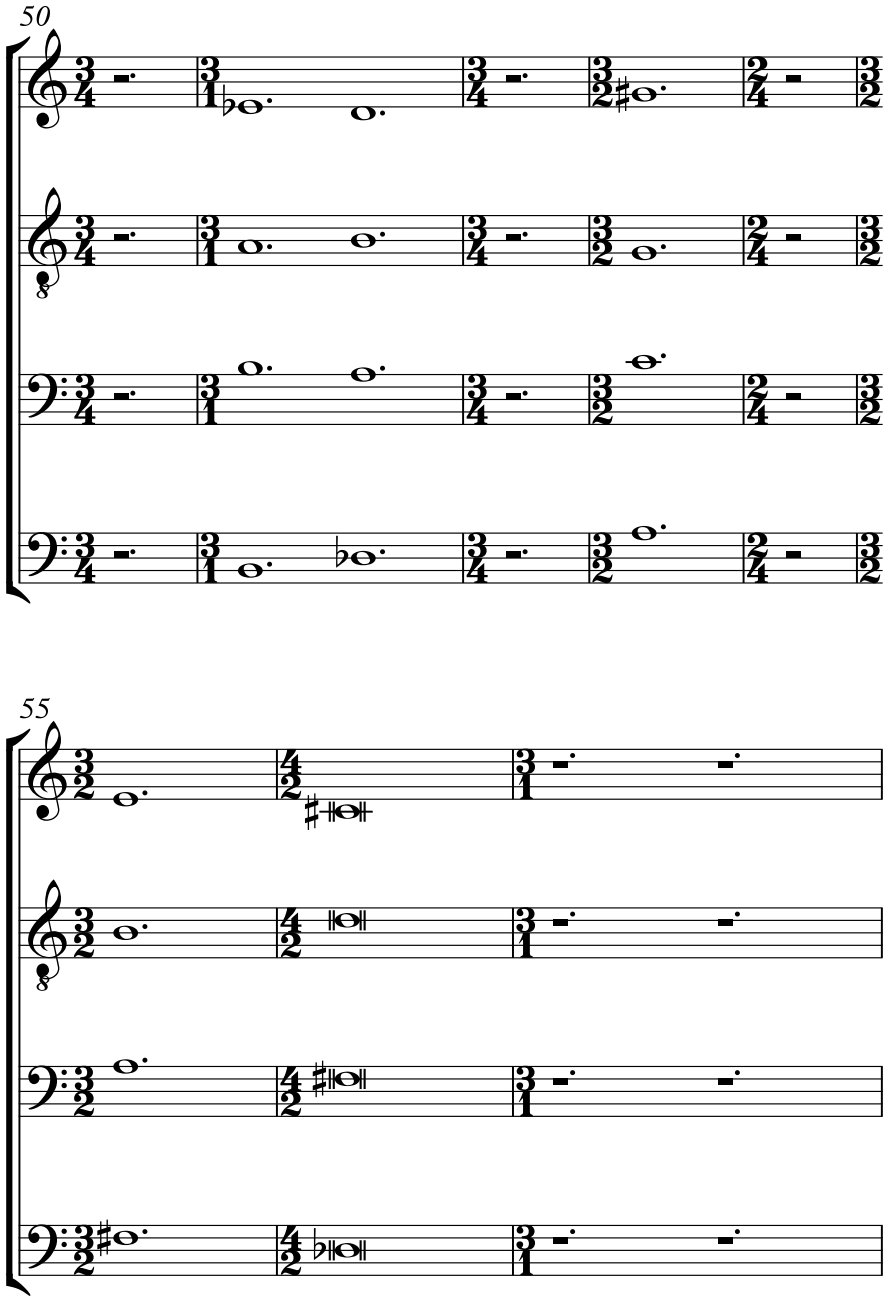
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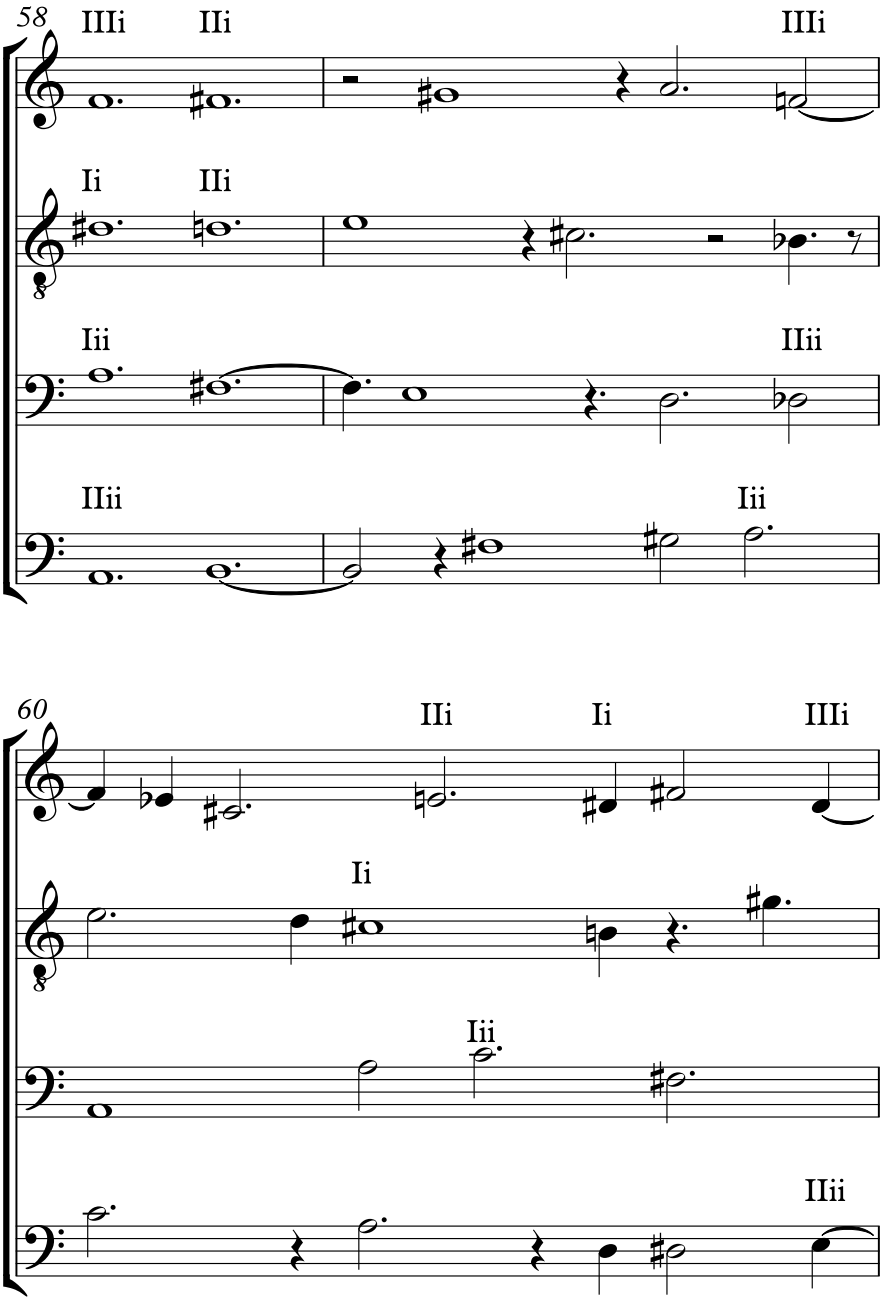
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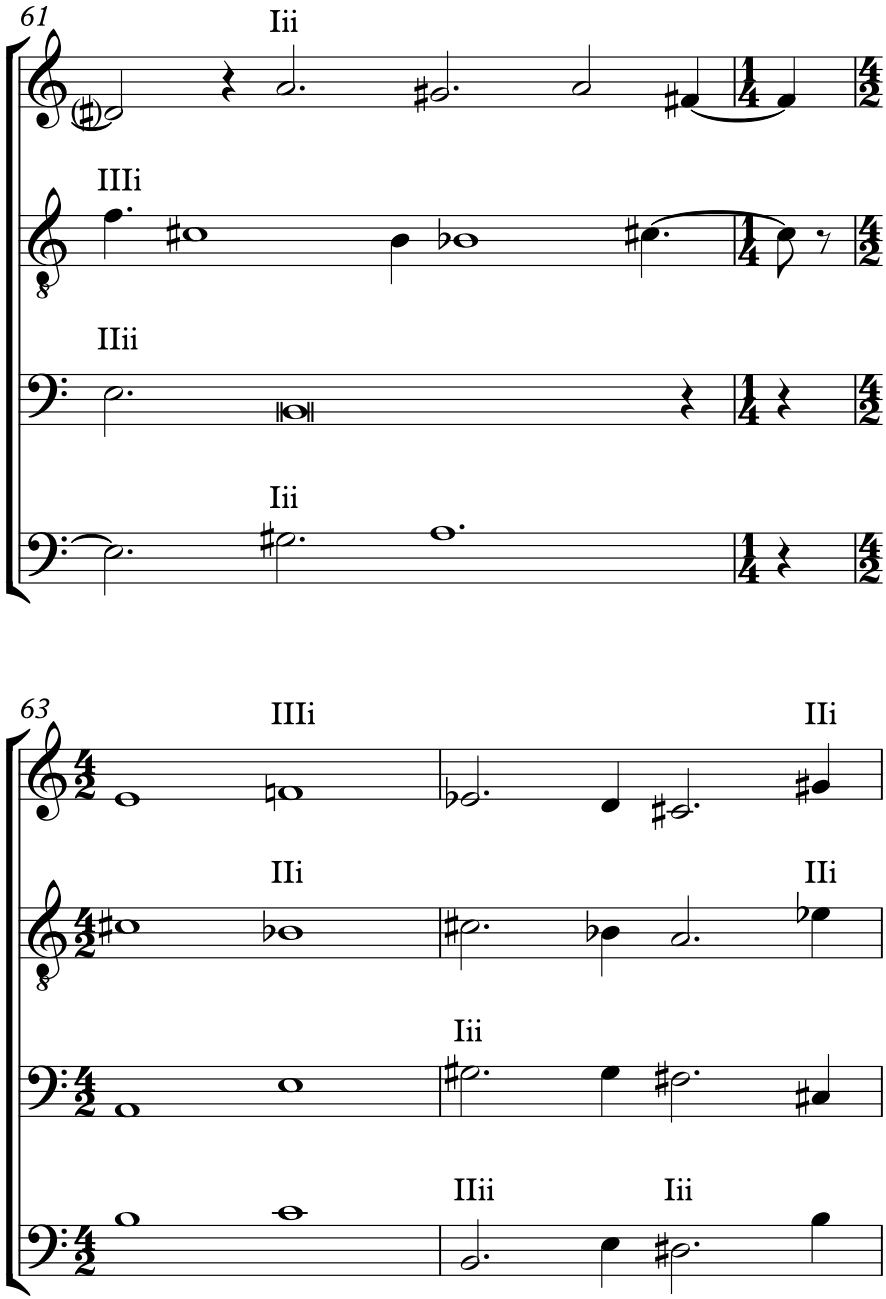
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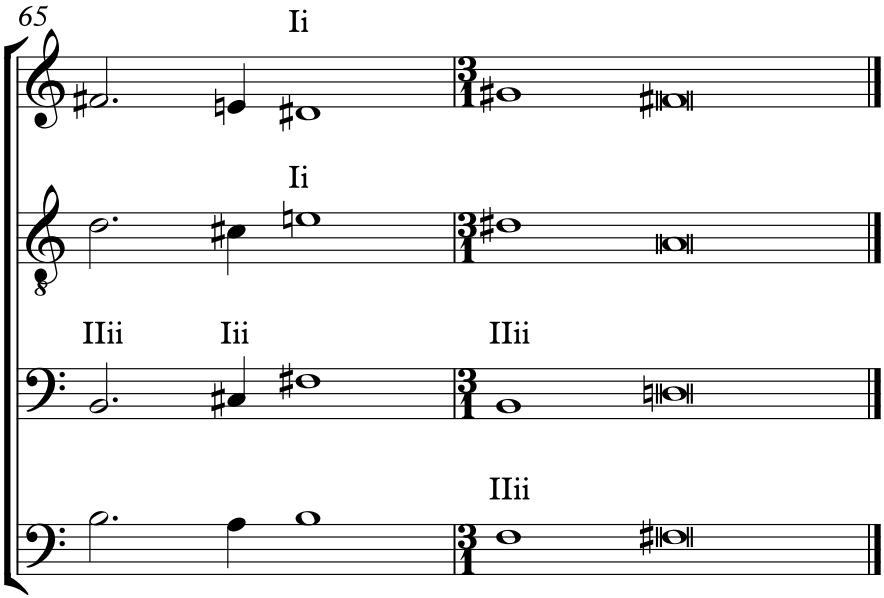
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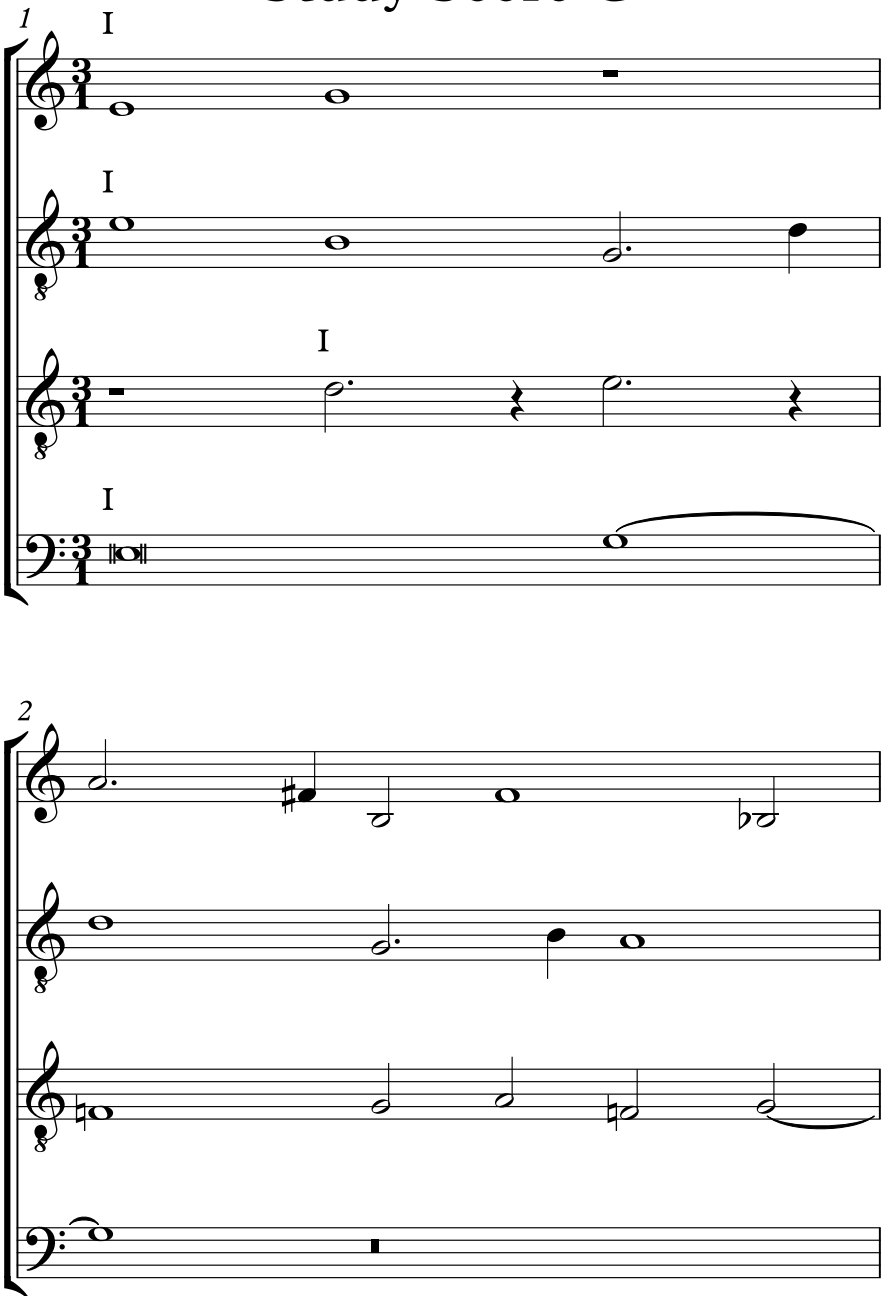

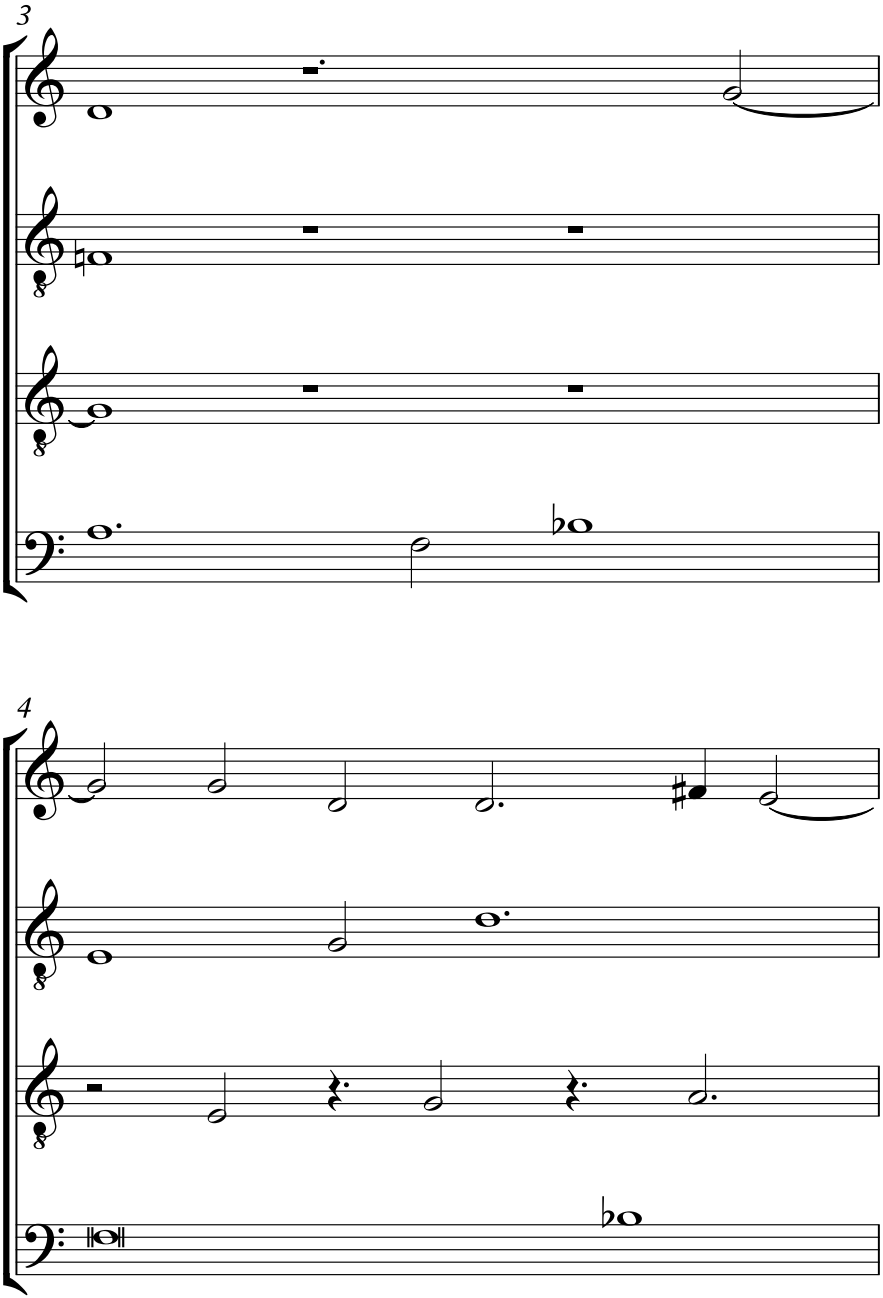
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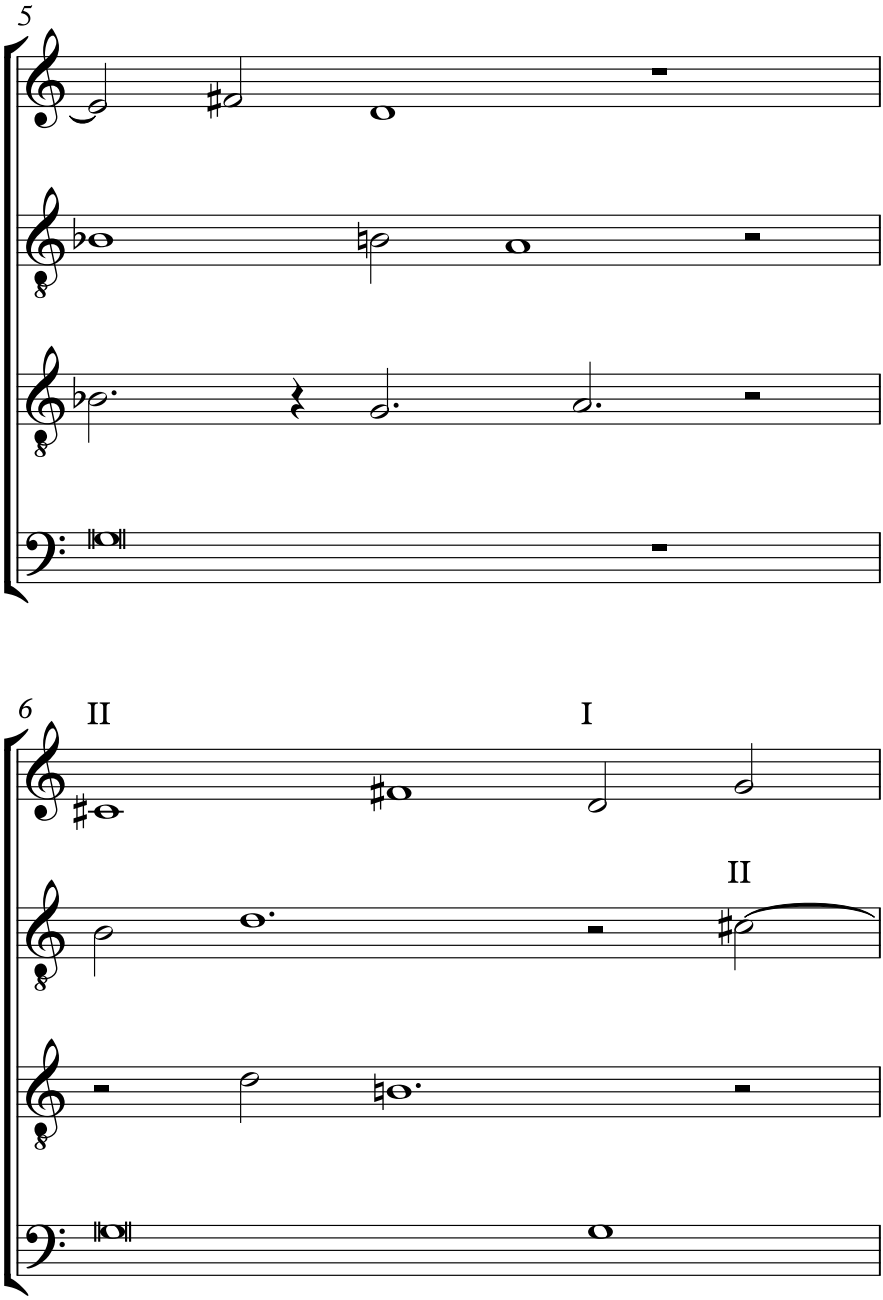
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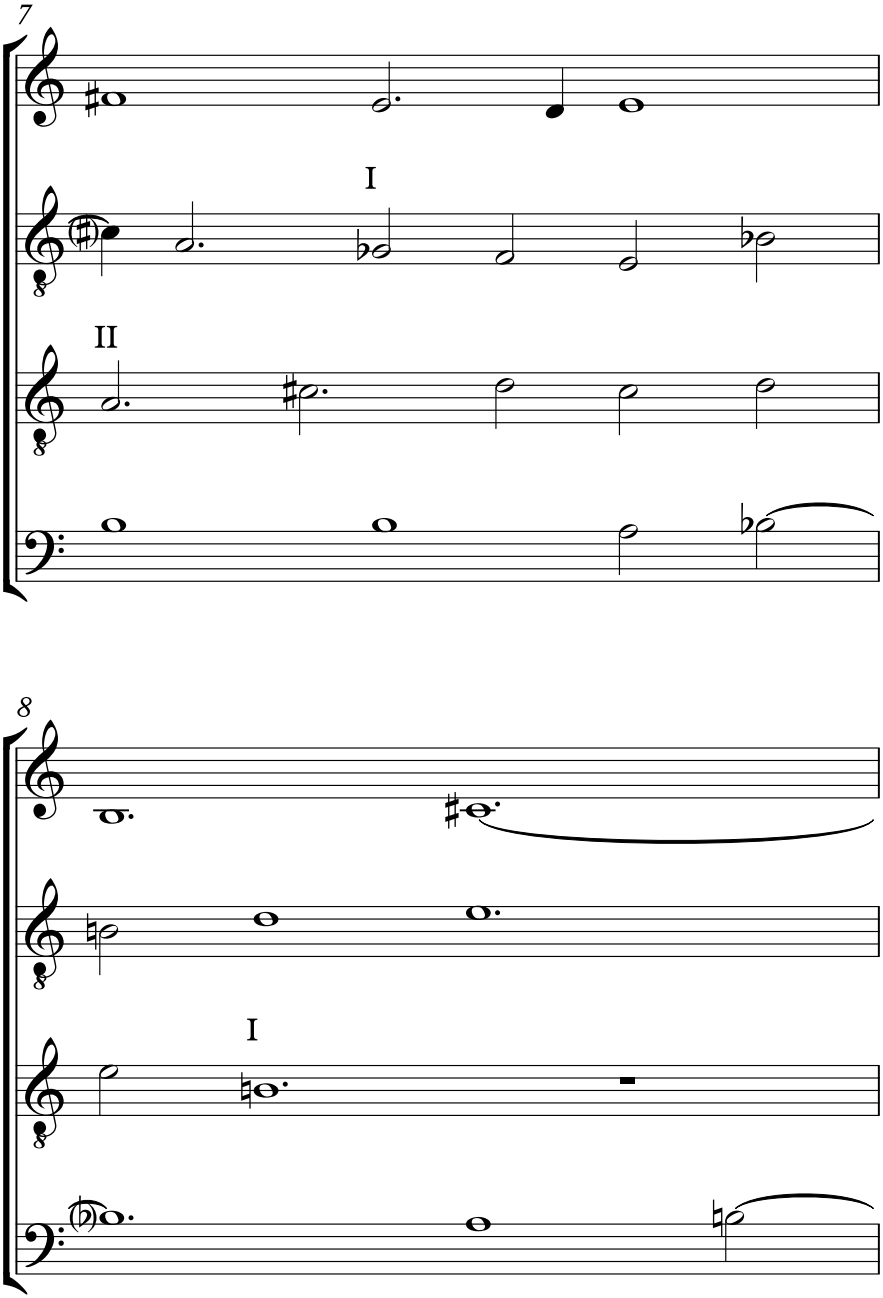
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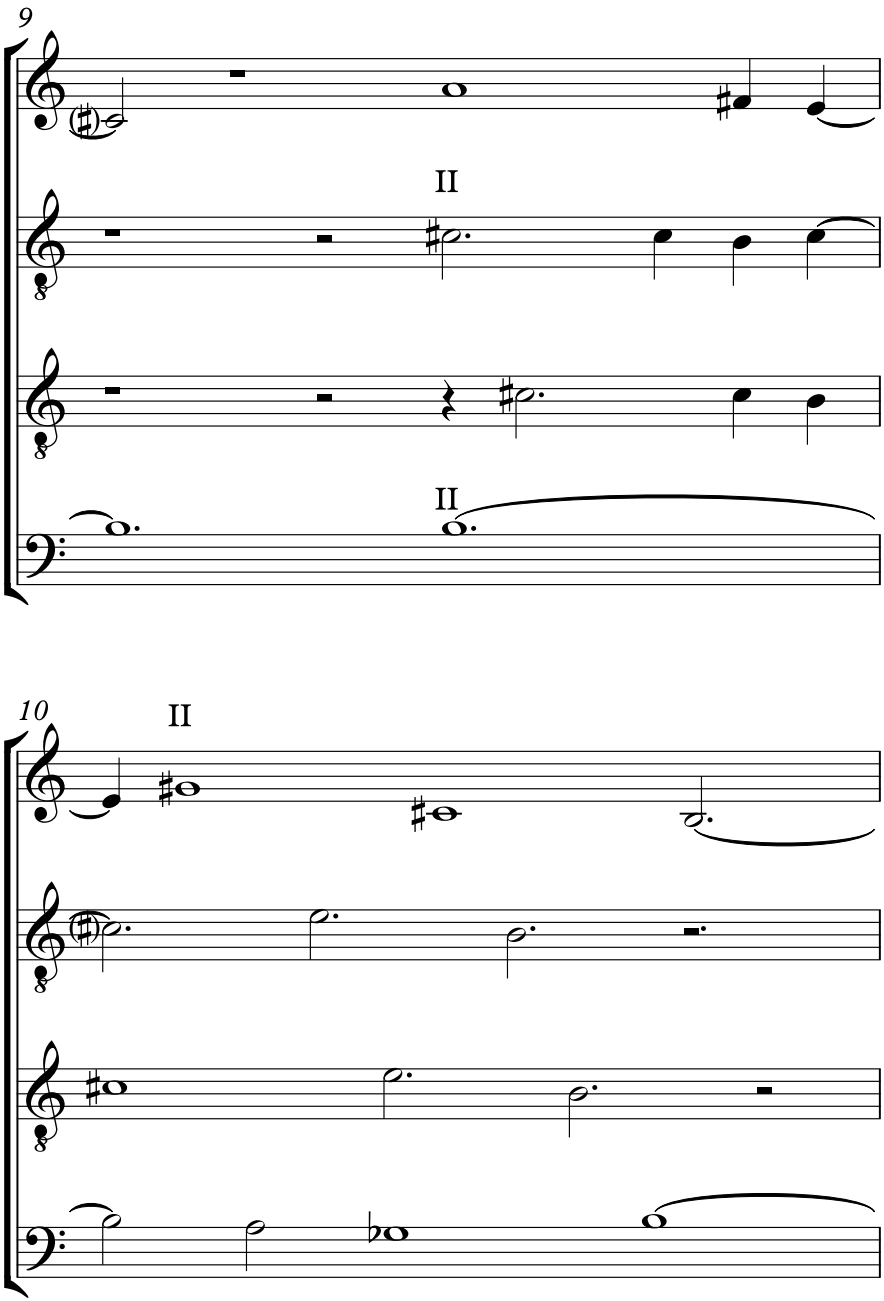
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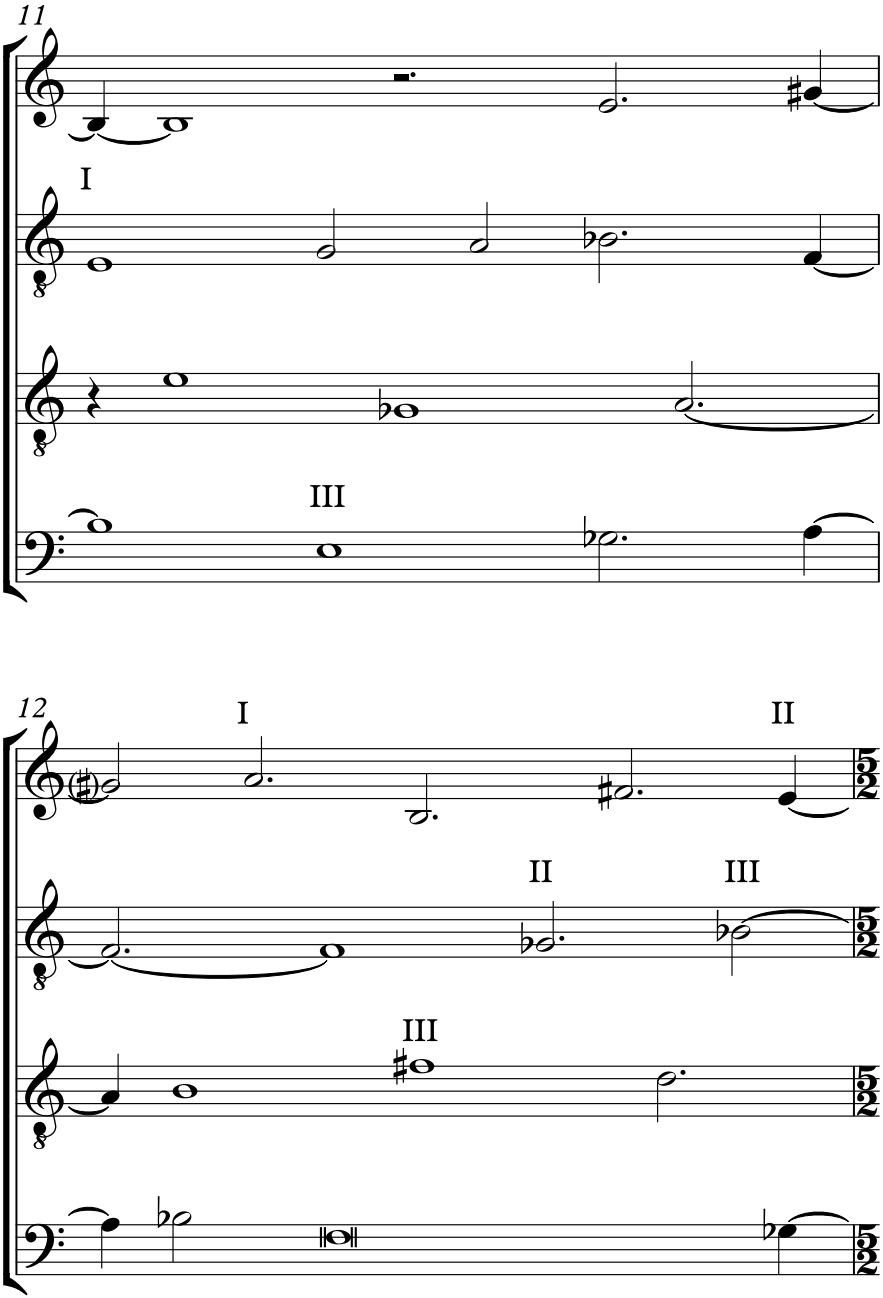
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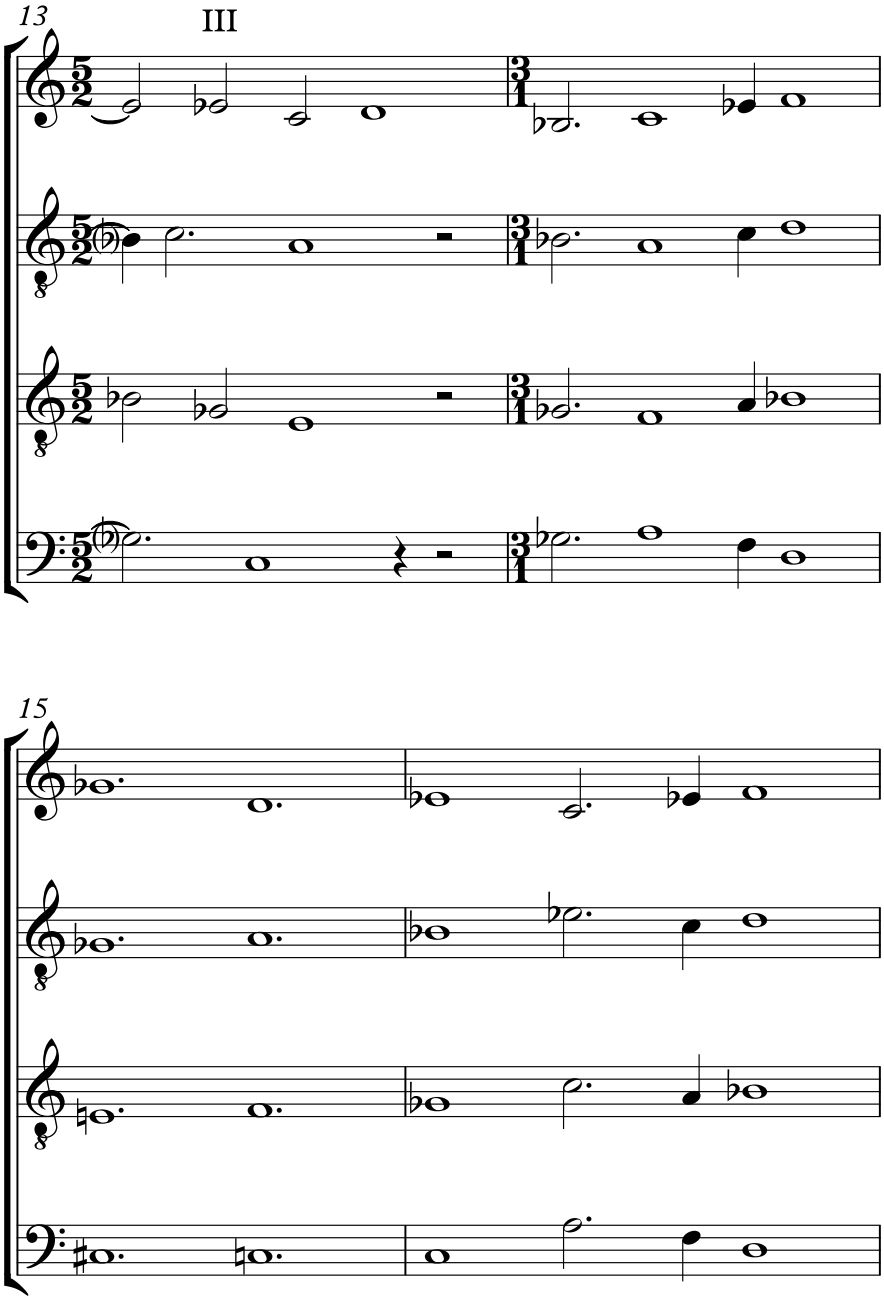
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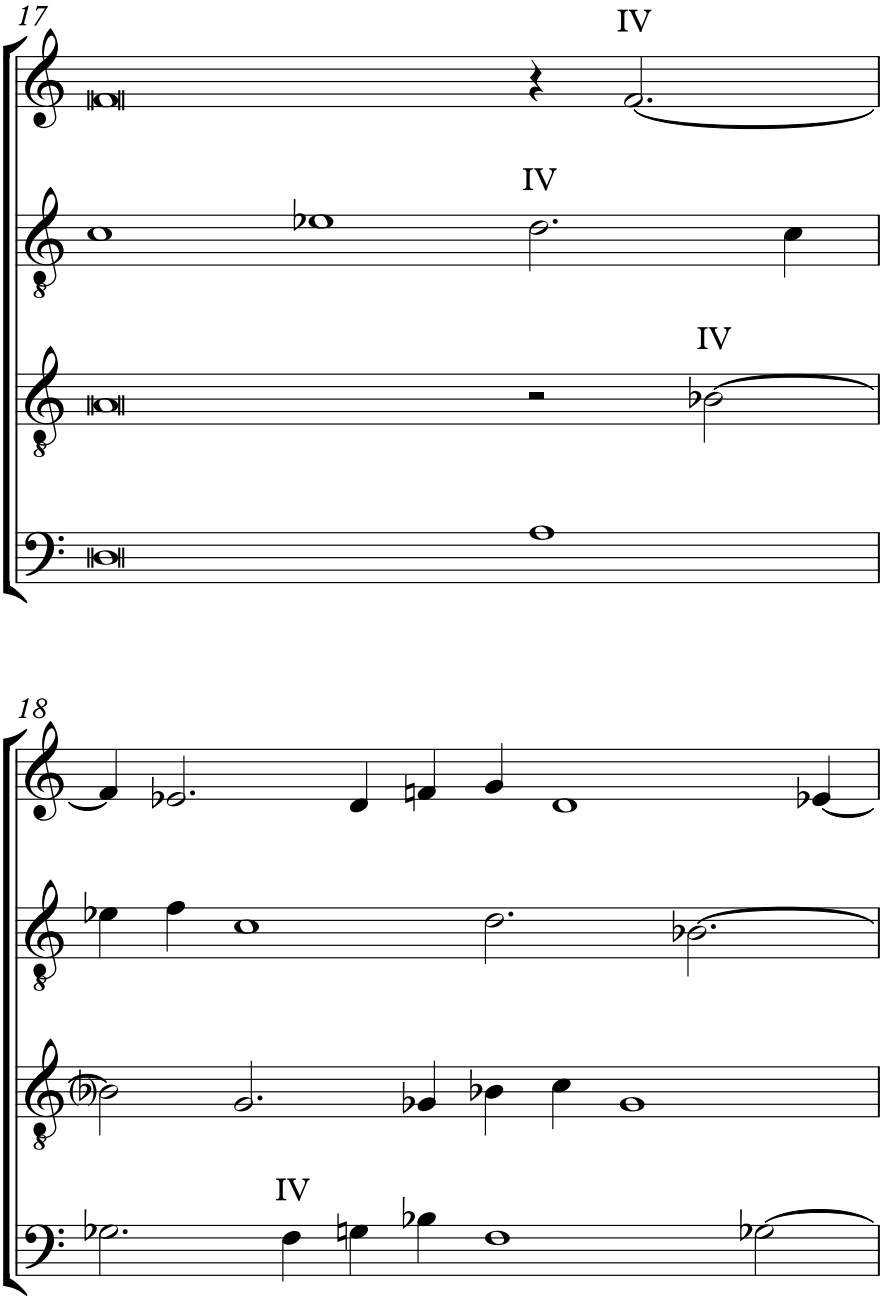
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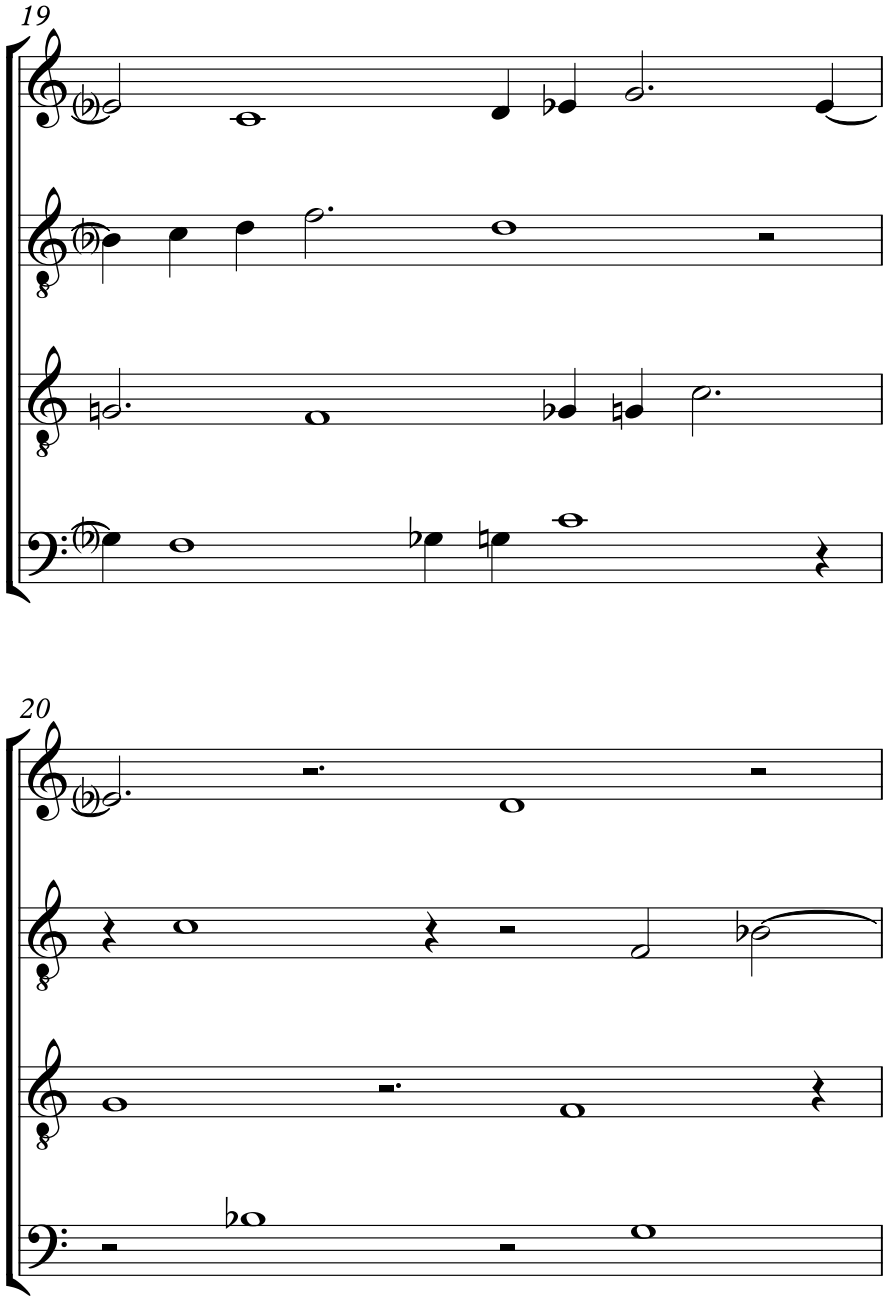
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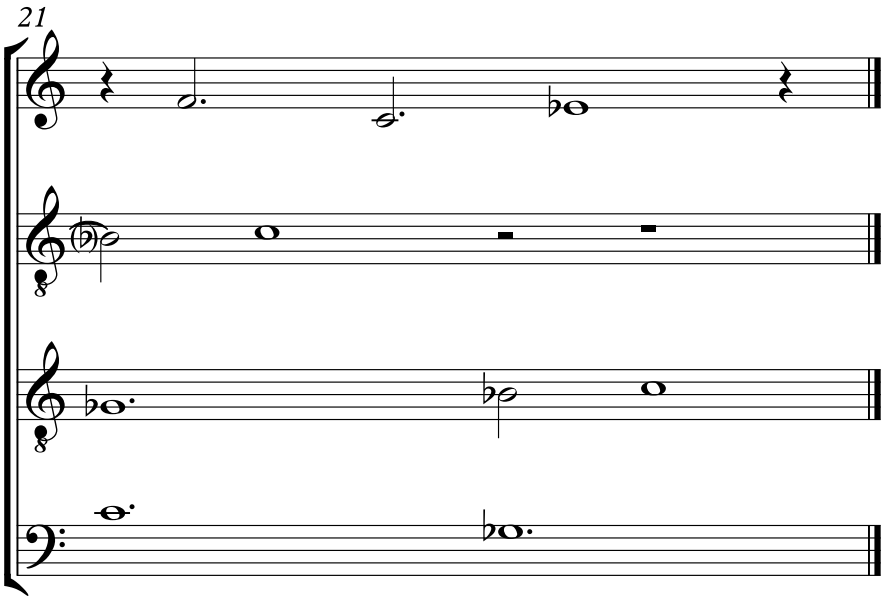
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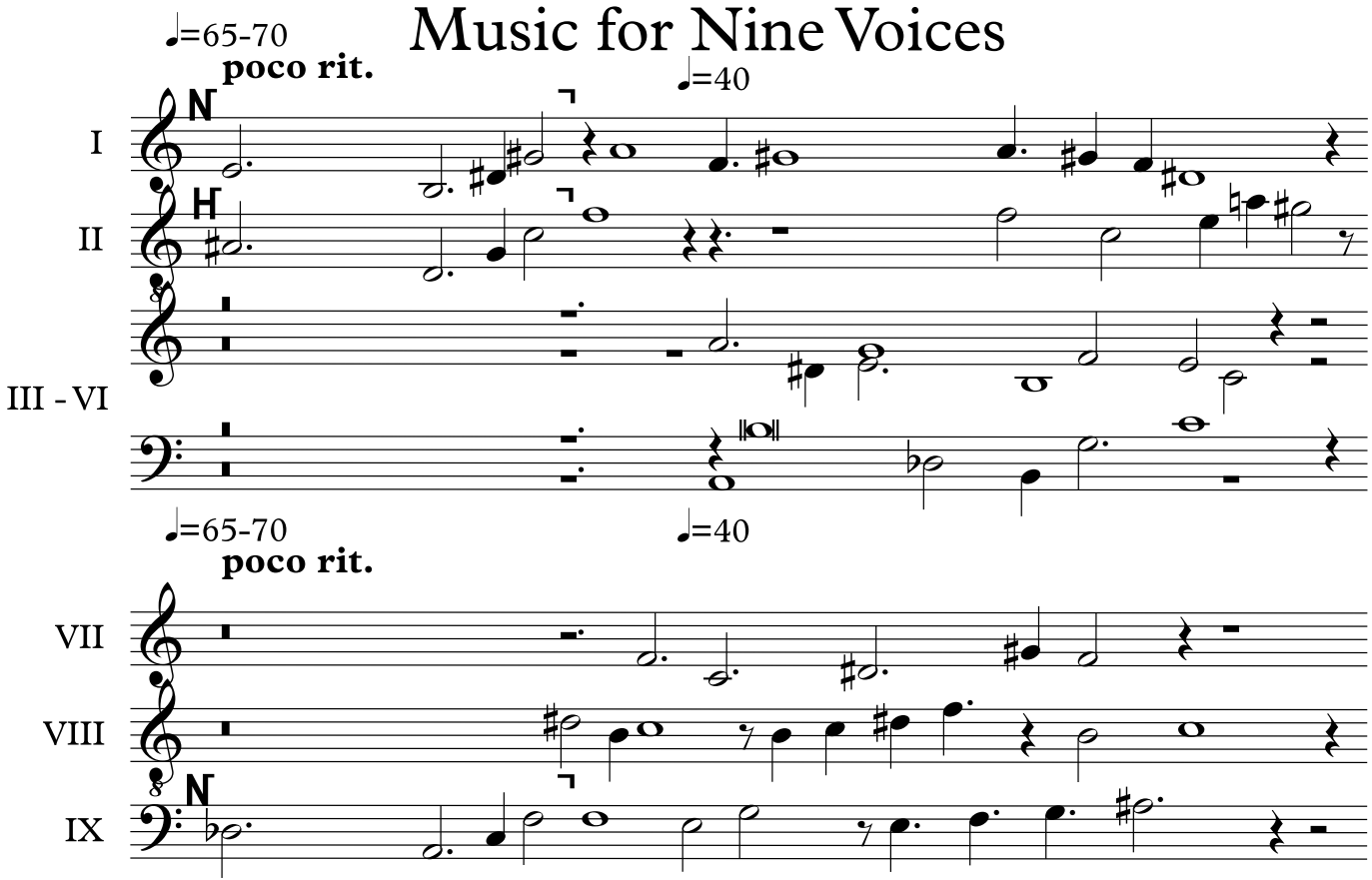
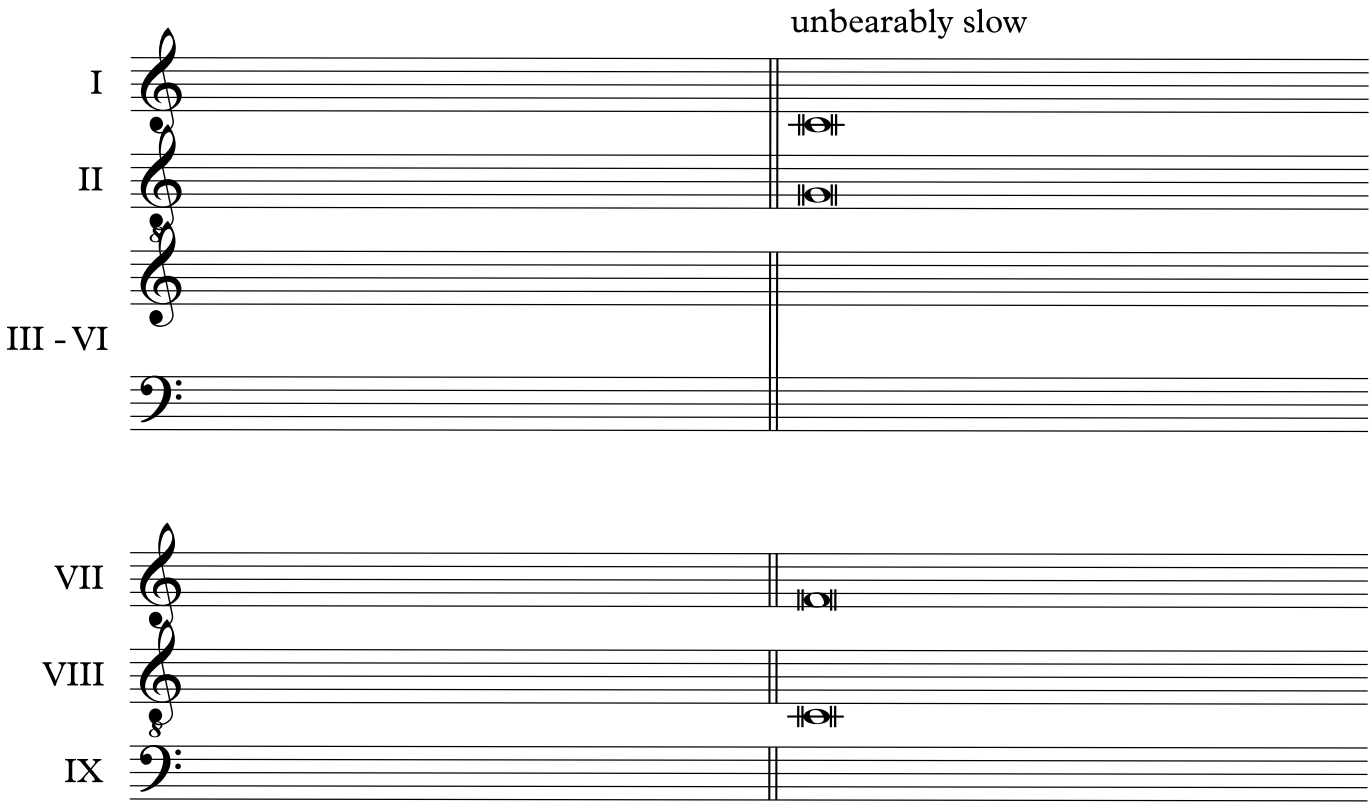
Music for Nine Voices

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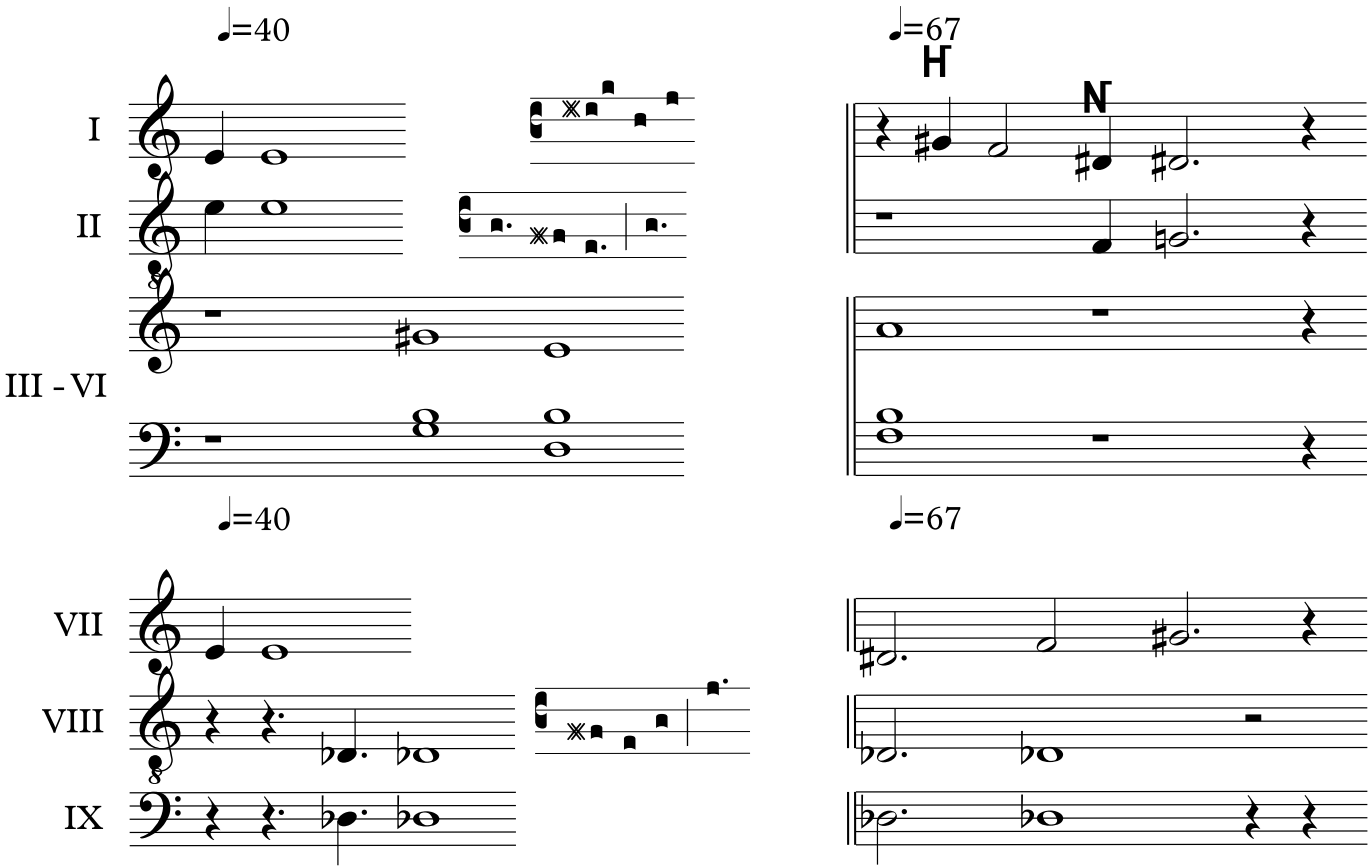
I
II
III - VI
VII
VIII
IX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♩=67
I
II
III - VI
♩=40
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VII
VIII
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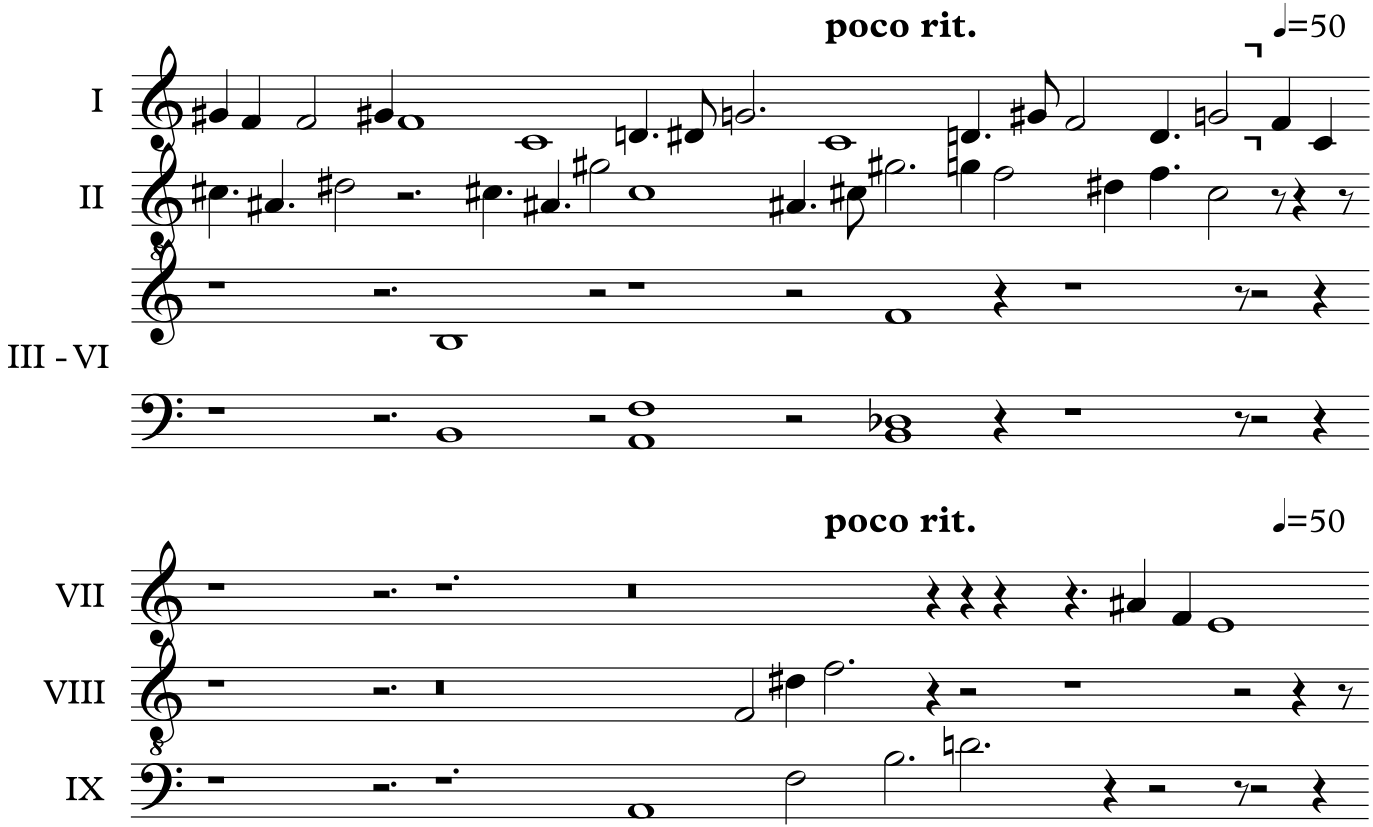
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I
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III - VI
poco rit.
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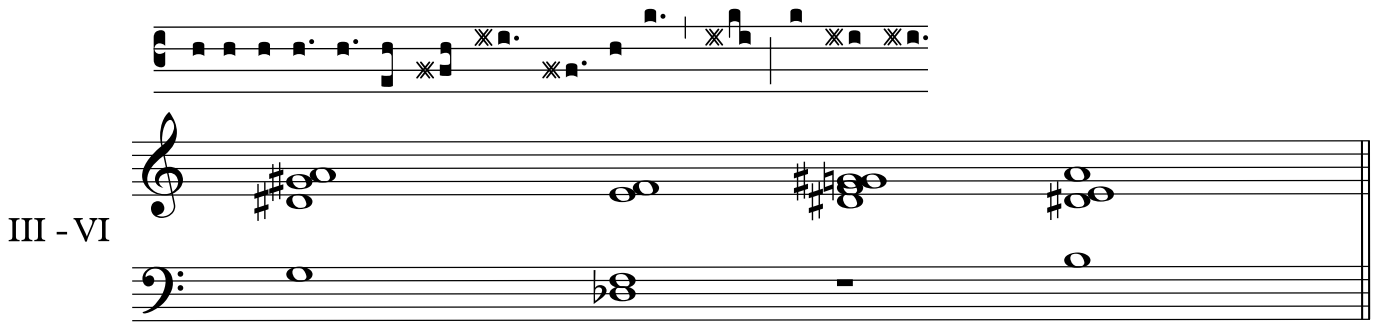
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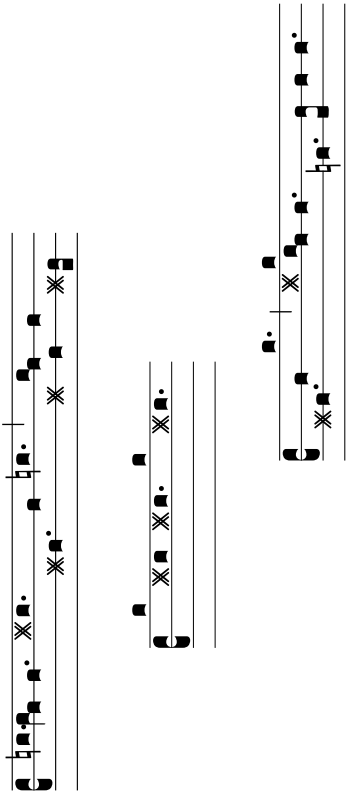
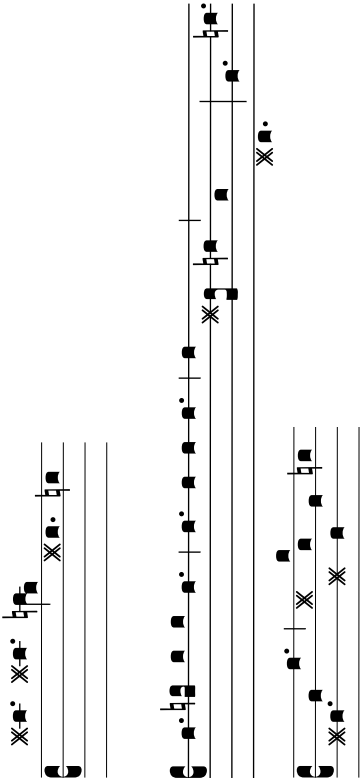
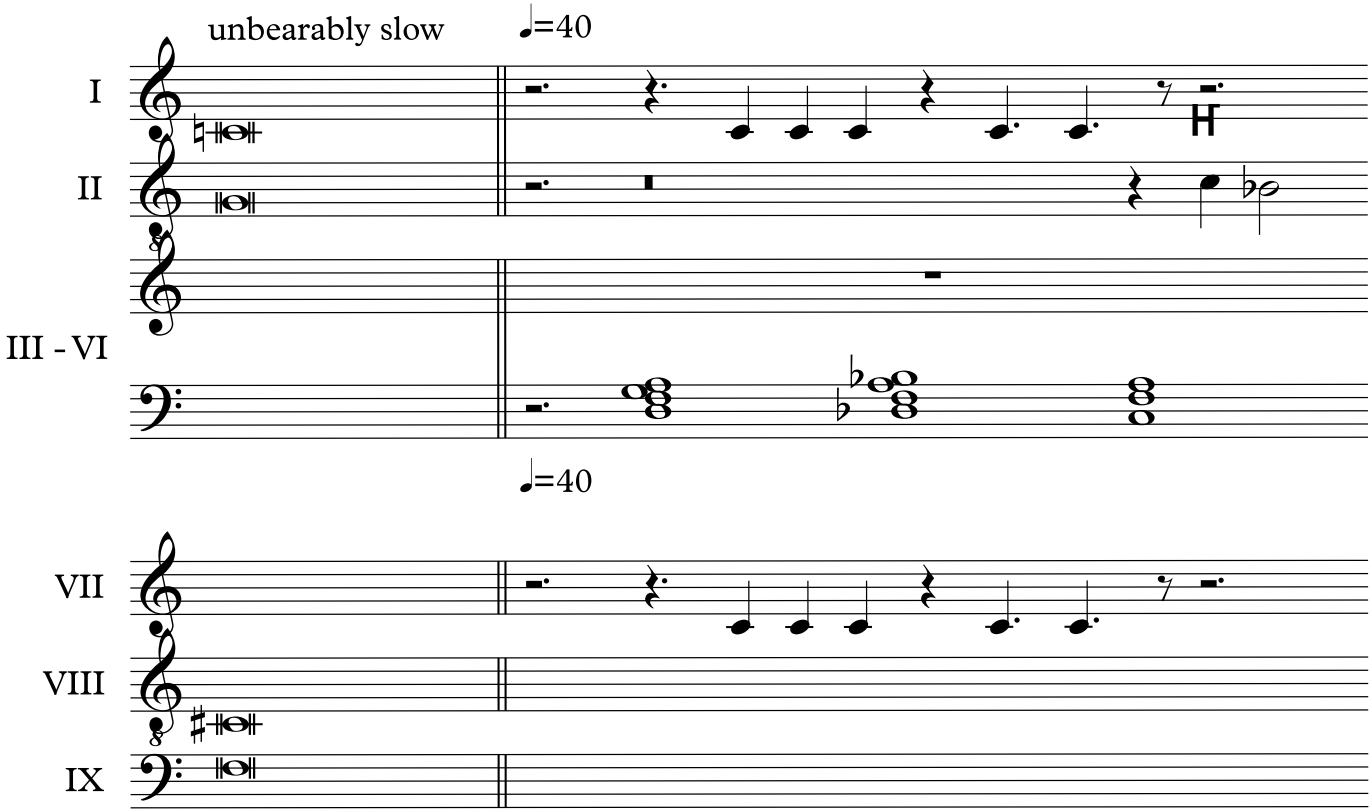
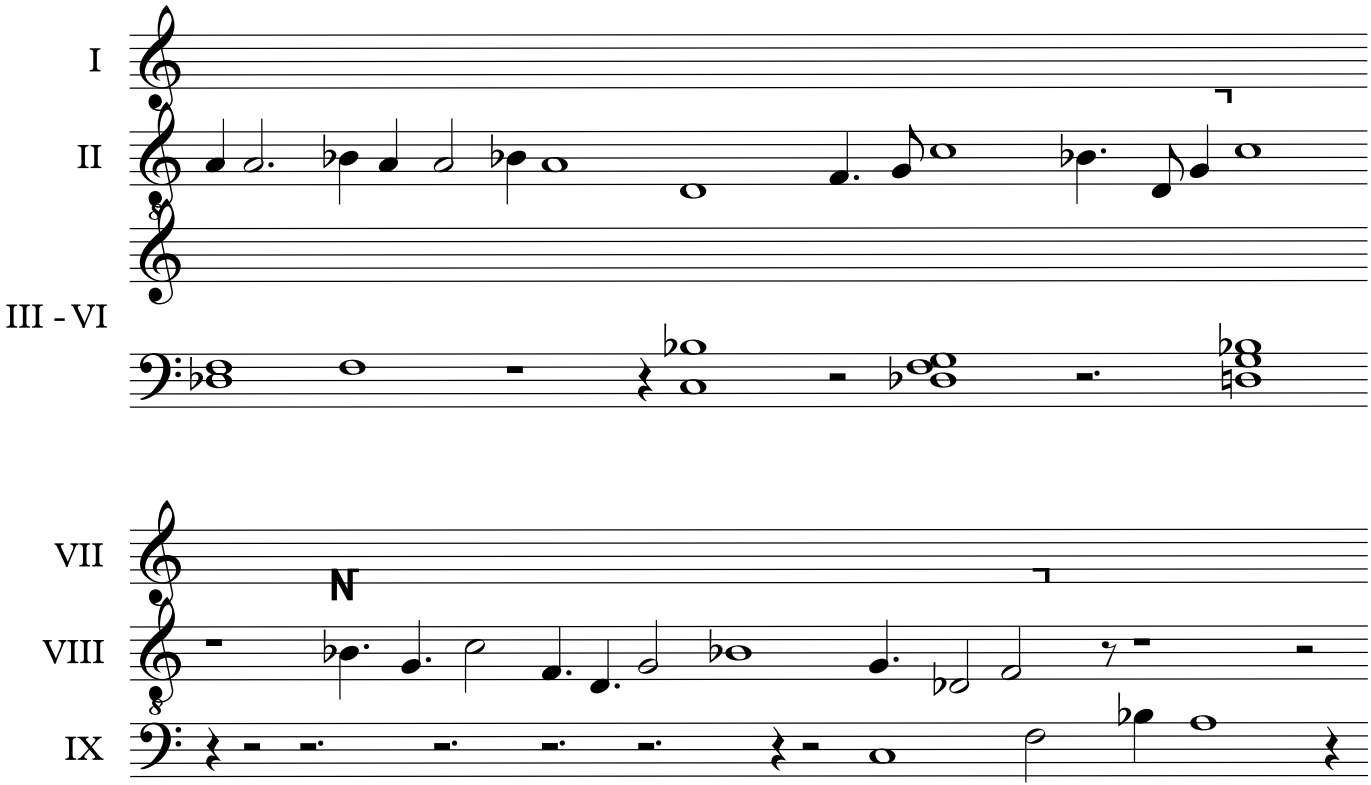





unbearably slow
♩=40
I
II
III - VI
♩=40
VII
VIII
IX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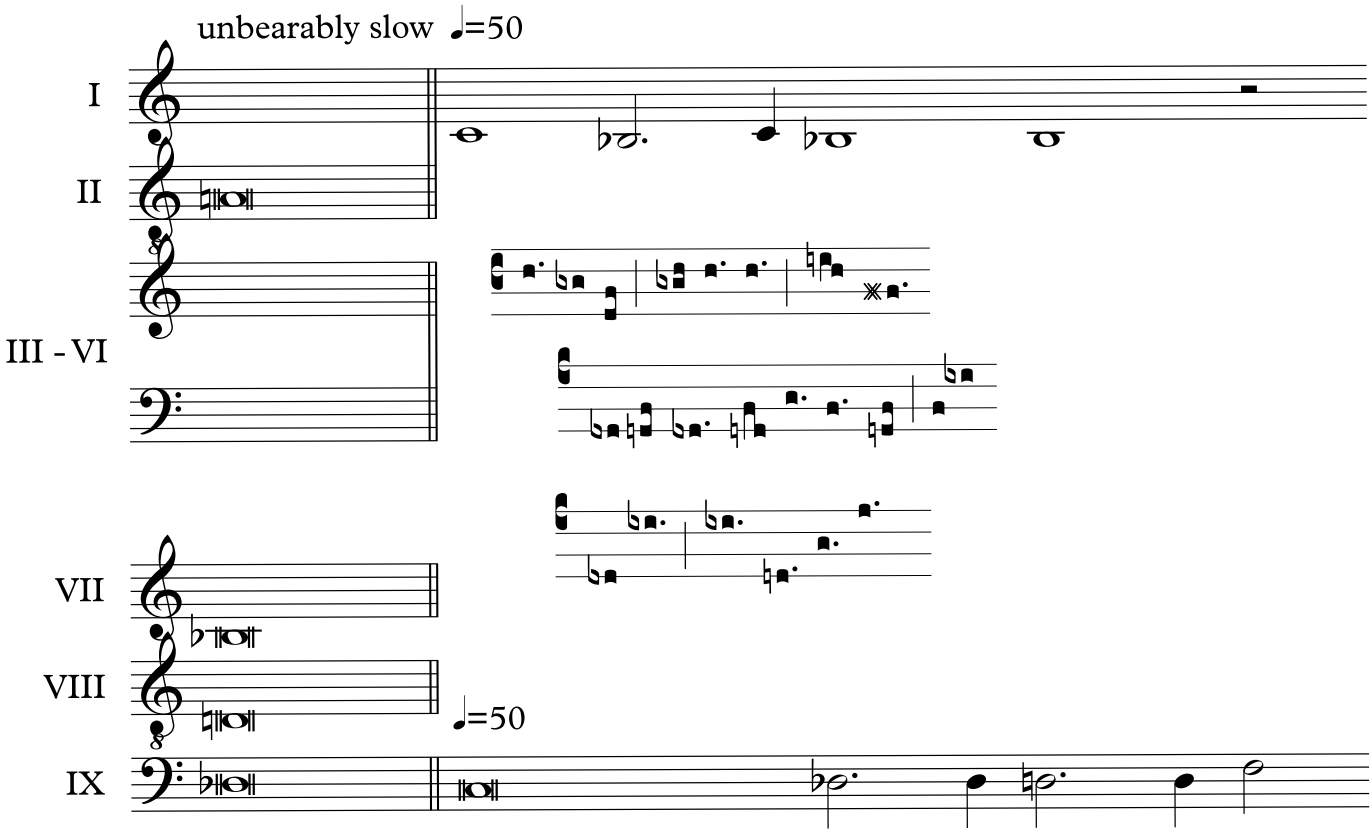
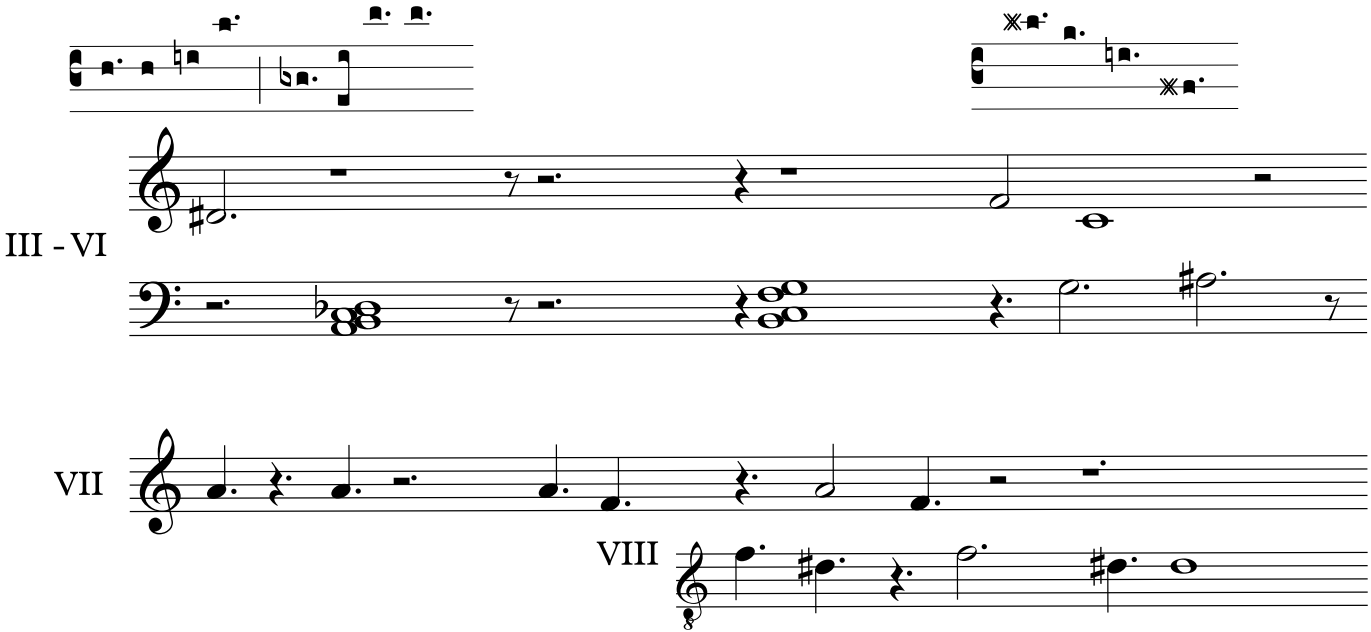
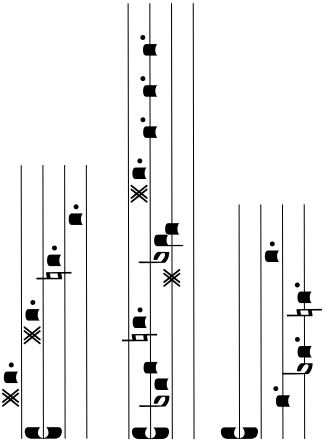
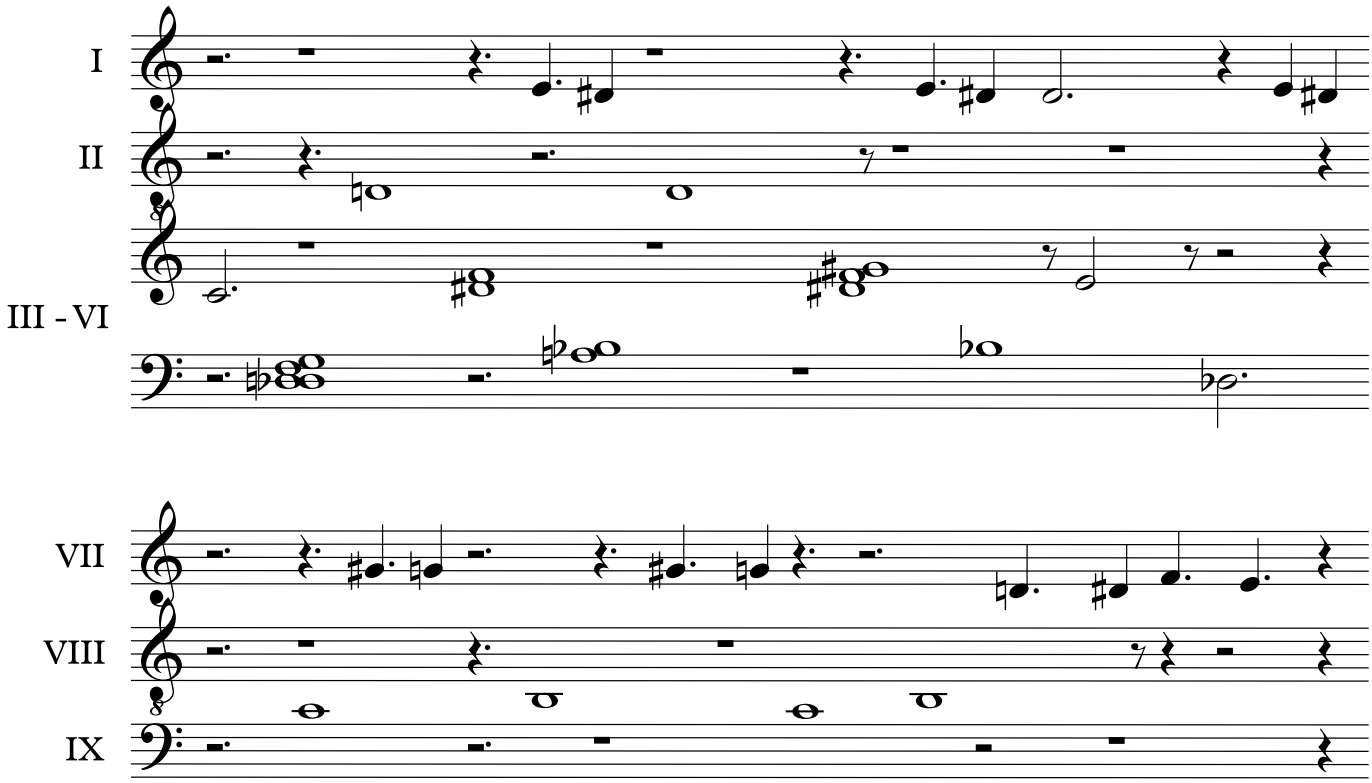
VIII
IX


unbearably slow ♩=50
I
II
III - VI
VII
VIII
IX
♩=50


III - VI
VII
VIII




I
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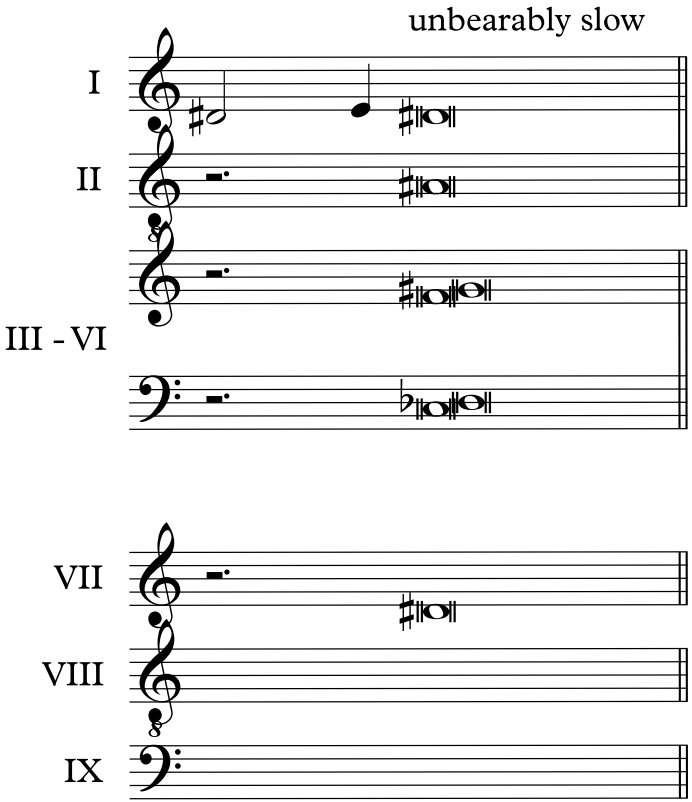
unbearably slow
I
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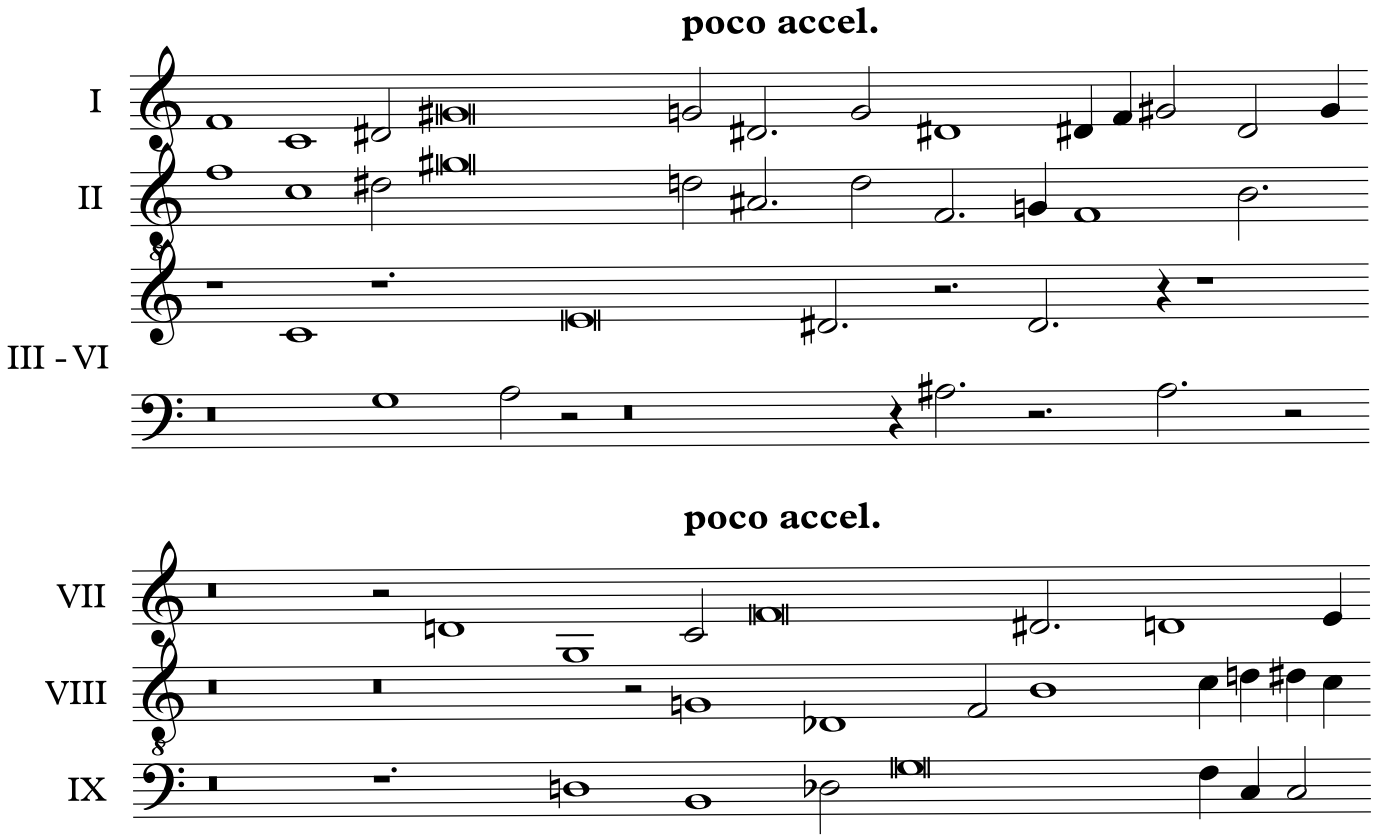
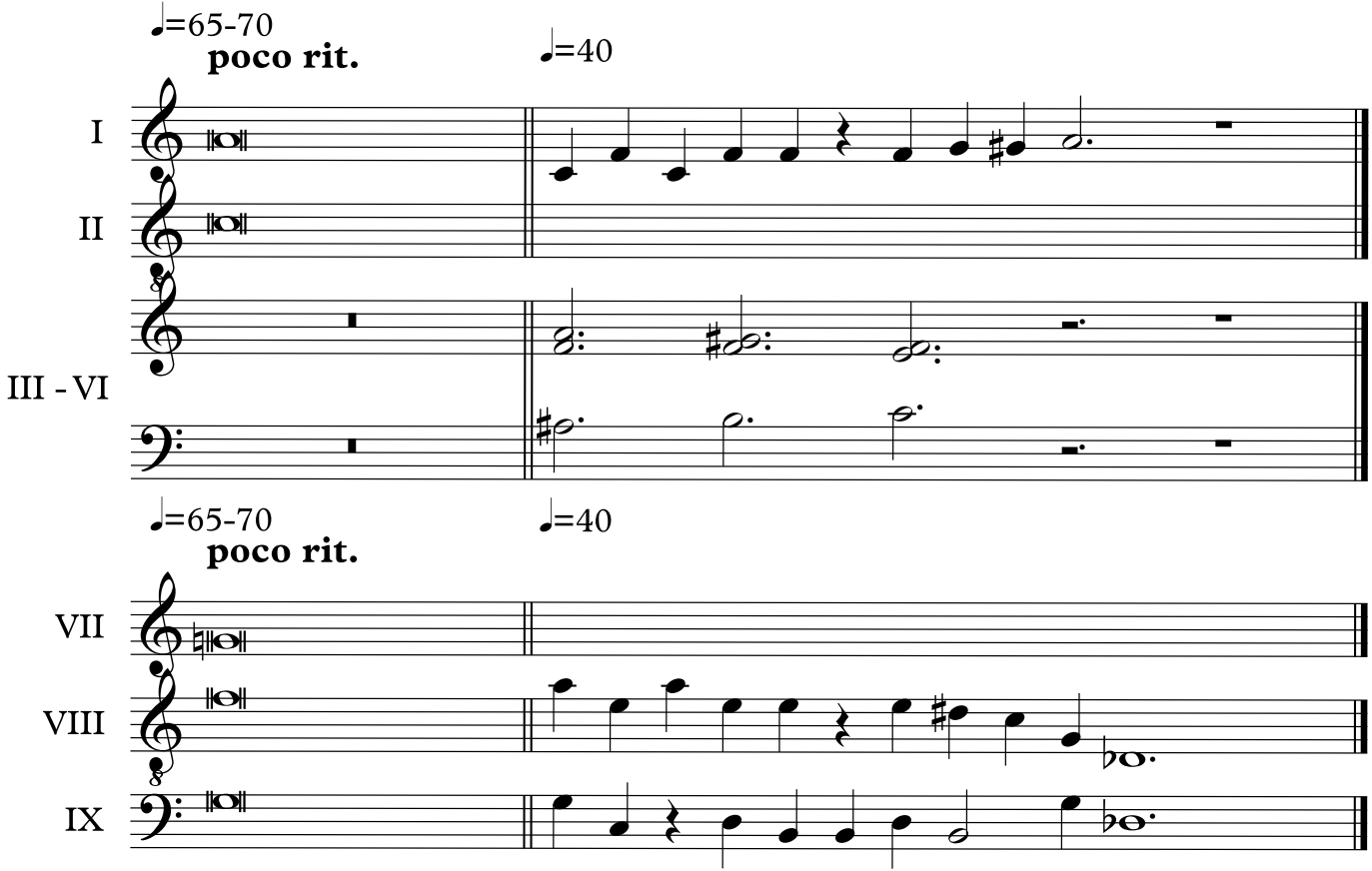

poco accel.
I
II
III - VI
poco accel.
VII
VIII
IX


♩=65-70
poco rit.
♩=40
I
II
III - VI
♩=65-70
poco rit.
♩=40
VII
VIII
IX