UNIVERSITY OF CALIFORNIA
SANTA CRUZ

CONSTRUCTUS PROFANEM

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DOCTOR OF MUSICAL ARTS

in

MUSIC COMPOSITION

by

K. C. M. Walker

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ABSTRACT

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This paper describes the various compositional considerations involved in the creation of the work *Constructus Profanem*, a multi-movement instrumental work exploring instrument mechanics, tuning strategies, acoustics, formal structures, and esoteric symbolism. We will begin with a look at the work of Harry Partch, a composer whose work embodies each of these topics and more. We will examine his tuning gamut, the "Monophony Fabric" and discuss its construction, as well as some of the instruments he has created for his compositions. From here, I will present the construction of a just intonation tuning system and its inherent challenges while discussing solutions and compromises as they relate to meantone temperaments and multiple division of the octave. I will give some of the history concerning nineteen-tone equal temperament and compare it to just intonation and twelve-tone equal temperament. Next, I will offer strategies for performing music in the temperament for the instruments suggested and offer ideas for substitutions. Then we will discuss the evolution of the formal structuring of the piece and the organization of its movements before finally examining the inner working of the movements themselves. We will see how the sections transition into one another and how their rhythmic and pitch material is organized.

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This paper describes the various compositional considerations involved in the creation of the work *Constructus Profanem*, a multi-movement instrumental work exploring instrument mechanics, tuning strategies, acoustics, formal structures, and esoteric symbolism. We will begin with a look at the work of Harry Partch, a composer whose work embodies each of these topics and more. We will examine his tuning gamut, the "Monophony Fabric" and discuss its construction, as well as some of the instruments he has created for his compositions. From here, I will present the construction of a just intonation tuning system and its inherent challenges while discussing solutions and compromises as they relate to meantone temperaments and multiple division of the octave. I will give some of the history concerning nineteen-tone equal temperament and compare it to just intonation and twelve-tone equal temperament. Next, I will offer strategies for performing music in the temperament for the instruments suggested and offer ideas for substitutions. Then we will discuss the evolution of the formal structuring of the piece and the organization of its movements before finally examining the inner working of the movements themselves. We will see how the sections transition into one another and how their rhythmic and pitch material is organized.

An important distinction to make early on is the difference in construction of gamuts and scales. Gamuts represent a system of all possible pitches from which scales may be derived, the way the chromatic scale contains the diatonic scales. The Grove Dictionary of Music defines a scale as "a systematic statement of the most important notes which form the basis of music…arranged in stepwise order." Yet the entry goes on to clarify that it is not the notes themselves which define the scale, but the collection of intervals (and their qualities) that determine the relationships of those notes to one another that does. For those of us brought up in the tradition of western music theory, it is quite natural to think that this means that scales are defined by the versions of the notes they use, i.e. sharp or flat, or by which intervals are major, minor, augmented, or diminished. Should we wish to explore new scaler constructions, we may find ourselves limited by the assumption that we must derive our scales from some existing set of predetermined pitches or that an interval is defined by the number of scale degrees between the pitches being compared.

Harry Partch developed a spatial philosophy which describes intervallic relationships not as different versions of scale degrees, but by describing the distance relationship from one pitch to the other mathematically. This understanding of harmonic relationships underlies the organization of "Monophony," his arrangement of forty-three tones spanning the octave used on his Chromelodeon and Harmonic Canon instruments. Partch organizes pitch relationships across two dimensions that he calls "Otonality" and "Utonality,"

which relate to one another as inversions from a common tone or "unity." He opts for his own terminology rather than calling this pitch the "fundamental," intending to emphasize the small number ratios involved in their calculation and not the locations of these relationships which may be found within an overtone series. The intervals described are expressed as fractions, the position as numerator or denominator of the largest prime number (or multiple thereof) between the two determines its identity as either Otonal or Utonal. Otonal intervals, or "Odentities" arrange this number, a prime or its multiple, as the "over number" or numerator in the fraction while in "Udentities," this is the "under number." Odentities describe a pitch relationship where a related pitch is defined above the unity, and Udentities, below. Because of this inverse relationship, there will always be an Odentity that completes an octave when harmonized from the over number by a Udentity and vice versa: 5/4 x 8/5 = 2/1 for example; these intervals are called "complements."

Partch associates the character Otonal intervals with the "major" classification of tonality and likewise he links Utonality to the "minor" sensibility. Again, he chooses to use his own terminology rather than referring to the over or under tone series because he feels that the ear does not struggle in rationalizing the relationships within a single octave. His forty-three tone gamut, the "Monophonic Fabric," uses an equal distribution of both Otonal and Utonal intervals, always including both an Odentity and its complimentary Udentity. To weave this fabric, Partch first lists every fraction less that 2/1

which can be formed from numbers twelve or less. Each interval from the list is arranged from unity, keeping in mind that each compliment describes the same intervallic relationship in the opposite direction from unity. By placing both an interval and its compliment at the same time, the steps of the scale are arranged from both ends simultaneously, creating a symmetrical form. So, regardless as to if these are arranged upward from unity to an octave or downward to a lower octave, the resulting pattern of step sizes for the gamut is the same.

At this point, there are some wider gaps remaining in the gamut construction. Since no numbers twelve or less can create a fraction of lesser value that 12/11, that becomes the smallest step size in the system. As the interval described here is still larger than an equally tempered semitone and there are multiple examples of it in the system, Partch needed some methodology for filling in the extra space. To fill the gap from unity to 12/11 and the few other spaces in the fabric, Partch employs compound intervals, placing the new pitches in one of the simplest five-limit relationships (3/2, 4/3, 5/4, 6/5) to a pitch already in the system.[1] Let us now list the first twenty-two intervals of the harmonic fabric and their twenty-two complements:

[1] Partch, Harry. *Genesis of a Music.* (New York, NY: Da Capo Music) 1974, 129.

$\frac{1}{1}$	$\frac{81}{80}$	$\frac{33}{32}$	$\frac{21}{20}$	$\frac{16}{15}$	$\frac{12}{11}$	$\frac{11}{10}$	$\frac{10}{9}$	$\frac{9}{8}$	$\frac{8}{7}$	$\frac{7}{6}$	$\frac{32}{27}$	$\frac{6}{5}$	$\frac{11}{9}$	$\frac{5}{4}$	$\frac{14}{11}$	$\frac{9}{7}$	$\frac{21}{16}$	$\frac{4}{3}$	$\frac{27}{20}$	$\frac{11}{8}$	$\frac{7}{5}$
$\frac{2}{1}$	$\frac{160}{81}$	$\frac{64}{33}$	$\frac{40}{21}$	$\frac{15}{8}$	$\frac{11}{6}$	$\frac{20}{11}$	$\frac{9}{5}$	$\frac{16}{9}$	$\frac{7}{4}$	$\frac{12}{7}$	$\frac{27}{16}$	$\frac{5}{3}$	$\frac{18}{11}$	$\frac{8}{5}$	$\frac{11}{7}$	$\frac{14}{9}$	$\frac{32}{21}$	$\frac{3}{2}$	$\frac{40}{27}$	$\frac{16}{11}$	$\frac{10}{7}$
$\frac{81}{80}$	$\frac{55}{54}$	$\frac{56}{55}$	$\frac{64}{63}$	$\frac{45}{44}$	$\frac{121}{120}$	$\frac{100}{99}$	$\frac{81}{80}$	$\frac{64}{63}$	$\frac{49}{48}$	$\frac{64}{63}$	$\frac{81}{80}$	$\frac{55}{54}$	$\frac{45}{44}$	$\frac{56}{55}$	$\frac{99}{98}$	$\frac{49}{48}$	$\frac{64}{63}$	$\frac{81}{80}$	$\frac{55}{54}$	$\frac{56}{55}$	$\frac{50}{49}$

Row 1: first twenty-two tones in ascending size, left to right, compliments of Row 2

Row 2: second twenty-two tones in descending size, left to right, compliments of Row 1

Row 3: intervals from one tone to the next tone in the system

In total, there are ten different step sizes within the system, they are all superparticular and they are each repeated at least once in either half of the scale, except for 50/49 which falls at the exact midpoint of the scale. The difference between the size of the largest interval, 45/44 (30.9 cents) and the smallest, 121/120 (14.4 cents) is almost an eighth of a tone, 25.5 cents. There is no tritone which divides the system into two half-octaves of equal size. As Ben Johnston points out in his essay on Partch's *Cloud Chamber Music*, there is no second point of reflection; Partch only derives its pitches from intervals of the unity and their compounds, never transposing the same full system of intervallic ratios onto another tone in the system (e.g. dominant or subdominant). Regardless, it is still possible to modulate to different tonal centers or "magnetisms" within the system, albeit with increasing limitation the more distant the relationship with unity.

Contained within this collection of intervals are just intoned versions of the major and minor scales, a multitude of modal variants, as well as many scales found in various musical traditions of the world. A great number of the scales used in the ancient worlds of Classical Greece and Rome are contained in the system as well. In both civilizations, there existed a rigorous tradition of analysis, theory, and invention of scalar structures. Most of the tunings for these scales are preserved in the writings of philosophers, mathematicians, and scientists, as well as a few instruments whose proportions still accurately describe their tuning practice. In constructing this gamut, Partch affords himself access to each of these scale types for composition and the ability to conceive of new derivative scales employing multiple versions of the Greek enharmonic scale in *Two Studies of Ancient Greek Scales* (1946), *The Dreamer that Remains* (1972), and *On the Seventh Day Petals Fell in Petaluma* (1966).

In total, Partch describes twenty-eight different tonalities within the structure of the Monophonic Fabric through a system of pitch organization he calls the Tonality Diamond. The Tonality Diamond organizes the two dimensions of Otonality and Utonality along the two diagonals of the diamond's thirty-six composite diamonds. The unity occurs six times as 1/1, 9/9, 5/5, 11/11, 3/3, and 7/7, 3/2 a second time as 9/6 and likewise, 4/3 a second time as 12/9. The formation, with variations used as a type of keyboard or player interface for some instruments, arranges the ratios in Otonal relationships along the main diagonal of the diamond and in Utonal relationships along the antidiagonal:

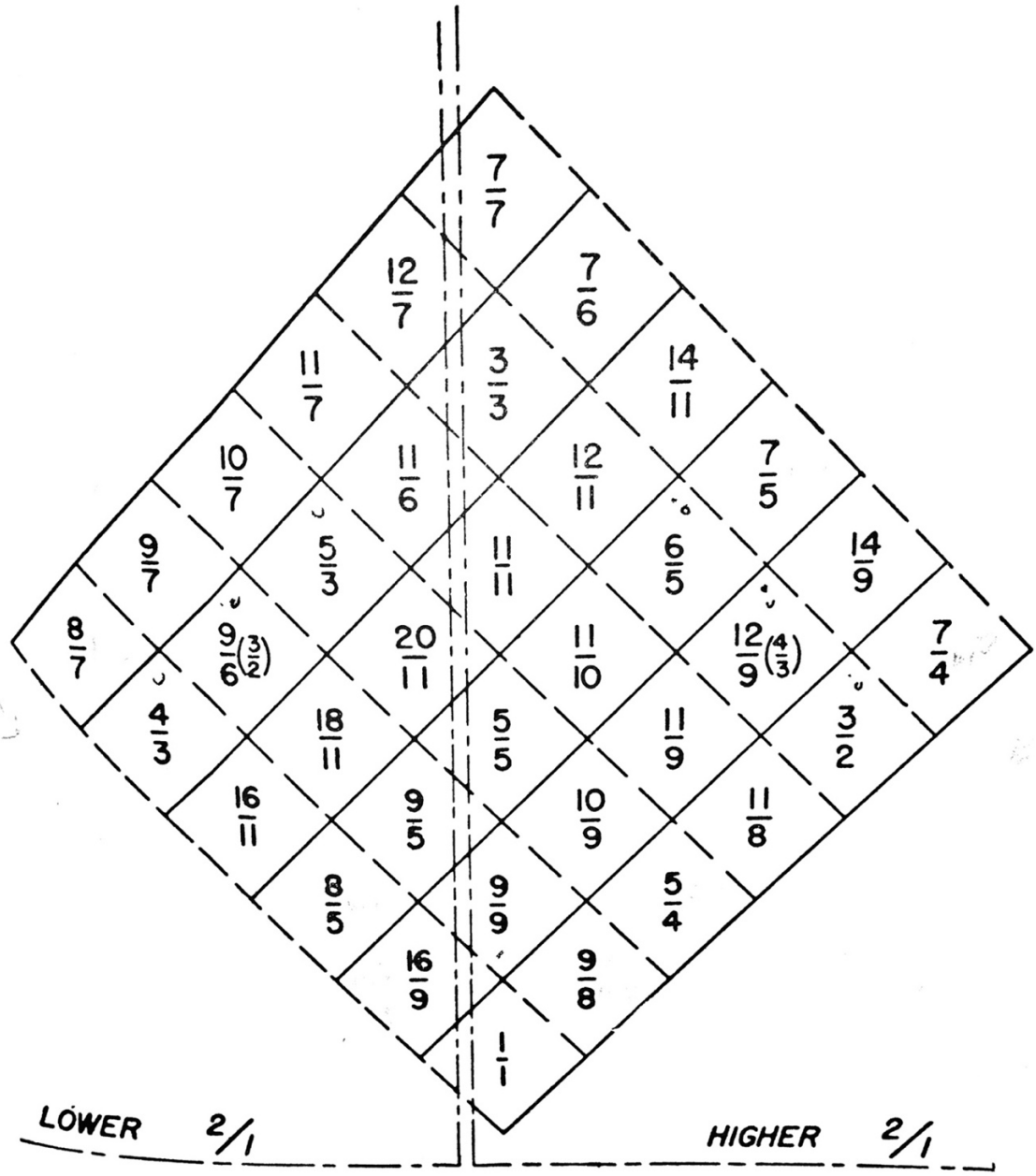


Diagram 9 from Partch's *Genesis of a Music*: "The Expanded Tonality Diamond," by Erv Wilson, p. 159. Note that at this point, Partch all but does away with the accepted note names and method for notation for most instruments, favoring the ratios he has established to describe their resulting pitches.

In addition to melodic organizations of pitch, the system also allows for a greatly extended vocabulary of chord structures for use in harmony. The twelve-tone chromatic scale is limited to four different types of triad (major, minor, augmented, diminished) and perhaps twelve quadrads, those triads plus major seventh, minor seventh, and diminished seventh. By constructing every permutation of every combination of numbers one, three, five, seven, nine, and eleven, we see that Partch's Monophony allows for twenty different types of triad, fifteen quadrads, and six quintads.[2] Partch does not mention the singular hexad formed by all six of these odd numbers in his discussion on the harmonies capable in Monophony, though he does tune the ranks of six strings on his Kithara instruments accordingly.[3]

Not all of Partch's instruments, designed and built by himself and a revolving team of musicians and instrument builders are capable of sounding every pitch from the Monophonic fabric. Most of them only provide a subset of the intervals capable in the full system and the music he writes for each instrument does not exceed its ability. The instrumentation of a piece may inform its pitch content just as much as the opposite could be true. The staging of the instruments themselves is essential to the setting of the musical material. Partch's compositions all involve some degree of theater set to a backdrop of the fantastic instruments in his ensemble. Though not every piece has a composed

[2] Partch, *Genesis of a Music*, 123-24.
[3] Ibid, 220.

theatrical element for performers beyond the musicians, many do (e.g. *Oedipus, Delusion of the Fury*). In performance, the ensemble is always staged for visual effect, enhancing the drama in the actions of the performers.

Instruments like the adapted guitars and viola and the Chromelodeon organ still follow the same form as the instruments they were adapted from, though the fret schema has been altered and the twelve notes of the chromatic scale no longer mapped to the standard "black and white" key arrangement. For these and many other reasons, standard musical notation does not suffice for many of the instruments of the Partch ensemble. Many instruments utilize tablature systems designed specifically for them, as in the Kithara, notated as groupings of six dots corresponding to the six strings of a single rank. Other instruments, like the marimbas: bass and boos, use notes along the staff, but with their ratios marked beneath them. The "Quadrangularis Reversum" uses this type of notation as well, but also incorporates both circular and triangular note heads designating notes in the right and left flanks respectively. The Chromeloedeon uses standard notation for keyboard instruments as its keyboard system remains unchained, however, the notated pitches do not correspond with those sounded by the instrument. In addition, the Chromelodeon has incorporated a color-coding system which correlates the odd numbered identity numbers in the ratios to colors on the keys.

As well-developed as his microtonal system of pitch organization and notation may be, it is not the single most defining characteristic of his

compositional output. Harry Partch's work as a composer has achieved a level of production unlike most others working at similar capacity as he was. Somehow, the ingenuity of his Monophonic fabric must share equal space with the other aspects of his visionary practice: the theatrical productions, the staging of the instruments, and the instruments themselves. For many experiencers of his music, the organization of this system may be secondary or even absent in their impressions of the work.

For the production of *Constructus Profanem*, I would have hoped to do as Partch did, designing and building each of the instruments I would use in my composition. This way the mysterious or otherworldly aesthetics of the instruments themselves begin to affect the audience's interpretation of the piece. However, my compositional ideas being much further developed than my luthery skills, I have yet to complete enough instruments for a work of this magnitude. Leaving the instrumentation open to allow for future creations I may construct, I chose to first imagine this work for an ensemble of Renaissance era instruments as I was already planning to use Renaissance formal structures throughout the work. Even more importantly, the string instruments of the era like the Lute family and the Viola da Gamba use tied on frets, making adding extra frets for extra notes without altering the construction of the instrument possible, but yet another problem with the original just tuning system arises here. The strings of these instruments are tuned in perfect fourths or 4/3 intervals with one another and unless the system can harmonize itself in parallel

intervals of this size, many extra frets will need to be added to cover the varying interval sizes for each individual string. While the practical need to comprise certain pitches in systems of just intonation is not unique to these instruments, this problem fretting lutes and viols is just as old as they are and methods for compromising the intonation of certain pitches have been explored by countless practitioners and theorists over the ages through the implementation of meantone temperaments.

While it seems the ear may tolerate most any combination of two pitches, no matter how much interference between their waveforms, when a third pitch is added, where before there was only one, now three complex pitch relationships occur. This is especially jarring, at least for most of us, if heard within the context of a piece of music or, for the most conservative of us, a musical tradition that more often than not favors the simplest relationships between multiple pitches (e.g. an unexpected occurrence of the wolf tone in a passage of music performed in a meantone tuning). The varying degrees to which any given pitch must be flexible in order to conform in simplest terms to all possible combinations of other pitches present creates a practical challenge for the composer, a technical challenge for the performer, and a contextual challenge for the listener. Some solutions we have found for these challenges include the development of the consort repertoire of the Renaissance, the gradual lessening of the severity of the wolf tone through the Classic Age of Music, the standardization of the twelve-tone equal temperament used for any music

realized at the standard piano or guitar (a lot of music), and the both abandonment of proportional twelve-tone tuning as well as harmonicity altogether through serialism. Although our tuning preferences have shifted, generally speaking, the idea that twelve notes span the octave has not.

Meantone temperaments preserve the unequal division of whole tone sized intervals by utilizing two different sized semitones, the larger referred to as diatonic and the smaller as chromatic. Yet meantone temperaments define a consistent size for all tones across the system. This means that the tempered position for a pitch between C and D will be nearer to one of the two surrounding pitches than it is to the other, but the distance from C to D will be the same as the distance from G to A or any other whole tone in the system. The difference between the possible tunings for a tone (or any two intervals of similar size) is called a “comma” and is the tuning discrepancy that must be resolved by the tempering process, breaking it into pieces which are added to other intervals in the system, compromising their intonation. The issue is that no interval that can be expressed as a ratio of simple whole numbers can be divided into or constructed from equal parts that can also be expressed as a ratio of simple whole numbers. The diabolic mythology around the twelve-tone equally tempered tritone (which divides the octave into two equal parts) has its roots here, but this is fact for just intervals of any size or ratio. The possibilities for dividing the comma have been the subject of debate for practitioners since the Renaissance and has led to the exploration of a variety of meantone

temperament strategies, each named for their method of comma division. An in-depth discussion of these techniques as they relate to fret spacing and orientation is well beyond the scope of this paper, but an extensive exploration of the topic is available in David Dolata's *Meantone Temperaments on Lutes and Viols* (2016).

Before any work had begun on *Constructus Profanem* I was very interested in two kinds of melody specifically: drone melodies and polyphonic ones. The combination of the two motivated me to analyze Renaissance melodic techniques and the latter lead me to back to Carlo Gesualdo, the deeply disturbed and murderous Count responsible for some of the most chromatically rich music created before the Romantic era. In trying to understand his approach to melodic writing, I discovered the influence of Nicola Vicentino's work, not only on Gesualdo, but on a slew of other fringe Renaissance composers experimenting with scale construction and even microtonality. Vicentino was a composer who had himself composed microtonal music, but it was his 1555 treatise "Ancient Music Adapted to Modern Practice" which I found so intriguing. In it he explains the Greek genera and their tuning but goes on to propose a method for composing and even learning to sing melodies using these scales, proposing a new system which he had hoped to become common practice.[4] Fundamental to his theory and teaching methodology was an

[4] Vincentino, Nicola. *Ancient Music Adapted to Modern Practice*. (New Haven, CT: Yale University Press) 1996, 317-17.

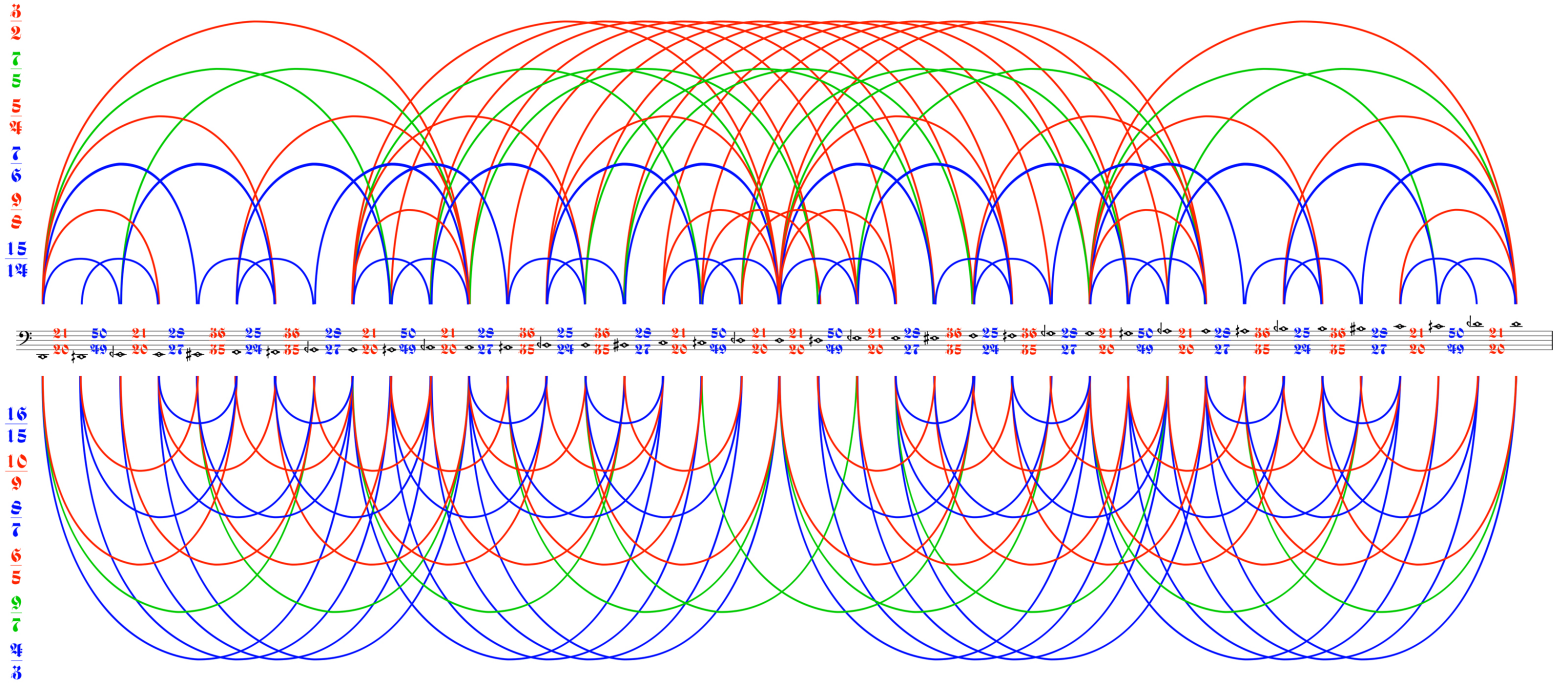
instrument of his own design called the “archicembalo,” a two-manual harpsichord with one manual configured in the normal way and a second with split black keys, a total of thirty-one keys inside a single octave. He offers two strategies for tuning the thirty-tone gamut, though the first seems questionable. Regardless of their effectiveness, a thirty-one-tone division of the octave and an instrument designed to facilitate its usage were the revelations I was searching for.

I set out to devise a system of my own that was simpler than Vicentino’s while still providing me with a greater variety of scales than twelve-tone with which to compose melodies and polyphony though I was not interested in doubling its resolution through the use of quartertones. By first placing each of the simplest three and five limit intervals: 3/2, 4/3, 5/4, 6/5, and 9/8, along with their compliments (8/5, 5/3, 9/16), the beginning framework for the tuning system was determined. As we have seen, using compliments for each interval creates a symmetrical structure. When we compare these pitches to one another, we find another 9/8 interval between 4/3 and 3/2 as well as some other new, smaller intervals. Between 4/3 and 5/4 we have 16/15, between 5/4 and 6/5 there is 25/24 and between 6/5 and 9/8, another 16/15. So, another point of symmetry emerges around the smallest interval, the 25/24. At this point I determined two things: first, that 25/24 might be preserved as the largest step size in the system and that those larger intervals would be further divided, 16/15 into two parts and 9/8 into three. Secondly, the 9/8 intervals would need to be divided in the

same manner as one another and that the manner should be symmetrical as to maintain a symmetrical system through the division of the central 9/8 interval and to allow for harmonic relationships of 3/2 and 4/3 between the pitches inside the central 9/8 and the 9/8s on either side of the fundamental.

The next prime number after five is seven so I wanted to try using seven limit intervals for the next set of divisions. By adding 7/6 to the system, a new pitch can be found which falls between 6/5 and 9/8 producing the smaller intervals 28/27 between 7/6 and 9/8 and 36/35 between 6/5 and 7/6. By reversing the order of these smaller intervals when dividing the 16/15 that falls between 4/3 and 5/4, effectively adding 36/35 to 5/4, the new interval found is 9/7 when referenced to the fundamental. The last step is to divide the 9/8 intervals. The next seven-limit interval to try is 7/5 and we see that it works fairly well as it is larger than 4/3 and smaller than 3/2. The interval between 7/5 and 4/3 is a seven-limit interval that is new to the system: 21/20. By mirroring the 21/20 within the 9/8 or by placing the compliment of 7/5, 10/7, we get a division of the 9/8 interval that puts two 21/20 sized intervals around a final, rather small interval of 50/49 that sits in the very center of the system, just like Partch's Monophony Fabric. In fact, when we compare this nineteen-tone, seven-limit gamut, we find that it is a subset of Partch's system which removes those intervals of higher prime limits.

JUST INTONATION NINETEEN-TONE DIVISION OF THE OCTAVE IN TWO OCTAVES TUNED OUTWARD FROM D



Red: Superparticular with prime limit in numerator, major unless perfect, “Otonal”
Blue: Superparticular with prime limit in denominator, minor unless perfect, “Utonal”
Green: Superpartient intervals

	D	Ebb D#	Eb Dx	E	Fb E#	F	Gbb F#	Gb Fx	G	Abb G#	Ab Gx	A	Bbb A#	Bb Ax	B	Cb B#	C	Dbb C#	Db Cx	D
D	$\frac{1}{1}$	$\frac{21}{20}$	$\frac{15}{14}$	$\frac{9}{8}$	$\frac{7}{6}$	$\frac{6}{5}$	$\frac{5}{4}$	$\frac{9}{7}$	$\frac{4}{3}$	$\frac{7}{5}$	$\frac{10}{7}$	$\frac{3}{2}$	$\frac{14}{9}$	$\frac{8}{5}$	$\frac{5}{3}$	$\frac{12}{7}$	$\frac{16}{9}$	$\frac{28}{15}$	$\frac{40}{21}$	$\frac{2}{1}$
Ebb D#	$\frac{40}{21}$	$\frac{1}{1}$	$\frac{50}{49}$	$\frac{15}{14}$	$\frac{10}{9}$	$\frac{8}{7}$	$\frac{25}{14}$	$\frac{60}{49}$	$\frac{80}{63}$	$\frac{4}{3}$	$\frac{200}{147}$	$\frac{10}{7}$	$\frac{40}{27}$	$\frac{32}{21}$	$\frac{100}{63}$	$\frac{80}{49}$	$\frac{320}{189}$	$\frac{16}{9}$	$\frac{800}{441}$	$\frac{40}{21}$
Eb Dx	$\frac{28}{15}$	$\frac{49}{25}$	$\frac{1}{1}$	$\frac{21}{20}$	$\frac{49}{45}$	$\frac{28}{25}$	$\frac{7}{6}$	$\frac{6}{5}$	$\frac{56}{45}$	$\frac{98}{75}$	$\frac{4}{3}$	$\frac{7}{5}$	$\frac{196}{135}$	$\frac{112}{75}$	$\frac{14}{9}$	$\frac{8}{5}$	$\frac{224}{135}$	$\frac{392}{225}$	$\frac{16}{9}$	$\frac{28}{15}$
E	$\frac{16}{9}$	$\frac{28}{15}$	$\frac{40}{21}$	$\frac{1}{1}$	$\frac{28}{27}$	$\frac{16}{15}$	$\frac{10}{9}$	$\frac{8}{7}$	$\frac{32}{27}$	$\frac{56}{45}$	$\frac{80}{63}$	$\frac{4}{3}$	$\frac{112}{81}$	$\frac{64}{45}$	$\frac{40}{27}$	$\frac{32}{21}$	$\frac{128}{81}$	$\frac{224}{135}$	$\frac{320}{189}$	$\frac{16}{9}$
Fb E#	$\frac{12}{7}$	$\frac{9}{5}$	$\frac{90}{49}$	$\frac{27}{14}$	$\frac{1}{1}$	$\frac{36}{35}$	$\frac{15}{14}$	$\frac{54}{49}$	$\frac{8}{7}$	$\frac{6}{5}$	$\frac{60}{49}$	$\frac{9}{7}$	$\frac{4}{3}$	$\frac{48}{35}$	$\frac{10}{7}$	$\frac{72}{49}$	$\frac{32}{21}$	$\frac{8}{5}$	$\frac{80}{49}$	$\frac{12}{7}$
F	$\frac{5}{3}$	$\frac{7}{4}$	$\frac{25}{14}$	$\frac{15}{8}$	$\frac{35}{18}$	$\frac{1}{1}$	$\frac{25}{24}$	$\frac{15}{14}$	$\frac{10}{9}$	$\frac{7}{6}$	$\frac{25}{21}$	$\frac{5}{4}$	$\frac{32}{27}$	$\frac{4}{3}$	$\frac{25}{18}$	$\frac{10}{7}$	$\frac{40}{27}$	$\frac{14}{9}$	$\frac{100}{63}$	$\frac{5}{3}$
Gbb F#	$\frac{8}{5}$	$\frac{28}{25}$	$\frac{12}{7}$	$\frac{9}{5}$	$\frac{28}{15}$	$\frac{35}{18}$	$\frac{1}{1}$	$\frac{36}{35}$	$\frac{16}{15}$	$\frac{28}{25}$	$\frac{8}{7}$	$\frac{6}{5}$	$\frac{56}{45}$	$\frac{32}{25}$	$\frac{4}{3}$	$\frac{48}{35}$	$\frac{64}{45}$	$\frac{112}{75}$	$\frac{32}{21}$	$\frac{8}{5}$
Gb Fx	$\frac{14}{9}$	$\frac{49}{30}$	$\frac{5}{3}$	$\frac{7}{4}$	$\frac{49}{27}$	$\frac{28}{15}$	$\frac{35}{18}$	$\frac{1}{1}$	$\frac{28}{27}$	$\frac{49}{45}$	$\frac{10}{9}$	$\frac{7}{6}$	$\frac{98}{81}$	$\frac{56}{45}$	$\frac{35}{27}$	$\frac{4}{3}$	$\frac{112}{81}$	$\frac{196}{135}$	$\frac{40}{27}$	$\frac{14}{9}$
G	$\frac{3}{2}$	$\frac{63}{40}$	$\frac{45}{28}$	$\frac{5}{3}$	$\frac{7}{4}$	$\frac{9}{5}$	$\frac{15}{8}$	$\frac{27}{14}$	$\frac{1}{1}$	$\frac{21}{20}$	$\frac{15}{14}$	$\frac{9}{8}$	$\frac{7}{6}$	$\frac{6}{5}$	$\frac{5}{4}$	$\frac{9}{7}$	$\frac{4}{3}$	$\frac{7}{5}$	$\frac{10}{7}$	$\frac{3}{2}$
Abb G#	$\frac{10}{7}$	$\frac{3}{2}$	$\frac{75}{49}$	$\frac{49}{30}$	$\frac{5}{3}$	$\frac{12}{7}$	$\frac{25}{14}$	$\frac{90}{49}$	$\frac{40}{21}$	$\frac{1}{1}$	$\frac{50}{49}$	$\frac{15}{14}$	$\frac{10}{9}$	$\frac{8}{7}$	$\frac{25}{21}$	$\frac{60}{49}$	$\frac{80}{63}$	$\frac{4}{3}$	$\frac{200}{147}$	$\frac{10}{7}$

	D	Ebb D#	Eb Dx	E	Fb E#	F	Gbb F#	Gb Fx	G	Abb G#	Ab Gx	A	Bbb A#	Bb Ax	B	Cb B#	C	Dbb C#	Db Cx	D
Ab Gx	$\frac{7}{5}$	$\frac{147}{100}$	$\frac{3}{2}$	$\frac{14}{9}$	$\frac{49}{30}$	$\frac{42}{25}$	$\frac{7}{4}$	$\frac{9}{5}$	$\frac{28}{15}$	$\frac{49}{25}$	$\frac{1}{1}$	$\frac{21}{20}$	$\frac{49}{45}$	$\frac{28}{25}$	$\frac{7}{6}$	$\frac{6}{5}$	$\frac{56}{45}$	$\frac{98}{75}$	$\frac{4}{3}$	$\frac{7}{5}$
A	$\frac{4}{3}$	$\frac{7}{5}$	$\frac{10}{7}$	$\frac{3}{2}$	$\frac{14}{9}$	$\frac{8}{5}$	$\frac{5}{3}$	$\frac{12}{7}$	$\frac{16}{9}$	$\frac{28}{15}$	$\frac{40}{21}$	$\frac{1}{1}$	$\frac{28}{27}$	$\frac{16}{15}$	$\frac{10}{9}$	$\frac{8}{7}$	$\frac{32}{27}$	$\frac{56}{45}$	$\frac{80}{63}$	$\frac{4}{3}$
Bbb A#	$\frac{9}{7}$	$\frac{27}{20}$	$\frac{135}{98}$	$\frac{81}{56}$	$\frac{3}{2}$	$\frac{54}{35}$	$\frac{45}{28}$	$\frac{81}{49}$	$\frac{12}{7}$	$\frac{9}{5}$	$\frac{90}{49}$	$\frac{27}{14}$	$\frac{1}{1}$	$\frac{36}{35}$	$\frac{15}{14}$	$\frac{54}{49}$	$\frac{8}{7}$	$\frac{6}{5}$	$\frac{60}{49}$	$\frac{9}{7}$
Bb Ax	$\frac{5}{4}$	$\frac{21}{16}$	$\frac{75}{56}$	$\frac{45}{32}$	$\frac{35}{24}$	$\frac{3}{2}$	$\frac{25}{16}$	$\frac{45}{28}$	$\frac{5}{3}$	$\frac{7}{4}$	$\frac{25}{14}$	$\frac{15}{8}$	$\frac{35}{18}$	$\frac{1}{1}$	$\frac{25}{24}$	$\frac{15}{14}$	$\frac{10}{9}$	$\frac{7}{6}$	$\frac{25}{14}$	$\frac{5}{4}$
B	$\frac{6}{5}$	$\frac{63}{50}$	$\frac{9}{7}$	$\frac{27}{20}$	$\frac{7}{5}$	$\frac{36}{25}$	$\frac{3}{2}$	$\frac{54}{35}$	$\frac{8}{5}$	$\frac{42}{25}$	$\frac{12}{7}$	$\frac{9}{5}$	$\frac{28}{15}$	$\frac{35}{18}$	$\frac{1}{1}$	$\frac{36}{35}$	$\frac{16}{15}$	$\frac{28}{25}$	$\frac{8}{7}$	$\frac{6}{5}$
Cb B#	$\frac{7}{6}$	$\frac{49}{40}$	$\frac{5}{4}$	$\frac{21}{16}$	$\frac{49}{36}$	$\frac{7}{5}$	$\frac{35}{24}$	$\frac{3}{2}$	$\frac{14}{9}$	$\frac{49}{30}$	$\frac{5}{3}$	$\frac{7}{4}$	$\frac{49}{27}$	$\frac{28}{15}$	$\frac{35}{18}$	$\frac{1}{1}$	$\frac{28}{27}$	$\frac{49}{45}$	$\frac{10}{9}$	$\frac{7}{6}$
C	$\frac{9}{8}$	$\frac{189}{160}$	$\frac{135}{112}$	$\frac{81}{64}$	$\frac{21}{16}$	$\frac{27}{20}$	$\frac{45}{32}$	$\frac{81}{56}$	$\frac{3}{2}$	$\frac{14}{9}$	$\frac{49}{30}$	$\frac{5}{3}$	$\frac{7}{4}$	$\frac{9}{5}$	$\frac{15}{8}$	$\frac{27}{14}$	$\frac{1}{1}$	$\frac{21}{20}$	$\frac{15}{14}$	$\frac{9}{8}$
Dbb C#	$\frac{15}{14}$	$\frac{9}{8}$	$\frac{225}{196}$	$\frac{135}{112}$	$\frac{5}{4}$	$\frac{9}{7}$	$\frac{75}{56}$	$\frac{135}{98}$	$\frac{10}{7}$	$\frac{3}{2}$	$\frac{75}{49}$	$\frac{45}{28}$	$\frac{5}{3}$	$\frac{12}{7}$	$\frac{25}{14}$	$\frac{90}{49}$	$\frac{40}{21}$	$\frac{1}{1}$	$\frac{50}{49}$	$\frac{15}{14}$
Db Cx	$\frac{21}{20}$	$\frac{441}{400}$	$\frac{9}{8}$	$\frac{189}{160}$	$\frac{49}{40}$	$\frac{63}{50}$	$\frac{21}{16}$	$\frac{27}{20}$	$\frac{7}{5}$	$\frac{147}{100}$	$\frac{3}{2}$	$\frac{63}{40}$	$\frac{49}{30}$	$\frac{28}{25}$	$\frac{7}{4}$	$\frac{9}{5}$	$\frac{28}{15}$	$\frac{49}{25}$	$\frac{1}{1}$	$\frac{21}{20}$
D	$\frac{2}{1}$	$\frac{21}{20}$	$\frac{15}{14}$	$\frac{9}{8}$	$\frac{7}{6}$	$\frac{6}{5}$	$\frac{5}{4}$	$\frac{9}{7}$	$\frac{4}{3}$	$\frac{7}{5}$	$\frac{10}{7}$	$\frac{3}{2}$	$\frac{14}{9}$	$\frac{8}{5}$	$\frac{5}{3}$	$\frac{12}{7}$	$\frac{16}{9}$	$\frac{28}{15}$	$\frac{40}{21}$	$\frac{1}{1}$

This version of a nineteen tone to the octave system works fairly well, but there are five different interval sizes that make up the system: 21/20, 25/24, 28/27, 36/35 and 50/49 in order of descending size. Were this a single scale, five different step sizes would be far too many, but seeing as it is meant as a gamut to extract scales from, I see less of an issue. However, I do have one complaint concerning the issue of "coherency" as described by David Rothenberg and Gerald Balzano.[5] A scale or tuning system is coherent when none of the steps are more than twice the size of any of the others. The conflict is in the use of the 50/49 interval. Two of intervals of this size can fit in either 21/20 or 25/24 and while I might accept this if the interval was only at the center of the symmetrical system, because of the motivation to divide the three 9/8 intervals in the same way, there are now three of these 50/49 intervals in the system. And that is not the only drawback to the system.

Vicentino's and Partch's interest in the Greek genera had motivated me to try to find ways to incorporate the tunings into this system. Much of the information we have for the tunings of the Genera comes from Ptolemy's "Harmonics." In it, he shows a particular fondness for the now lost work of Archytas of Tarentum, and the 28/27 sized interval is what Archytas uses for the first step for all of his modes.[6] Kathleen Schlesinger's work studying the tunings of extant examples of Greek auloi shows that Archytas' versions of these scales

[5] A conversation with Professor Larry Polansky introduced me to the Rothenberg Property.
[6] Jon Solomon, *Ptolemy "Harmonics": Translation and Commentary* (Leiden: Brill, 2000), 43.

were used in the construction of auloi.[7] The use of the 28/27 for the first interval of a scale allows for a harmonic relationship of 7/6 when the upper note is played against a subtonic scale degree that is tuned 9/8 below the fundamental. So another option would be to replace each of the 21/20 intervals with a 28/27 which is already in the system between the 9/8 and 7/6. Unfortunately, this replaces the 7/5 with a far less attractive 111/81 and even worse, the three steps that were once 50/49 are now 6561/6272. Knowing that a nineteen-step division of the octave would be my approach to this work, but feeling unsettled about the precise interval organization, I began to explore the work of earlier composers and theorists dealing with similar issues.

Nineteen-tone divisions of the octave have been discussed as alternatives or an evolution of the twelve-tone division since at least the sixteenth century. First described in mathematical terms in Francisco de Salinas' 1577 treatise *De musica libri septem*, 1/3 comma meantone divides the tone into two intervals, one essentially half the size of the other. If the larger of these two intervals is further broken down into two of the smaller, adding new pitches to the system for each new division, seven new pitches are added for a total of nineteen in the system. Salinas even suggests that a keyboard of nineteen pitches could be used to realize compositions in circulating meantone.[8] Even earlier in 1558, the French

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[7] Schlesinger, Kathleen. *The Greek Aulos: A Study of its Mechanism and of its Relation to the Modal System of Ancient Greece.* (London: Methuen) 1939, 201.

[8] Salinas, Francisco de, *De musica libri septem*, Mathias Gastius, Salamanca, 1577, 1592. Reprint M.S. Kastner (ed.), Documenta Musicologica I no. 13 (Kassel: Bärenreiter, 1958).

composer and organist Guillaume Costeley composed the chanson *Seigneur Dieu ta Pitié*. The composition specifies dividing the tone into three equal parts and the diatonic semitones from B to C and E to F into two equal chromatic semitones resulting in a nineteen-tone, equally tempered system. Just as is the case with twelve tone equal temperament when fretting a lute or viol, so long as the fundamental for each string is tuned to a pitch falling within the equally tempered system, a single fret placement will function across all strings in any equally tempered system, producing the other tones within the system. This means that an equally spaced nineteen tone division of the octave would require the fewest number of frets to realize on a lute or viol but can still be used effectively as a meantone temperament. Remarkably, when we compare the size of this chromatic semitone, one nineteenth of an octave, to its nearest just ratio, we find that it is nearly identical to that of the 28/27 ratio (only an imperceptible .2 cents sharp) found in the tunings of Archytas.

By the Nineteenth century the exploration of tuning and temperament had become largely a practice of organ designers and scientists rather than being maintained within the tradition of musical composition. In his 1877 "On the Sensation of Tone," German Physicist Hermann Helmholtz discusses a number of nineteenth century inventors developing vast arrays for extended just-intoned and tempered organ or harmonium tunings. Many of these designs all but bypass nineteen and even thirty-one note divisions of the octave in favor of much larger divisions of fifty-three, seventy-eight and one hundred and six tone

divisions. One of these figures, the American engineer Henry Ward Poole proposed a layout for extended just intonation that, while too impractical to ever see a physical realization, influenced another American, Paul White's harmonium design. White's Harmonium features a fifty-three tone, equally tempered keyboard which organizes chains of like intervals along each diagonal and must have influenced Partch's tonality diamond. One other designer that favored fifty-three tone equal temperament was the English scientist RHM Bosanquet whose harmonium features what he calls the "generalized keyboard." Here he makes the point that "every key is surrounded by the same definite arrangement of keys, and that a pair of keys in a given relative position corresponds always to the same interval."[9]

In the twentieth century we see western composers begin to explore tuning once more and with that a new found interest in nineteen-tone divisions of the octave. Joel Mandlebaum's 1961 dissertation "Multiple Division of the Octave and the Tonal Resources of Nineteen-Tone Temperament" explores nearly every conceivable aspect of a nineteen-tone octave division with specific interest to the composer. Mandelbaum's work follows a number of other advocates of nineteen-tone octave divisions, namely Joseph Yasser's "A Theory of Evolving Tonality," published in 1932 adds seven "auxiliary" tones to the twelve-tone system, totaling nineteen. From there, Mandelbaum discusses not

[9] Helmholtz, Hermann L. F. *On the Sensations of Tone: as a Physiological Basis for the Theory of Music*. (New York: Dover) 1954, 479.

only nineteen-tone divisions of the octave, but countless other divisions greater than twelve, though he limits his exhaustive approach to the fifty-three tone division used by Bosanquet and White. Mandelbaum explores various tuning strategies for the nineteen-tone division beyond an equally tempered system with a particular interest in the "Golden System" of Thorvald Kornerup which intends to set the sizes of the diatonic and chromatic semitones to the golden ratio: 118.9 and 79.5 cents respectively. He goes on to discuss scale construction for any number of tones within the system and catalogs each possible triad, tetrad, and pentad, while also mentioning the system's one possible hexad. He explains the melodic tendencies for the tones in each scale and the harmonic motion implied by each chord possibility. He does not, however, discuss any scalar construction using more than two sizes of interval nor does he allow for intervals that vary by more than the smallest unit of division: one nineteenth of an octave. This means that he is unable to show a nineteen-tone equivalent for scales using augmented intervals like harmonic minor or the double harmonic scale.

The dissertation includes Mandelbaum's composition "Nine Short Preludes for Two Pianos in Nineteen-tone Equal Temperament," for which he describes tuning the white keys of one piano to their diatonic equivalent in the temperament and the other with flat versions of each of those pitches, so one third of a tone lower. Both pianos have their black keys tuned for the sharp accidentals, a third of a tone up from their diatonic versions. Mandelbaum

suggests that "with the mastery by the ear would come the availability of the vocal and string media as well as the slide trombone."[10] He goes on to suggest microtonal crooks for valved brass and multi-tiered key systems for wind instruments as methods for realizing music in nineteen-tone. However, the quartertone valves found more commonly on brass instruments today than in the 1960s could be retuned for 1/3 tone use and the greater fluency modern wind players have with alternate fingerings should be more than adequate.

Mandelbaum and colleagues: John Chalmers, Ivor Darreg, and Erv Wilson were advocates for Harry Partch's work in just intonation and instrument design. Erv Wilson worked closely with Harry Partch, assisting in the creation of the "Quadranglus Reversum" and creating the diagrams for "Genesis of a Music." He also developed the Wilson-Hackelman keyboard for several clavichords in nineteen-tone equal temperament based on the "generalized keyboard" of Bosanquet. Of the four, Ivor Darreg is nineteen-tone's next greatest supporter, building a number of fretted instruments he calls "Megalyra" for the system. He writes about the relationship between nineteen and thirty-one tone temperaments and their use as meantone tunings in his "A Case for Nineteen:"

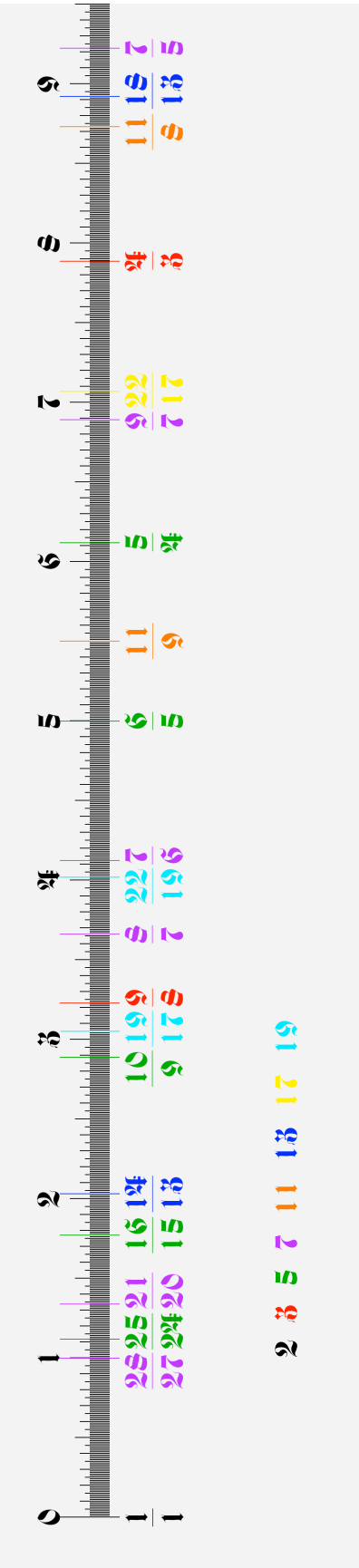
[10] Mandelbaum, Joel. "Multiple Division of the Octave and the Tonal Resources of Nineteen-Tone Temperament," (PhD Diss., Indiana University) 1961, 382.

> "the moods of the two systems are very different and we need BOTH moods for their valuable contrast. Briefly, thirty-one favors harmony over melody while nineteen has a much stronger melodic impact, but both systems are varieties of meantone and so mathematically related. Both fit ordinary musical notation" and he goes on to add "there is no need to be stuffy or perfectionist about exact tuning of nineteen. The serious performer, especially on the violin family, will make various expressive deviations, and this works as well in nineteen as it does in twelve -- in fact we could never have endured twelve for two centuries, if soloists hadn't made those deviations!"

It is not my personal belief that executing this music in rigid nineteen tone equal temperament or a circulating 1/3 comma meantone is the ideal method for realizing it. I support Darreg's assertion that deviation from the exact tunings of an equal temperament system can lead to more musical realizations of compositions in the tuning. Just as a violinist may learn to raise their thirds or a brass choir may not temper notes played on the fifth partial, the flexibility of intonation should be explored among the ensemble. In particular, a subtle widening of fifths is always acceptable here as we know the interval is roughly six cents too narrow in the temperament. In *Meantone Temperament on Lutes and Viols,* David Dolata describes playing directly over the fret versus slightly behind as having different intonations and that increasing the pressure behind the fret can raise the pitch as much as nine cents, more than enough to force a fifth in tune as a 3/2 ratio. Pushing the string against the fret and

towards the bridge can lower the pitch, to a lesser extent than it can be raised and less so near the nut than further down the neck, but still to enough a degree as to bring fourths in tune as 4/3 ratios.[11] Ultimately, the decision to attempt a strict nineteen tone performance or one where diatonic pitches are closer to just intoned ones and accidentals alter the pitch by a 28/27 ratio is up the performers, their personal preferences, and goals as musicians and an ensemble.

[11] Dolata, David. *Meantone Temperaments on Lutes and Viols*. Bloomington: Indiana University Press, 2016, 180 – 82.



This figure represents exactly half of a nineteen-tone equally tempered octave, the distance of an equally tempered tritone. Colors are used to show prime-limit identities for just intervals.

Let us take a moment and compare nineteen tone equal temperament to some simple whole number ratios derived from the harmonic series. We can see that the minor third and major sixth are practically in tune with the 6/5 and 5/3 ratios, as is the chromatic semitone or smallest step of nineteen tone with the 28/27 ratio. The perfect fourth and fifth are about six cents off from just and performers may choose to use performance techniques to intonate these intervals more closely to 4/3 or 3/2 respectively. The biggest compromise I find in using nineteen tone equal temperament is the compromise of the 9/8 tone for a much narrower interval. While the new interval is relatively close to a 10/9 ratio – a ratio which defines the tone between the second and third scale degree in a major scale in just intonation – it is even closer to the nineteen-limit interval 19/17. Losing the 9/8 tone means that augmenting the interval by 28/27 no longer creates a true 7/6 harmonic relationship as used in Archytas' scales, but we can still come closer to approximating the interval than twelve-tone does in approximating just thirds. However, this distance of four chromatic semitones is most accurately a representation of the nineteen limit interval 22/19. Along with the major third, which is built from six chromatic semitones and sounds about half as flat as it is sharp in twelve-tone equal temperament, these intervals and their compliments should be harmonic reference points for the system. Knowing what direction an interval is off from its just counterpart and shading those pitches accordingly in practice and performance can be

meaningful practice for an ensemble, producing harmonically rich music.

19-TONE				12-TONE	
Name of tone	Interval from C	Cents	Cents	Interval from C	Name of tone
C	perfect prime	00	00	perfect prime	C
C♯	aug.prime-dim. 2nd	63			
Db	minor second	126	100	minor second	Db (C♯)
D	major second	189	200	major second	D
D♯	aug.2nd-dim. 3rd	253			
Eb	minor third	316	300	minor third	Eb (D♯)
E	major third	379	400	major third	E
E♯-Fb	aug.3rd-dim. 4th	442			
F	perfect fourth	505	500	perfect fourth	F
F♯	augmented fourth	568			
Gb	diminished fifth	632	600	aug. 4th; dim. 5th	F♯-Gb
G	perfect fifth	695	700	perfect fifth	G
G♯	aug.5th-dim. 6th	758			
Ab	minor sixth	821	800	minor sixth	Ab (G♯)
A	major sixth	884	900	major sixth	A
A♯	aug.6th-dim. 7th	947			
Bb	minor seventh	1011	1000	minor seventh	Bb (A♯)
B	major seventh	1074	1100	major seventh	B
B♯-Cb	aug.7th-dim. 8th	1137			
c	perfect octave	1200	1200	perfect octave	c

Comparison of Nineteen-tone and Twelve-tone equal temperament in cents from Mandelbaum's "Multiple Division of the Octave and the Tonal Resources of Nineteen-Tone Temperament."

While the choice to work in an equal temperament forces certain compromises, it most importantly allows for the use of standard instruments, but in the case of fretted strings a different fretting arrangement must be used. The viol typically uses seven frets, the last being a perfect yet tempered fifth and the lute usually has eight, reaching a minor sixth. When we compare the fifths of nineteen and twelve-tone equal temperament with the just 3/2 tuning for the interval, we find the tuning slightly sharp (about two cents) in twelve tone and flat by slightly more (about six cents) in nineteen tone. This means that the

regular seventh fret on one of these instruments must be slightly lowered and four more frets added in between it and the nut. Depending on the construction of the lute, there may be room for one or two frets between the newly positioned eleventh fret and the point where the neck joins the body and I leave it to the performer to decide what is necessary. Historically, performers of these instruments have used the "rule of eighteen" and more recently, the more precise 17.817… as the constant by which they determine the fret placement in twelve-tone equal temperament. By dividing the overall string length (from bridge to nut) by the constant, the distance to the first fret can be calculated and further fret positions determined by dividing the distance from the previously positioned fret to the bridge by the same constant. For a nineteen-tone fret spacing, the process is the same, but the constant is $1/1-(1/19\sqrt{2})$ or 27.914…

While the specific instrumentation for *Constructus Profanem* is left open, I am imagining it for the small early music orchestra-type ensemble described in the performance notes. There are varying degrees of flexibility with regards to instrument substitution determined by the tuning strategies employed in the composition of the work. We have just covered the viols and lutes on which frets can be added and repositioned accordingly, but other fretless instruments could also have frets tied or glued on en lieu of those constructed using nineteen tone equal temperament. A reed or chest organ can be used as a substitute for bass recorder or potentially the entire recorder section. Harpsichords, virginals, or clavichords may be used alongside or instead of the plucked strings and it is an

exciting prospect to imagine a realization of this work using a Wilson-Hackelman generalized keyboard clavichord, or even a double manual harpsichord tuned similarly to Mandelbaum's pianos. However, access to all nineteen tones is not actually necessary for the keyboards as their material is limited to the CANTUS FIRMUS melody and variations which only use a nine-tone scale. The PROFANUS exceeds these nine pitches but would only require keyboards if substituting for other instruments and even then, it does not exceed twelve notes. The issue of tuning is of little to no consideration for the percussion as they require no specifically tuned instruments but has stronger implications for the brass and recorders.

Though originally, I had wanted to use natural horns which by nature play only in just intonation, the shift to nineteen tone equal temperament prompted the use of sackbuts, an early relative of the trombone. The compromise is in losing access to many of the upper partials available to the natural horn in favor of the variable tube length of the sackbut, but valved brass instruments, especially french horns, equipped with 1/3 tone valves are also an excellent option. Still, the seventh harmonic of the overtone series is easily reached by a capable instrumentalist making seven-limit harmonies readily accessible. In order to execute music tuned in this way, one must learn a new mapping of positions for the slide of the sackbut or trombone. Where in twelve tone equal temperament the instrument utilizes seven slide positions, nineteen tone requires eleven. First position stays the same and fifth position becomes the

new ninth position. Third position is the fourth position in nineteen tone and is practically in the same location though theoretically, it should be ever so slightly closer in. The new seventh position is slightly closer than twelve tone's fifth position and should feel as far from fourth as fourth is from first; then each of those gaps get two positions in between them. Eighth position reveals itself between seventh and ninth with tenth and eleventh following suite, eleventh being a full arm's stretch. I find the easiest way to think about it is to learn the diatonic scale with pitches adjusted according to the positions described and then raise or lower by one position according to the accidental given, essentially learning the distance to slide for the chromatic semitone.

The alto and/or tenor recorders could be performed instead on shawm, baroque oboe, or flute; almost any wind instrument could work and the tuning should not be impossible. If an organ in circulating 1/3 comma meantone was available, both recorders and the reed organ parts could all be performed on it together. I am not the most practiced recorder player but have had luck by using standard fingerings for diatonic pitches and lowering one chromatic semitone with the standard "fork" which means skipping one uncovered hole of the standard fingering and covering the next then I let the note go sharp for a flat accidental. For a sharp, one must use the fingering for the whole tone above and add the fork plus one more finger, skipping one whole and covering two. In fact, every hole you cover after skipping one open hole lowers the pitch further. Slightly covering the holes has a similar effect, so there is great flexibility for

intonation on the instrument. Trained wind players will have a much greater knowledge of alternate fingerings techniques used to raise or lower pitches for better intonation and should employ this knowledge in rehearsal, learning the best versions by tuning to the rest of the ensemble. Recorder players with experience performing in meantone temperaments, especially ¼ comma, should transition easily so long as the prospect interests them.

As we know, the Renaissance was a time of scientific discovery and invention which lead directly to the development of all the instruments I have suggested for the realization of this work. However, the voice maintained supremacy over instrumental music partially due to lingering medieval superstitions about its purity as a divine gift, but this also has practical implications. The voice has no need for temperament or tuning strategies at all as it is perfectly capable of extremely fine adjustments which can be utilized by trained singers to great musical effect. This allows choral ensembles to tune to just intonation (or any other internalized intonation practice) in real time creating the purity of consonance we still associate with choral music today, even when the performance is not actually in just intonation. Still, *Constructus Profanem* is an entirely instrumental work celebrating instrument design, construction, and techniques as well as the unique acoustic properties of a space. To better explore the various parameters of these ideas, I began conceptualizing the work as a series of smaller works that would play out in various locations throughout the space, some of which would be instrumental forms common

during the period. This would require an overarching framework for a multi-movement composition and the Renaissance form that best fits this description is the Mass. However, Mass forms set a specific set of biblical verses to music to be sung by groups of singers. In the Middle Ages the Mass was strictly acapella and while compositions of this kind from later eras have often included instrumental accompaniment, the voice or voices remain the focus of the work. Despite the rather appropriate modern and technical definitions of an Opera, today the genera has become so mainstream that evoking the tradition fails to put the audience in any kind of shared sense of reverence or ceremony. And again, the form is widely understood to mean a theatrical piece in which the characters sing, so just like the Mass, the Opera is a work that showcases the voice. Without any Renaissance era multi-movement instrumental forms to choose from, I decided to continue working with versions of the Mass knowing that whatever the piece would become would corrupt the form.

Coming to this understanding, I began exploring settings of the "Black Mass." The depictions we have of the Black Mass are more than likely rumors and hearsay by early Catholics themselves, imagining the most evil corruption of their most sacred rite and the details of these rumored events range from hypersexual events, to gross or depraved acts, to extreme violence and cruelty. None of these ideas are the kind of profanity I was interested in exploring. Now, the form has grown into something practiced less by true followers of Satan and more so by those seeking a spiritual practice that is in some kind of opposition

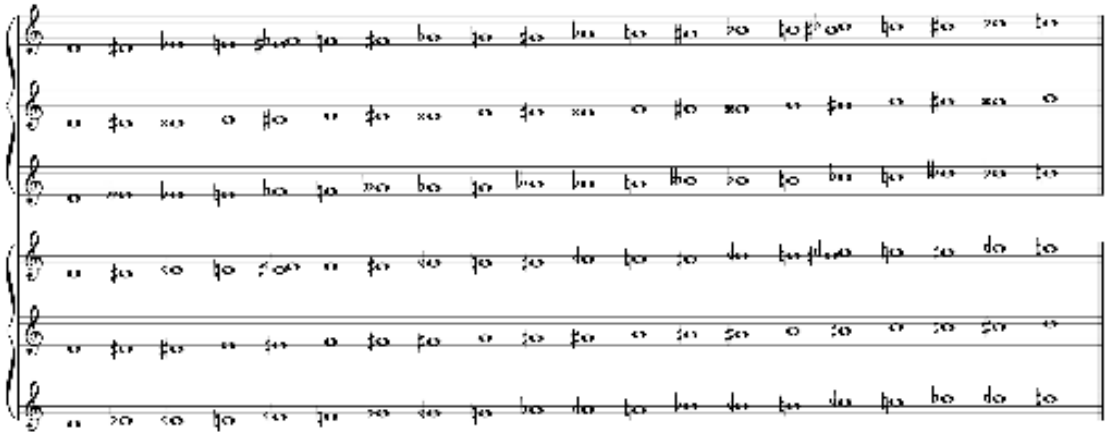
with contemporary forms of Christianity and its history of persecution and domination and the more modern rituals I found were problematic for other reasons. The first attempt to describe the rites of a black mass as understood by true followers of Satan can be found in H. T. F. Rhodes' *The Satanic Mass* (1954) and has influenced most versions of the rite since. Most notably, the influence of Rhodes' work can be seen in Anton LaVey's *The Satanic Bible* and *The Satanic Rituals* which are key texts describing the production of rites in the Satanic Church, the branch of Satanism founded by LaVey himself. LaVey documented one of these ceremonies for audio release in 1968, the same year the rock band Coven recorded their debut *Witchcraft Destroys Minds and Reaps Souls* (1969) which ends with a theatrical track or skit entitled "Satanic Mass." Neither of these versions of Satanic or Black masses appeal to me. It seems that most of LaVey's motivations behind codifying Satanism and founding a movement behind it were solely financial as reported by the Federal Bureau of Investigation. Coven's attempt is more interesting as it seems to be an exercise in world-building on the part of the band, creating an untold backstory for the band as practitioners of dark arts. This is far closer to the exploration of the profane that *Constructus Profanem* employs, but Coven does not necessarily exist in that world and utilizing their "Satanic Mass" would forever bind the two.

Moving away from the idea of the Black Mass, I began thinking about other Mass forms to work with. The Requiem Mass is written specifically in honor of someone or persons who have died, but it affords the composer with a

much more flexible form than the traditional Mass. Its earliest examples were composed by the Renaissance composers Ockeghem and Dufay in the mid fifteenth century, although the earlier of the two, composed by Dufay, has since been lost. Since this time composers have explored the form with examples of major works being added to the western canon in every period following with no two versions following the same construction. Berlioz' *Grande Messe des Morts* (1835), Brahms' *German Requiem* (1868), and Penderecki's *Polish Requiem* (2005) are notable as being significant deviations from prior versions of the form, Berlioz for his massive production and Brahms for setting his work in German rather than Latin. Penderecki follows Brahms' use of the vernacular.

While *Constructus Profanem* does take its structure and movements from the Requiem Mass, it has no choral component and it uses the form very loosely and as such is not a true Requiem. It does not make any use of biblical verse in the construction of the movements and its "profanity" is in casting aside the word of god in favor of earthly and intellectual pleasures in the form of instrumental music. It does however borrow formal structures within the Mass form to organize its structure and even follows certain formal guidelines for subsections. However, nearly half the time the work references the form it is subverting it. Much like the Black Masses of French literature and LaVeyan Satanism, the sacred form is used both to elicit a heightened sense of spiritual significance within the setting of the piece and to challenge or reimagine an established structure while recognizing if not reveling in its corruption.

In the melodic and scalar examples that follow, I use the standard notation for nineteen-tone as described by Mandelbaum, but I also make some use of an adapted quartertone notation. While differentiating between flats and sharps makes for an economical use of standard notation, I find the quartertones more legible when reading the music. The following chart compares both systems of notation from D to D with all vertically aligned notes representing alternate spellings of the same pitch. The top three staves are in standard notation and the bottom three in adapted quartertone. The top line gives mixed notation, the second line sharps only and the third flats. Note that the enharmonic equivalency of B# and Cb as well as that of E# and Fb.



MOVEMENT	INSTRUMENTATION or PERSONEL	INTONATION	DENSITY and RHYTHM	FORM
INTROITUS	Bells performed by Recorder Players Plucked String Players Keyboardists Percussionists	n/a	Building Texture of Repeating Rhythmic Gestures	A Gentle Call to Attention Becomes Background For Next Movement
REQUIEM ÆTERNAM	Brass Bowed Strings	Nineteen-tone and Just Intonation	Short Note/Long Note Notation	Performed While Previous Movement Wains
GRADUAL	Brass Only	Just Intonation	Long Tones Overlapping to Create Pulsing Rhythm	Canon at Halfnote
TRACTUS	Full Ensemble	Nineteen-tone Subset. The CANTUS FIRMUS Scale.	Steady, Led by Percussion	Psuedo-Basse Danse
SEQUENCE	All Musicians not Performing the PROFANUS	Just Intonation	Drone	Improvised Exploration of Harmonic Spectrum
PROFANUS	Recorders One Plucked String One Bowed String One Percussionist	Nineteen-tone Expanded version of CANTUS FIRMUS scale (12 pitches total)	Rhythmic Dance	Saltarello dance form uses material from SEQUENCE as drone accompaniment
CAPER SABBATI	Full Ensemble	Nineteen-Tone Scalar Subset of Nine Pitches	Slowly Building Polyphonic Melodies	Prolation Canon
ELEGIA	Bowed Strings	Nineteen-tone All pitches in system used	Three-part polyphony	Chaconne with variation in the form of upward modulation

The first movement is the INTROITUS which serves to set the stage for the unfolding choreography that progresses through the piece. It has very little musical material, only sustained ringing of small hand-held bells performed by the percussionists, keyboardists, recorder and lute players. Each musician chooses their own pattern: an alternation between a quick sequence of rings and a pause. The musicians are scattered throughout the space spatializing the texture of bell sounds in order to get the audience's attention and quiet them down. This way no announcement has to be made and the piece can begin with the musician playing the first sackbut part and an attendant with carrying a thurible of smoking incense processing to the stage. The scattering of performers spatializes the rhythmic patterns resulting in a texture like that of a chorus of crickets or cicadas. Now that the tone is set and the audience is settled, the ringing dwindles as the piece transitions into to the next movement, which is in a way, the opening statement of the piece. The chorus of bells continues on as the second movement begins, becoming a background for the new material.

This movement, REQUIEM ÆTERNAM, began as a Kyrie, a part of the Mass form which sets only two lines of text of two words each to music. For this reason, many composers choose to explore melismatic singing for their settings of the Kyrie. Likening a melisma to the howling of animals, I began to think about the carnyx, a medieval Celtic warhorn made to resemble a beast. Using only the natural overtones of the harmonic series, wild inhuman trumpeting (like that of elephants) can created on these instruments. Within the overlap of

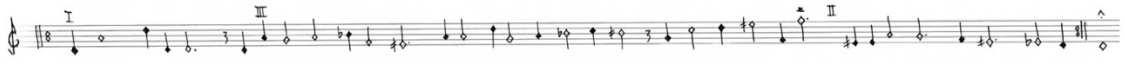
the insectile droning of bells, the howling of the brass, and the echoes of the strings, perhaps a convincing simulation of nightly wilderness soundscape can be found. If the bells are taken as symbolic of the cosmos, then the leaping gestures of the sackbuts are meant to represent the natural world, drawing on the natural harmonics of the overtone series and evoking that nature. Remembering the tromba marina's flageolet simulation of brass, the violas da gamba use harmonics to play their own versions of the gestures while spaced throughout or somehow, behind the audience. When the sackbuts return, the strings have all but died away and the form is completed by another round of harmonic howling that ends in the third sackbut settling down to the first note of the harmonic series.

The use of just intonation continues through the third movement, the GRADUAL, but now a simple, yet strict rhythmic structure is introduced. All three musicians play through the same series of dotted whole notes, but in canon at the half note. The canon is so quick that it is barely a formal concern for this section and functions more like a delay or echo, creating harmonies where different pitches overlap. The musicians perform this material from memory as they ambulate about the space separately, exploring the resonances found and hopefully, generating the kind of high combination tones or sum tones that medieval mystics might have described as angelic voices. The melodic material is a simple progression through the overtone series that begins with unison pedal tones and octaves and gradually reveals new odd numbered harmonics as

the piece progresses. The progression eventually reaches its highest pitch, the ninth harmonic which gives us the 9/8 ratio, an interval with particular significance to the Pythagorean tradition being the distance between harmonic and arithmetic means of an octave. Originally imagining this movement performed on natural horns, I wanted to venture further into the harmonic series, but as a trained brass player myself, I find the ninth partial to be near the top of the usable range for most other brass instruments, including sackbuts. Rather than continue the upwards exploration of the harmonic series, the melody brings the instruments back down, eventually adding a subtonic interval 9/8 below an octave of the fundamental. This pitch requires a new slide position to play representing a break from the purity of the harmonic series and symbolizing a step away from the natural order and towards a civil one. The gesture expands the musical material from tones limited to the natural overtone series as this new pitch capable of being expressed as the just ratio 16/9, a "Utonal" interval in the words of Partch, where until now, all have been "Otonal."

As we reach the end of the GRADUAL, the percussion prepares us for the fourth movement as the gourd shakers begin accenting every other attack from the sackbuts which eventually reach the end of the section and drop out leaving the slow pulse of the shakers. During the previous movement, while the sackbuts were moving about the space, the rest of the performers have arranged themselves on stage, eventually joined by the brass as they reach the end of the

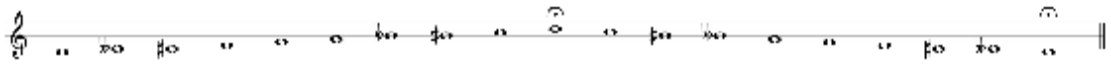
material from the third movement. This moment of prolonged gourd shakers allows for the performers to regroup if necessary before the percussion performs the lead in material for the next movement. The fourth movement which I have chosen as the TRACTUS introduces the central theme or CANTUS FIRMUS of *Constructus Profanem* that much of the following material is based on. Aspects of each of these phrases may sound familiar having been foreshadowed by the howling gestures from the second movement.



Cantus Firmus Melody
Roman Numerals show subsequent entrances for CAPER SABBATI

Both scalar constructions used in *Constructus Profanem* are nine note scales derived from the gamut of nineteen tone equal temperament and both scales use natural versions what would be our normal fourth and fifth scale degrees, the notes corresponding to the 4/3 and 3/2 ratios. For example, the twelve tone equally tempered major scale follows a pattern of: tone, tone, semitone, tone, tone, tone, semitone with each semitone equaling half the size of the tones. In nineteen tone equal temperament the tuning of the major scale is slightly different, but is constructed in the same way: tone, tone, diatonic semitone, tone, tone, tone, diatonic semitone, where the diatonic semitone is the size of two chromatic semitones and the tone the size of three or the combination of one diatonic and one chromatic semitone. The scale used for the

CANTUS FIRMUS adds one extra pitch between these two scale degrees (4/3 and 3/2) and the nearest octave of a fundamental making them now the fifth and sixth notes of the scale. I wanted to stick to only using two sizes of interval as we saw in both the twelve and nineteen tone version of the major scale so this scale uses only tones and chromatic semitones. It follows the pattern: chromatic semitone, tone, chromatic semitone, tone, tone, chromatic semitone, tone, chromatic semitone, tone. The melody is constructed from five smaller phrases over a grid of sixty beats with no true meter. It can be felt in half time or in groupings of three or even five quarter notes. As sixty is the product of three, four and five, all three underlying rhythmic structures can work and I composed the phrases of the melody to be more or less ambiguous, implying groups of each division at different moments.



CANTUS FIRMUS scale

The TRACTUS is one of only two movements that uses the full ensemble as such, introducing the CANTUS FIRMUS as a monophonic melody played in octaves by the melodic instruments of the ensemble with some modulating drone accompaniment by the brass. It is meant to sound like a courtly dance piece, perhaps a basse danse though it is not a true representation of the form. The modulating drones of the sackbut give the sense of an underlying melodic

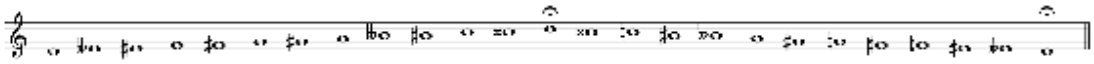
construction, but are in fact derived from the main CANTUS FIRMUS and not the other way around. The melody deviates slightly from the CANTUS FIRMUS the first time through as it repeats before the final phrase of the melody, saving it for the closing ending which is performed the second and third time through the material. The piece follows a simple AA'A' pattern alternating between opening and closing endings every other pass through the material and ending on the sustained D that has defined the fundament of all the musical material so far. This unifying moment, well into the full timescale of *Constructus Profanem* is the first movement to end without directly transitioning into the next. In the following silence, the musicians quietly begin exiting the stage one by one and moving into various locations throughout the performance venue.

The following movement is a take on the SEQUENCE, or the Dies Irae, the "days of wrath." The verse, though not biblical, is a medieval latin poem detailing the final judgement, the apocalyptic scene whence Christians are either allowed into heaven or cast into a pit of fire. Here the judgement weighs not the measure of virtue in one's heart, but rather the natural order of just harmony with the compromise of an equally tempered system. The SEQUENCE is largely improvised with the strict rule that all sounds be limited only to the D overtone series it and represents one side of this divide. The percussionists bow large improvised monochords made from piano wire and wooden boxes or washtubs, tuned to a low D fundamental. Two performers bow a single string with separate bows, creating random yet controllable overtones. The other

musicians, scattered throughout the venue, sustain long tones from the same harmonic series eventually arriving at a harmonically rich drone that ideally, still has a strong sense of fundamental. This moment of stasis should take some time to reach, ten or fifteen minutes maybe as much as twenty, but the arrival at this uniform drone structure signals the beginning of the next movement of the work.

While the SEQUENCE continues to sustain its drone texture, a small ensemble including both recorders, a bowed string and a plucked string has formed along with a single percussionist. With the SEQUENCE providing the background drone the small ensemble performs an expanded version of the CANTUS FIRMUS, the PROFANUS. This movement is based on the SANCTUS, a staple of most composed mass forms. It takes the CANTUS FIRMUS melody and expands it into a five part version of monophonic dance form used by peasants and the court alike called the saltarello. The saltarello uses the same formal construction as the istanpitta or estampie, but the parts can be shorter and end with a hop or jump. These dance forms play through each part twice, using one of two different endings, called the *aperto* (opening) and *chiuso* (close), each time through a cycle and gradually begin referring back to previously used material. The form used for the PROFANUS is AA'BB'CACA'DCADCA'ECAECA', note the occurrence of the full CANTUS FIRMUS in the A' parts and the return to the material from the third part, C, in both the fourth and fifth parts. Through the course of this melodic expansion,

three more pitches from the Nineteen-tone gamut are added to original nine in the CANTUS FIRMUS. The resulting twelve note scale represents an adequate tuning for keyboards for all of *Constructus Profanem.* The PROFANUS should be performed with improvised harmonization at the fourth or fifth or modulating drones as is the style with early monophonic music. However, twelve key keyboards tuned in the manner described will not be able to harmonize in this way, only double manuals or nineteen key layouts can be used as such.



Expanded Twelve Note CANTUS FIRMUS Scale

The SEQUENCE material continues throughout the performance of the PROFANUS, again, providing the drone accompaniment for the monophonic movement. As the small group progresses through each part of the piece, the musicians performing the SEQUENCE begin migrating toward lower harmonics of the D fundamental reaching only multiples of two, three, or seven by the final part, the first instance of E in the form. When the PROFANUS ends, the seventh harmonic should be dissipating as well and a quiet open fifth (displaced by octaves as necessary) sonority reached. The sustained tones of the fifth begin to quiet beginning with the highest sounding pitches as the musicians begin returning to the ensemble arrangement on the stage from the TRACTUS. Somewhere in this choreography an extremely slow, but consistent beat emerges

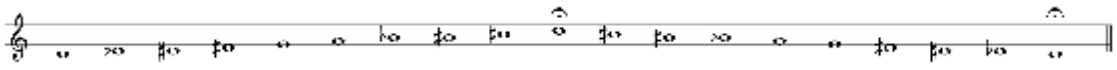
from the castanets. This pulse is accenting the underlying metric structure for the finale to *Constructus Profanus* though it is not the last movement in the piece.

The final movement is based on the AGNUS DEI movement in many masses and here is called CAPER SABBATI, "the goat of the sabbath," a reference to the mythology that uses the goat's independence as a foil to the shepherded flock of sheep as a metaphor for pagans and Christians. It uses the most complex formal structure of any movement in *Constructus Profanem,* a prolation canon. Like a traditional canon, each voice plays the same music, but offset from the others somehow. Transpositions of the octave as is used in CAPER SABBATI is not uncommon and pieces using other transpositions exist. Not only can each voice enter at a different time as in a traditional canon, but they also read their parts at different rates. For example, if all three performers have three quarter notes and a half note, while one reads it this way, another may read each value as doted and the other reads them doubled: three half notes and a whole. During the middle ages and renaissance basic rhythmic units could be grouped into twos or threes, like half notes in 4/4 meter versus 6/4 and those units, the half notes, could be broken down into two or three subdivisions themselves. Because these "levels of prolation" use two and threes, we can construct any polyrhythmic relationship using multiples of those numbers: two against three or three against four, but even the rather complex eight against nine can be constructed using this kind of prolation. However, in the Renaissance sense of prolation, there is no way to express the relationship of

four against five or five against six as there is no room for five or any prime number greater than three within the system.

I composed the CANTUS FIRMUS around the prolation canon structure and I wanted to explore prolation levels of three against four against five for the piece. This is the reason for constructing the cantus firmus over a frame of sixty beats, the product of three, four, and five. The melody plays three times through for each level of prolation beginning with the lowest and slowest voice and ending when the three align on what would be the downbeat for each of their fourth repetitions. This means the voices do not enter simultaneously, but successively as is needed for them to line up at the end. For the rhythm of the melody itself, I made a graph of sixty units and marked every three, four, and five units. The units where all three overlap show moments when all three melodies could lineup together and the units with no marks in them give the moments that a voice would not synchronize with the others. By structuring most of melodic contour around these beats, voices connect and diverge against the flow of the lopsided rhythm created. Beyond this I used my ears, trying to compose an interesting solo melodic line and harmonic texture for the prolation canon, largely by trial and error. With the completion of the CAPER SABBATI, the ensemble goes silent and pieces effectively ends. If the audience wishes to applaud they can do it now and the ensemble can bow, but there is one final piece of music which serves as a kind of epilogue.

The final movement of *Constructus Profanem* is an ELEGIA. It is performed for a standing, exiting, or conversing audience. It is scored for the strings alone so the other musicians may even be able to influence that setting by leaving the stage and conversing with friends that may be in attendance. The musical material for this final composition began as a different scalar construction than the one from the CANTUS FIRMUS, following the construction for a nine tone scale that Mandelbaum gives in "Multiple Division of the Octave and the Tonal Resources of Nineteen-Tone Temperament" which uses eight steps the size of a diatonic semitone and one a full tone. The construction begins the same way as CANTUS FIRMUS scale by placing the only tone between pitches corresponding to the 4/3 and 3/2 ratios giving the scale the standard dominate and subdominant scale degrees. The remaining distances, both fourths, are filled in with diatonic semitones so that the construction follows: diatonic semitone, diatonic semitone, diatonic semitone, diatonic semitone, tone, diatonic semitone, diatonic semitone, diatonic semitone, diatonic semitone.



Original ELEGIA scale

While composing in this modality I found, as Mandelbaum had predicted, that the lack of variation in step size makes for rather bland melodic writing. However, after some exploration, I found that once a steady motion by

diatonic semitone had been established, varying that motion through a chromatic semitone made for interesting and dramatic harmony. Having been interested in the idea of continuous modulation following the composition of KATABASIS, a round in twelve-tone that descends by half step with each repetition, I decided to try the same approach here. The resulting piece is organized around a descending progression of diatonic semitones in the outer voices with each of the three violas da gamba given their own voice. The harmonic progression they follow modulates up one nineteenth of an octave each repetition creating a twisting series of cadential figures that never fully resolve. The material could go on forever, always modulating upwards if the instruments were not limited by their ranges. Likewise, the music could have begun in any transposition, though it begins with the lowest transposition possible on a seven-string viola da gamba.

Going forward, I will continue to explore just intonation and multiple divisions of the octave. I have become increasingly interested in the tuning systems of Erv Wilson and Wilfrid Perret following work on this piece and would like to explore them more while continuing to design my own. I remain fascinated by instrument design and construction and maintain my own workshop and luthery practice. In the long term, I hope to develop my own ensemble of instruments to compose for as Partch was able to do over the course of his career. This concludes my discussion of my composition *Constructus Profanem* for broken consort. The full score with performance notes follows.

CONSTRVCTVS PROFANEM

broken consort

KCM WALKER

mmxxii

INSTRUMENTATION tune to A 415

2 (or 3) Recorders: Alto, Tenor (and Bass)

3 Tenor Sackbuts in D at A 415 (common Eb Sackbut) 1 doubling Bass Sackbut

1 Double Manual / 19-tone Harpsichord or 2 standard Harpsichords (or Virginal/s)
AND / OR
2 Lutes fretted for 19 tone equal / 1/3 comma meantone
1 Theorbo fretted for 19 tone equal / 1/3 comma meantone

Chest organ, 19 tones to the octave, may be possible on retuned standard instrument
Maybe unnecessary if there is bass recorder

3 (6 or 9) Violas da Gamba fretted for 19 tone equal / 1/3 comma meantone
all playable on bass, Third part for ELEGIA requires 7 string/low A
upper parts can be performed on tenor or treble if available

Percussion, 6 or 8 performers ideal, could be 2 or 4 in a smaller orchestra
Triangle
Finger Cymbals
Castanets
Gong or Bell
Tambourine
Frame Drum (perhaps Daf)
Jaw Harp
Large Gourd Shaker/Cabasa
Concert Bass Drum
2 or 3 Improvised piano wire and box instruments tuned to very low D

FORM 60 – 80 minutes total duration

Although it's an entirely instrumental composition, the piece uses a form of the Requiem Mass to structure itself. There are eight separate sections of material mostly scored for subsets of the full ensemble. There is a central CANTUS FIRMUS which is referenced directly in the movements: REQUIEM ÆTERNAM, TRACTUS, PROFANUS, and CAPER SABBATI. Each section of the piece transitions into the next with the REQUIEM ÆTERNAM and PROFANUS performed over the top of their preceding sections by another subset of the group. The performance opens with the INTROITUS which begins without an introduction, before the audience has directed their attention toward the musicians. The final section, ELEGIA, is performed after the ensemble takes their bows and applause. NOTE: There is a lot of room for cross collaboration with other types of artists for a production of this work. The piece is open to costuming and choreographic exploration, stage design and lighting effects as well as the addition of dance, film or theatrical material.

SETTING

The piece is intended to be performed in a HIGHLY reverberant space e.g. Stone Cathedral, Hockey Rink, Cavern. As the audience enters the performance space or perhaps during an intermission preceding the piece, the performers move into positions around the space, not on stage, somewhat hidden. Some are at levels above or below the audience. The recorders and percussion begin performing the material for the INTROITUS before the concert's start time or during the intermission. No announcement is made and as the sounds are extremely quiet, they should go unnoticed for some time. As the audience becomes aware of the performance, more musicians join in making the beginning of the performance more obvious. As the audience settles and quiets, the musicians continue with the INTROITUS material.

INTROITUS 10 – 15 minutes (includes 5 – 10 minutes before audience attention)

Winds and Percussion – text instructions only

As the audience enters the performance space, the musicians take their places – unnoticed by most – and begin performing extremely sparse and quiet wind sounds, insect sounds, and rustling. The texture thickens as the audience begins to settle and continues to develop for 5 or less minutes.

Once First Sackbut approaches the stage area attended by percussionist carrying a thurible of smoking incense. Percussionist stops at foot of stage while Sackbut takes place at center. The texture of sounds continues.

REQUIEM ÆTERNAM 3 – 4 minutes (INTROITUS winds and percussion continue)

Sackbuts and Violas da Gamba

The Sackbut I raises their instrument and begins performing the scored material: a gestural leap and downward glissando reminiscent of an animal call or howl and is joined by a responding chorus from the viols, all playing harmonic gestures with similar contours to the sackbut's and positioned throughout the performance area, mostly unseen. The sackbut waits as the Viol chorus dies down and sounds another call and is answered by another Sackbut, just to one side of the audience that has until now, gone unnoticed. The strings continue and the Sackbuts make another round of calls, this time adding a third horn on the other side of the audience. The Strings carry on a bit after the brass go silent.

GRADUAL 10 minutes

Sackbuts only – notated, but ought to be memorized for performance

Just as the preceding String material dies away, Sackbut III enters on a sustained accented pedal D followed by the same from Sackbut I and then II. The Sackbuts continue trading off attacking the pedal tone while sustaining it under the others until a steady tempo of less than half note equals 60 is established. The musicians begin to ambulate throughout the stage and audience area. Lead by the Sackbut I, the musicians progress through the

notated material, exploring the resonance and harmonics in the space. They should maintain a steady tempo, repeating sections as desired and cued by the first Sackbut progress towards new material.

Meanwhile, all the other musicians are making their way to the stage where there is a typical chair arrangement awaiting them. Towards the end of the piece, when the music introduces a sub tonic C natural, the Gourd shaker/Cabasa (and perhaps Daf) enters in time with every other Sackbut entrance e.g.: 1,3,2,1,3… repeating the whole note pattern through the close of the sackbut material.

TRACTUS 4 – 5 minutes

Full ensemble – sort of a monophonic courtly dance

As the Sackbuts end the preceding piece, Bass Drum and Castanet enter, shifting the Gourd attacks to the backbeat. Castanets, Gourd, and Bass Drum can repeat the section as desired, especially if others are still settling in on stage. When all are ready, Tambourine enters cueing the rest of the percussion, jaw harp and monophonic melodic material and a low D drone from chest organ (or pipe organ even!) and 2 or 3 improvised instruments using piano wire and a box, bowed by 2 percussionists each.

SEQUENCE 30 minutes, PROFANUS plays concurrently

Full Ensemble – all text instructions

Largely improvised but arranged through rehearsals in the space

These instruments are essentially wash tub basses using long piano wire that is anchored to resonant points within the performance space using clamps or other appropriate methods. They are spaced around the space wherever is convenient and resonant; you should be able to hear each instrument from the positions of the others. The musicians explore bowing the strings at different locations, finding different overtones and textures. Think James Tenney's *Spectum Pieces* meets Alvin Lucier's *Vespers*.

The Brass, Winds, and Strings have begun moving away from the stage, some through the audience, others backstage and in the balconies, rafters, orchestra pits, crypts,

or whatever spaces might be available. They are sustaining various overtones of any D and exploring the acoustics of the space itself. The texture shifts slowly, from high but quiet harmonics and overtones to lower, fuller sounds. The bowed piano wires are sounding strong fundamentals and the musicians are spaced well apart in the space. Once a steady sense of drone texture has been achieved, a small ensemble forms at a secondary stage location. It could even be the floor in front of the main stage.

PROFANUS 4 – 6 minutes during the SEQUENCE

Medieval Bande

Recorders
Viol (treble or tenor if using one)
Citole/ Baroque Guitar/ Lute
Possible Hurdy Gurdy
Drum

With the SEQUENCE settling in on a drone with prominent second, third, seventh, ninth, tenth, and thirteenth harmonics, a small ensemble gathers in a secondary stage location. The drum, probably frame drum, cues the ensemble in with either a short lead in fill or just a nod. The group plays the monophonic saltarello in medieval style, with different musicians taking parts as solos and embellishing the melody if they chose. Some moments may be harmonized at the fifth or played in a different octave to the ensemble's choice.

SEQUENCE (return)

Full Ensemble

The upper drone harmonics dissipate one by one and by the time the PROFANUS ends the drone has simplified greatly in harmonic complexity. Each musician is now sustaining one of only the first three harmonics. The seventh harmonic is last to leave the texture around the same time as the small ensemble concludes the PROFANUS. These sustained drones quiet one by one beginning with the viols who are closest to the stage and audience, followed by the recorders and lutes who are on the periphery of the audience. As the drone

thins out the remaining sounds become more distant with the brass and percussionists' sounds coming from areas beyond the main performance area. The viols move back into a central position on the stage followed by the lutes/theorbo and percussionists, the recorders, and eventually, the brass in a new arrangement for the final group piece.

CAPER SABBATI 8 – 10 minutes

Full Ensemble – Prolation Canon

Once Viola da Gamba I, Theorbo, and the castanet player have returned to the stage, the castanets begin playing their ostinato rhythm and the final drones from the SEQUENCE go quiet. Viola da Gamba I and Theorbo begin the slow CANTUS FIRMUS melody while the Recorders, Brass and other Percussionists continue to settle in behind them, entering into the texture as the canon progresses. The material closes with a unison cutoff and silence. The ensemble bows and takes their applause though it does not conclude the piece.

ELEGIA 12 + minutes

Violas da Gamba – Chorale / Chaconne modulating up 1/19 of an octave each cycle

After the applause has ended, the musicians move offstage and as the lights are coming up, the violas da gamba begin performing the final material as exit music. They can play through as many of the upward modulations as they'd like. The audience should feel free to move about the space during this time and as conversations build, the strings die away. I imagine the other musicians curating this environment.

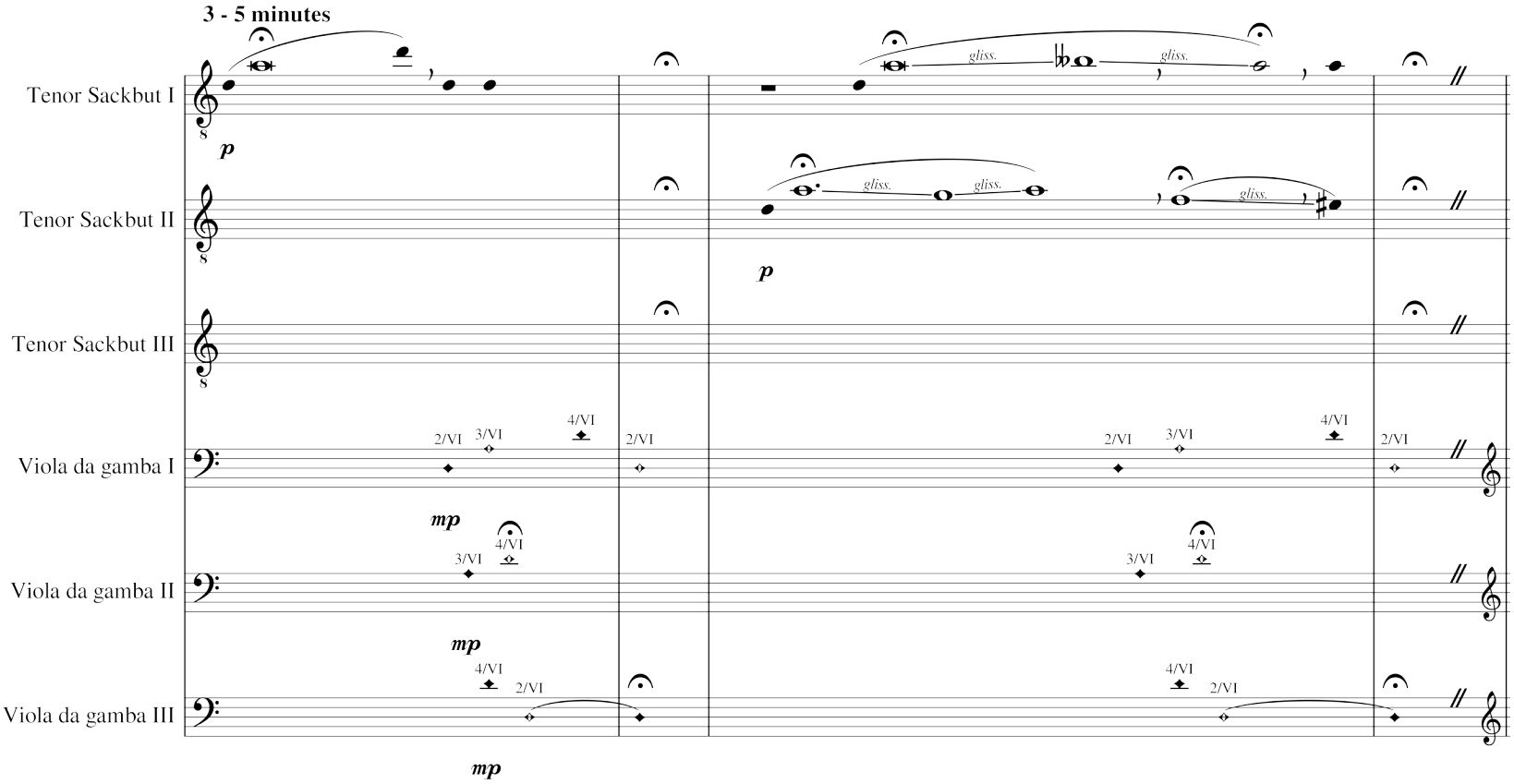
INTROITUS 15 minutes, could be much more

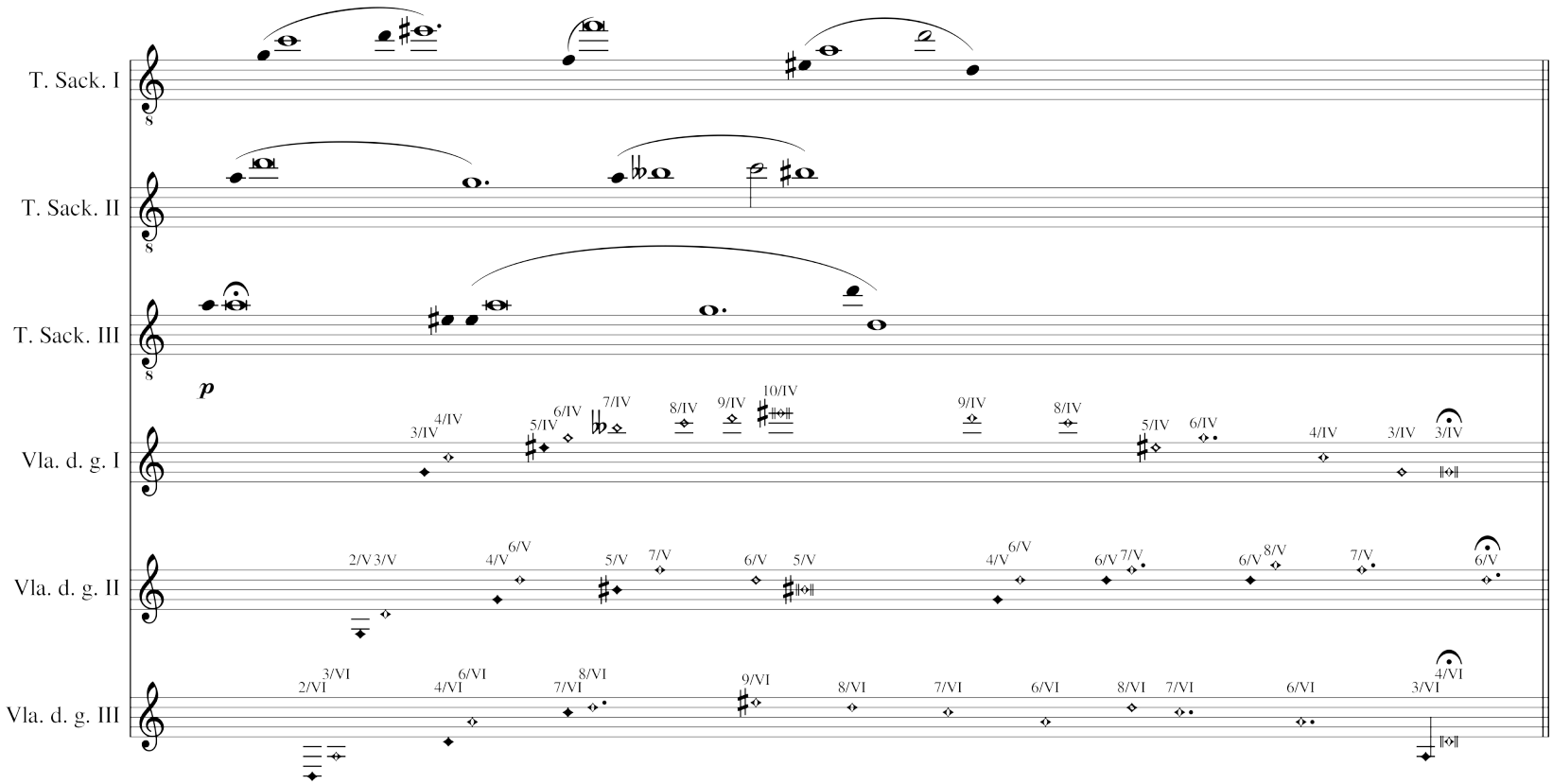
All musicians not required for REQUIEM ÆTERNUM

Anywhere but on stage

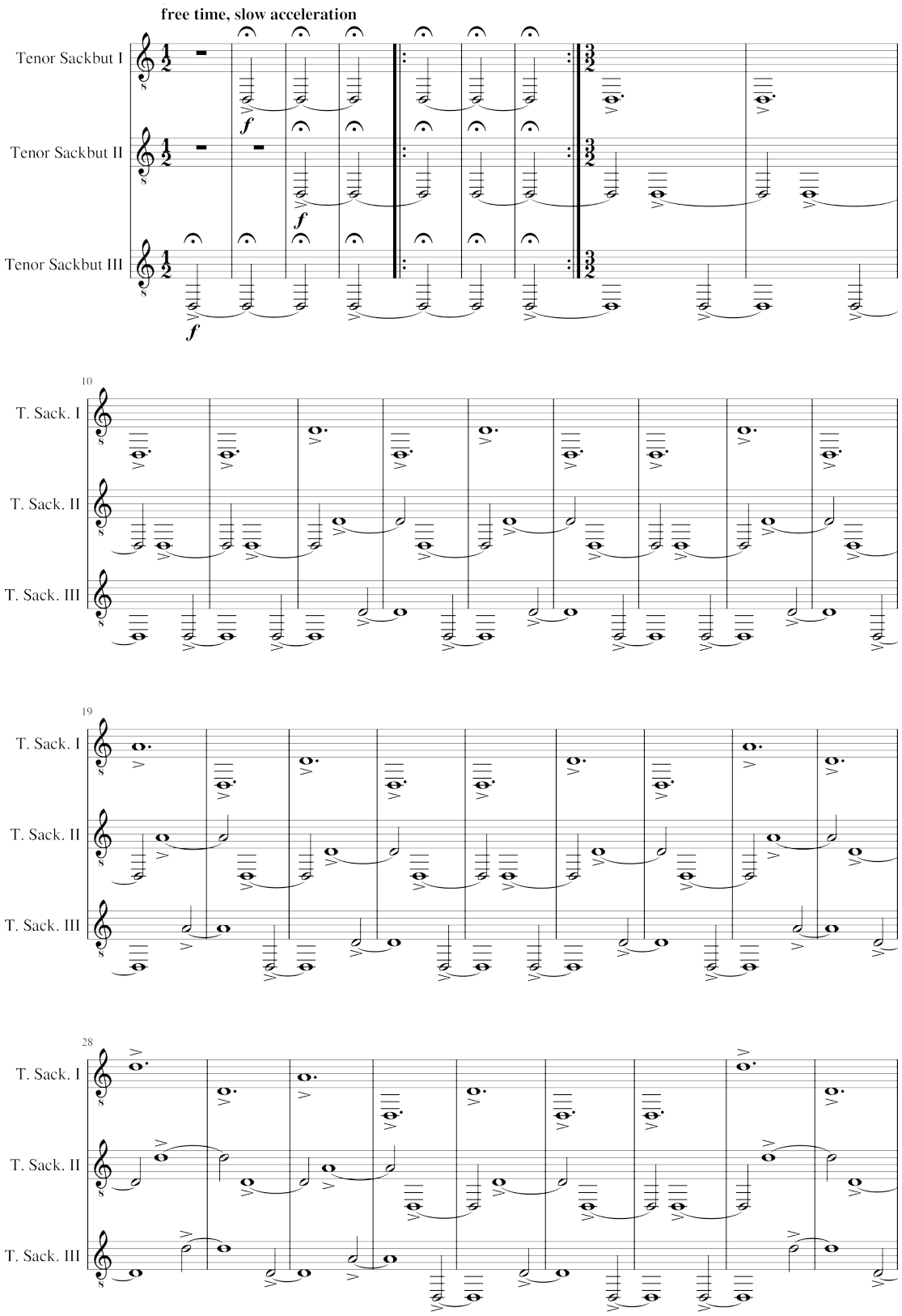
Each musician should carry a unique bell, higher in pitch and more delicate in timbre is best. The space is occupied by witnesses. Bells begin short repeated rhythmic patterns, one at a time. Allow for time between each entrance. These sounds are not audible at first, at least the first few should go unnoticed. Each musician improvises their own pattern: a number of quick and steady attacks and a pause. First the overlapping bell patterns build up and the audience acknowledges the beginning of the performance. The Sackbut enters and the bells quit down in response. Louder bells stop completely, the others extend their pause. Sometimes the pauses are very long, the pattern stops for a minute or so. The texture continues thinning in this manner through the first half of REQUIEM ÆTERNUM with only the highest few bells sporadically tinkling through the second half, mostly silent by the time only the strings remain.

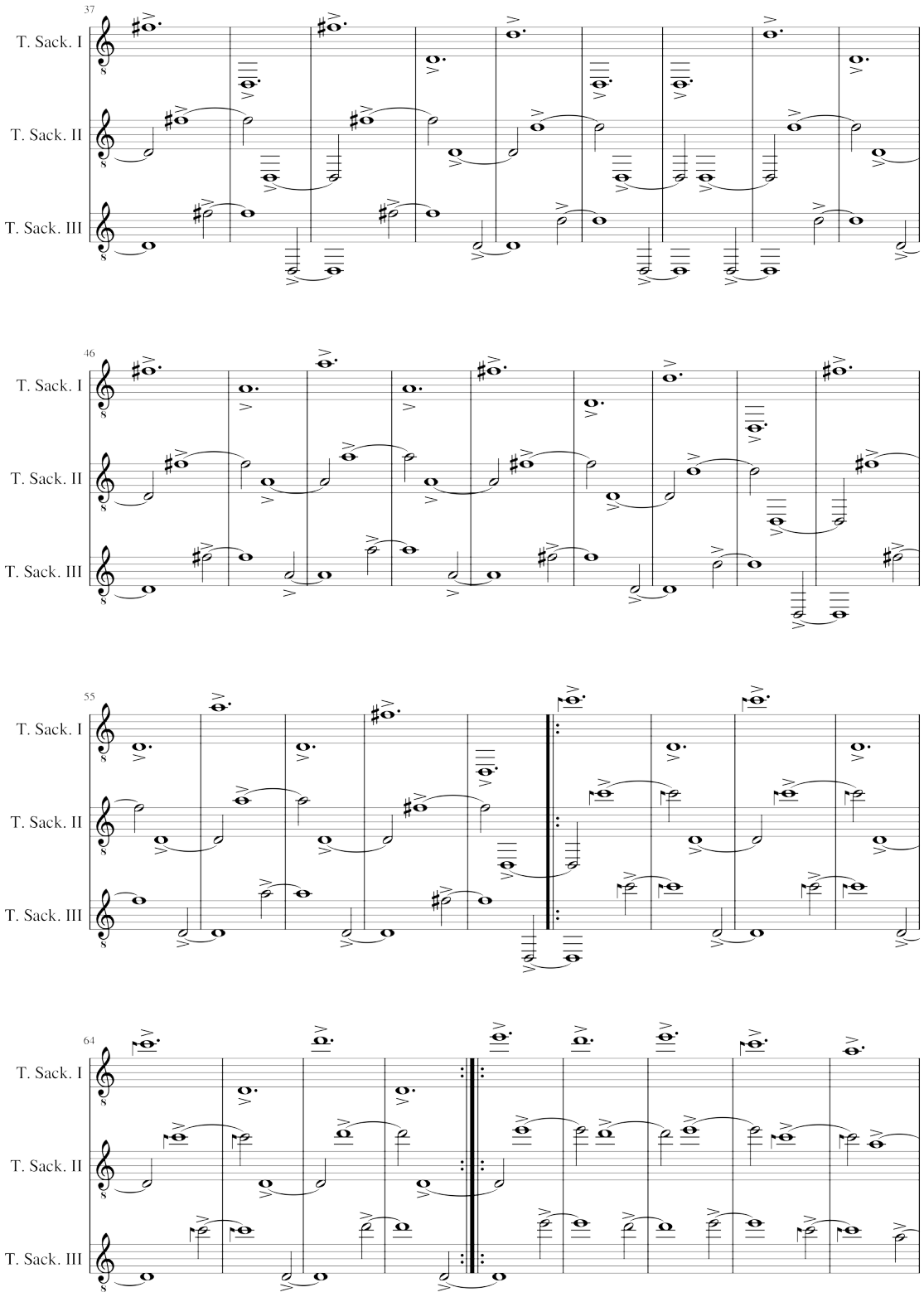
REQUIEM ÆTERNAM

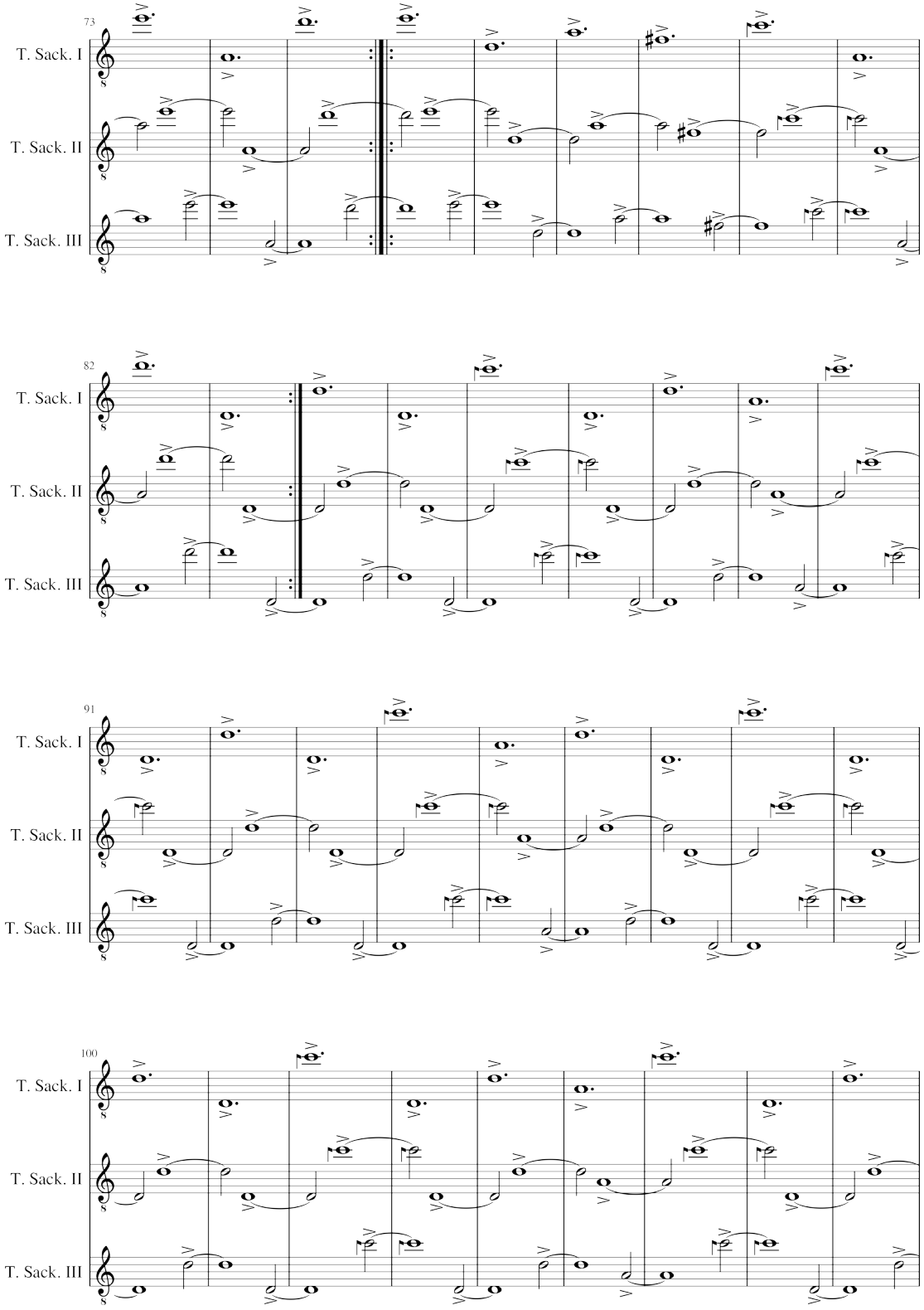


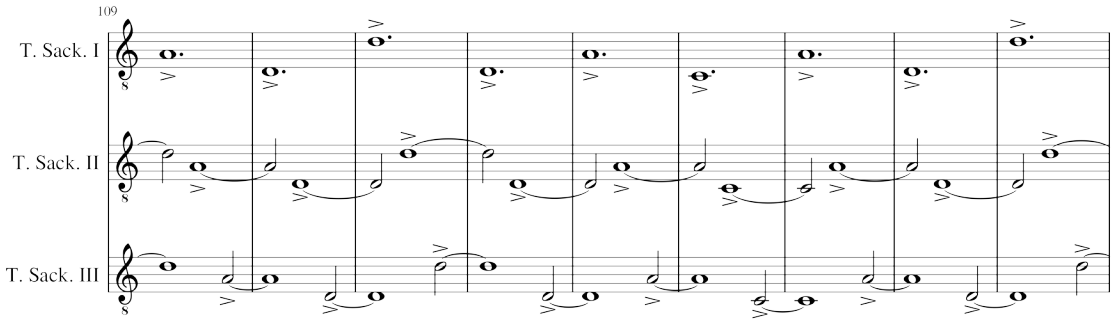

T. Sack. I
T. Sack. II
T. Sack. III
p
Vla. d. g. I
3/IV 4/IV 5/IV 6/IV 7/IV 8/IV 9/IV 10/IV 9/IV 8/IV 5/IV 6/IV 4/IV 3/IV 3/IV
Vla. d. g. II
2/V 3/V 4/V 6/V 5/V 7/V 6/V 5/V 4/V 6/V 6/V 7/V 6/V 8/V 7/V 6/V
Vla. d. g. III
2/VI 3/VI 4/VI 6/VI 7/VI 8/VI 9/VI 8/VI 7/VI 6/VI 8/VI 7/VI 6/VI 3/VI 4/VI

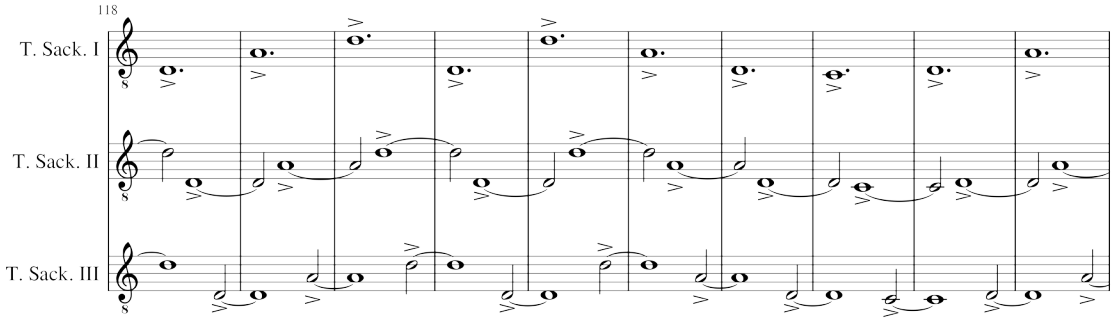
GRADUAL

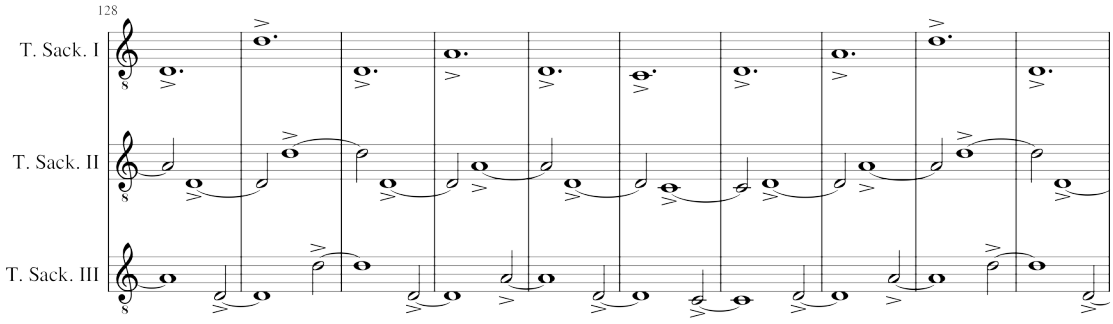

free time, slow acceleration
Tenor Sackbut I
Tenor Sackbut II
Tenor Sackbut III
f
10
T. Sack. I
T. Sack. II
T. Sack. III
19
28

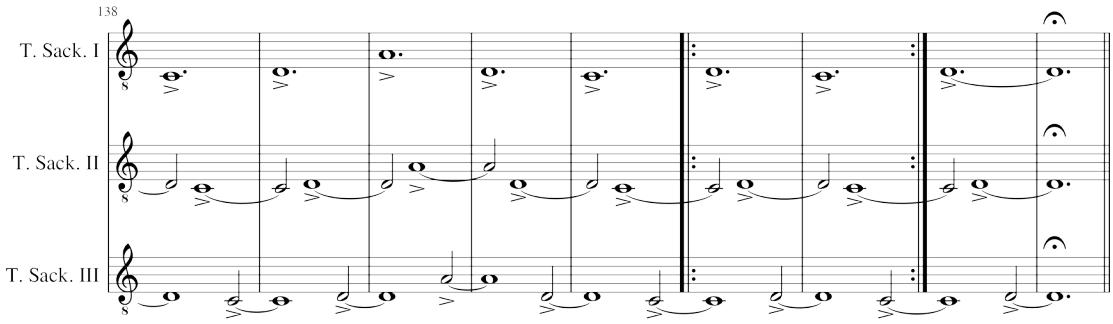

37
T. Sack. I
T. Sack. II
T. Sack. III
46
T. Sack. I
T. Sack. II
T. Sack. III
55
T. Sack. I
T. Sack. II
T. Sack. III
64
T. Sack. I
T. Sack. II
T. Sack. III


73
T. Sack. I
T. Sack. II
T. Sack. III
82
T. Sack. I
T. Sack. II
T. Sack. III
91
T. Sack. I
T. Sack. II
T. Sack. III
100
T. Sack. I
T. Sack. II
T. Sack. III

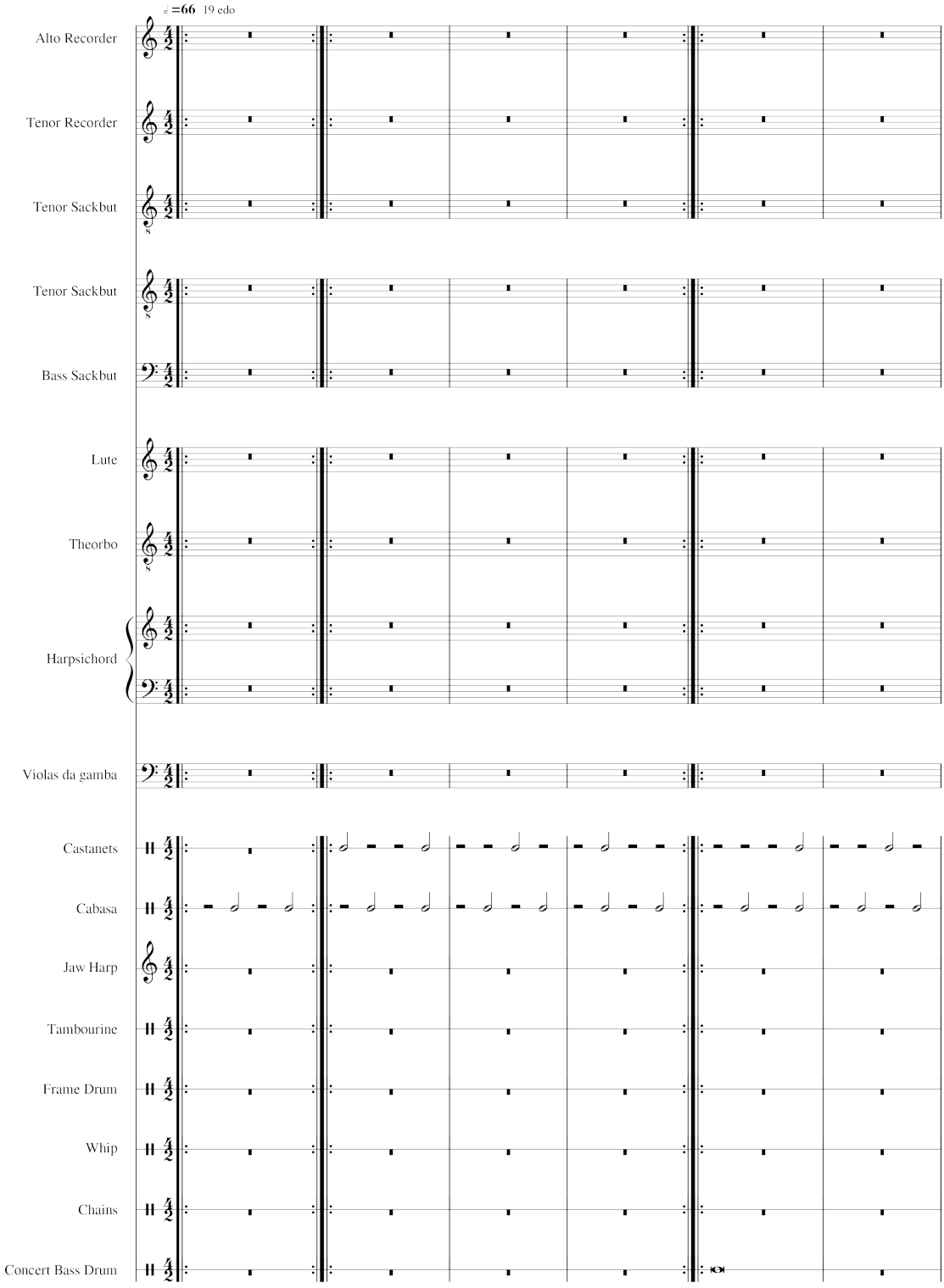

109
T. Sack. I
T. Sack. II
T. Sack. III

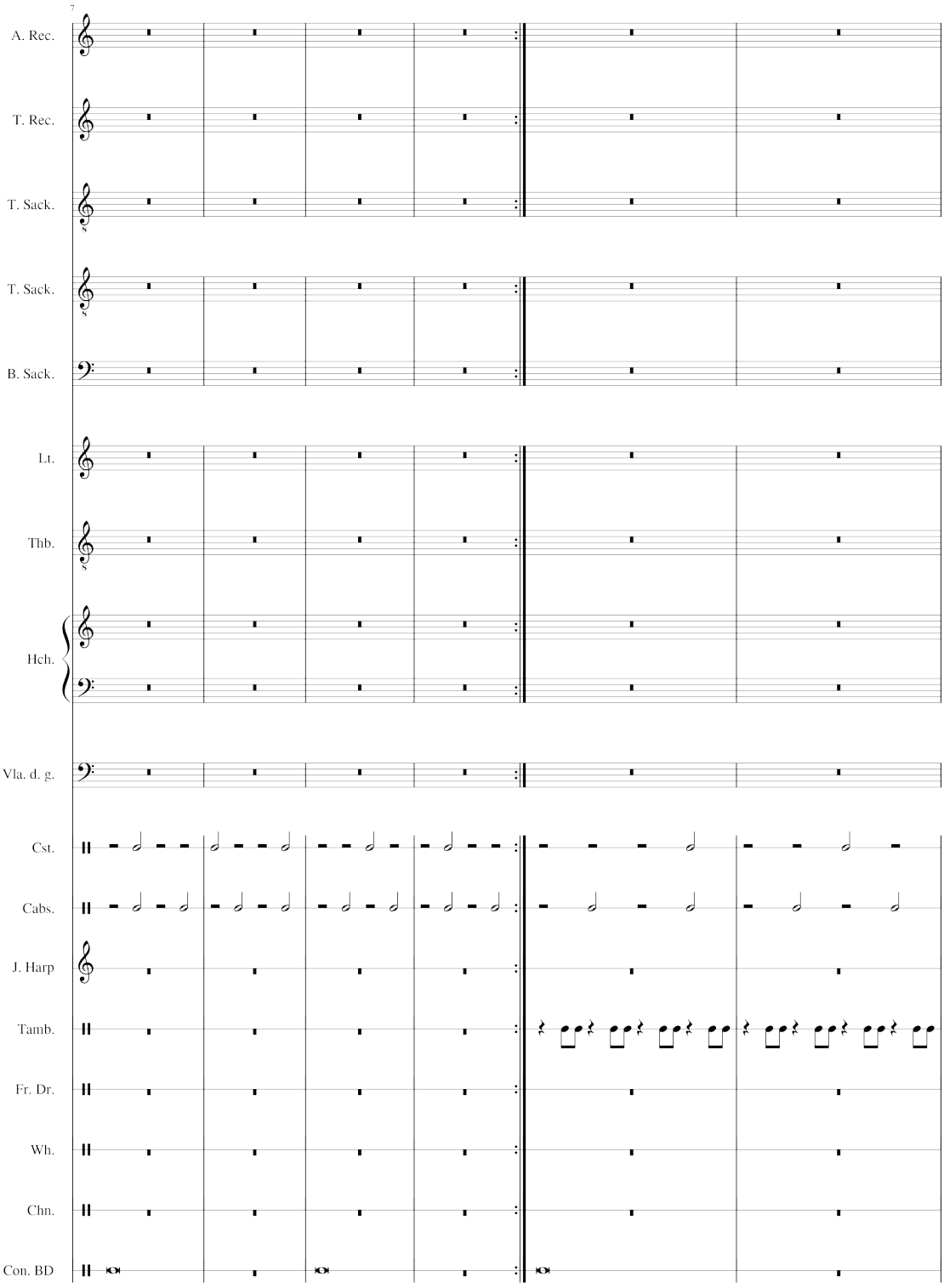

118
T. Sack. I
T. Sack. II
T. Sack. III

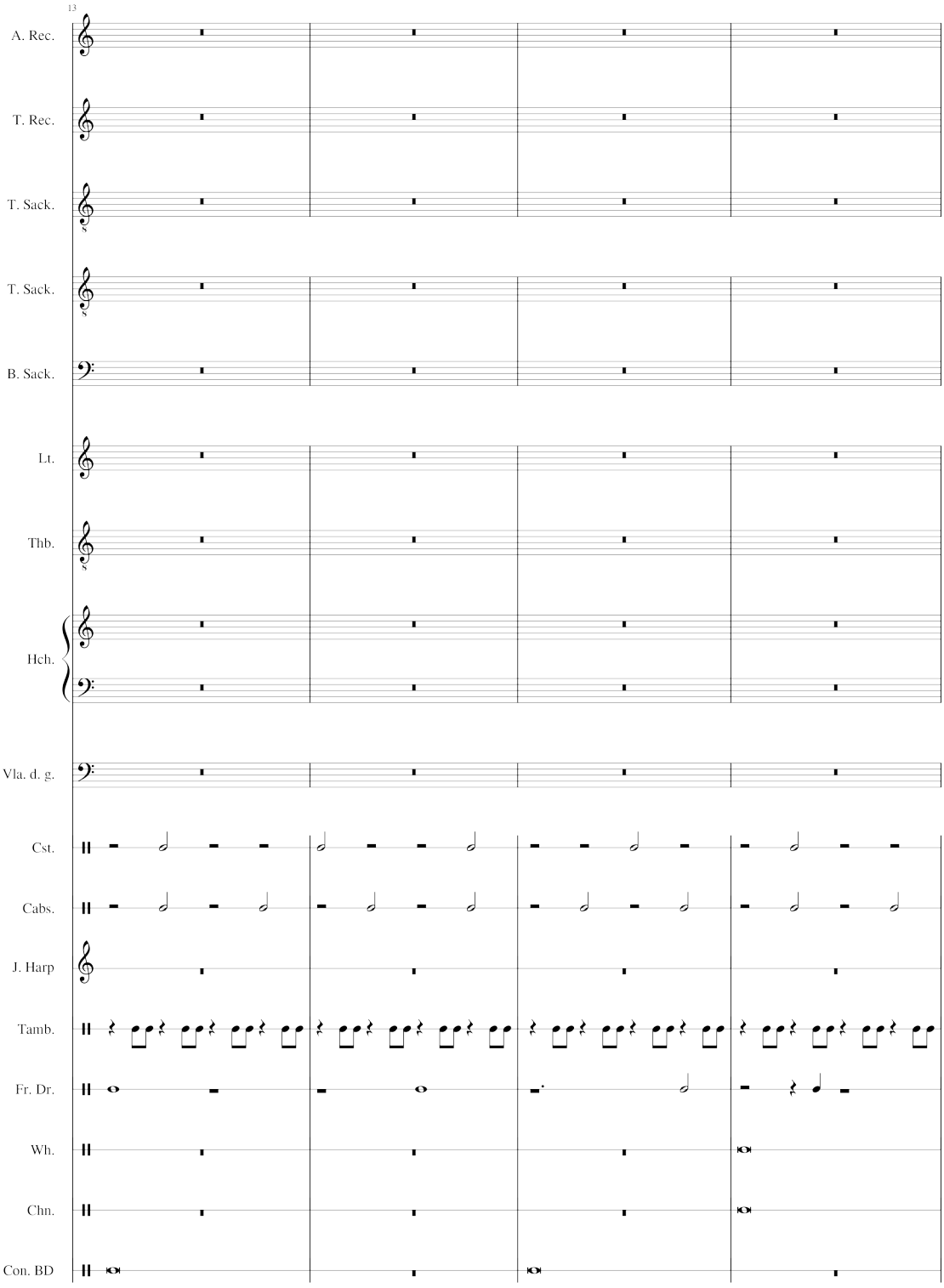

128
T. Sack. I
T. Sack. II
T. Sack. III

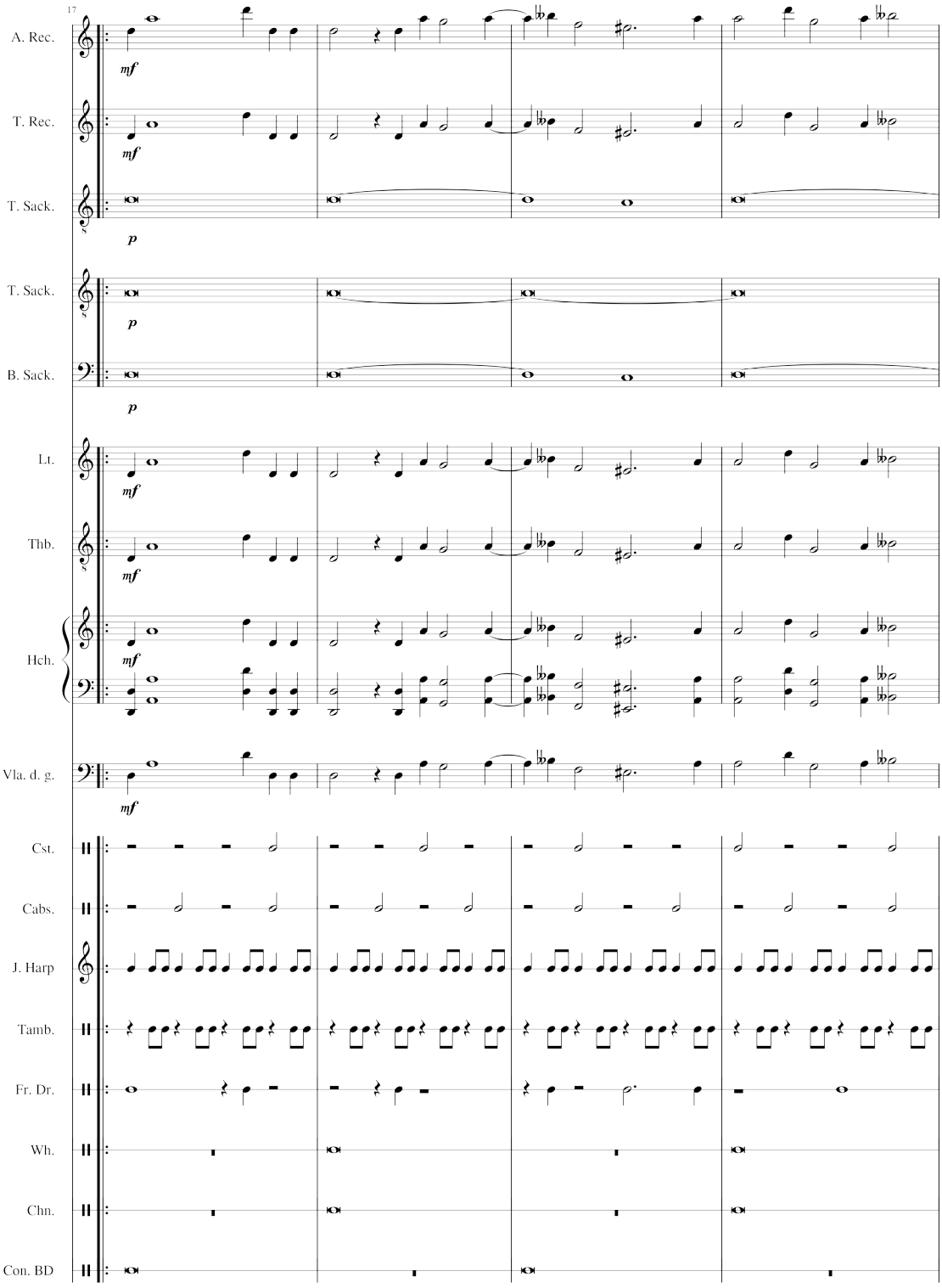

138
T. Sack. I
T. Sack. II
T. Sack. III

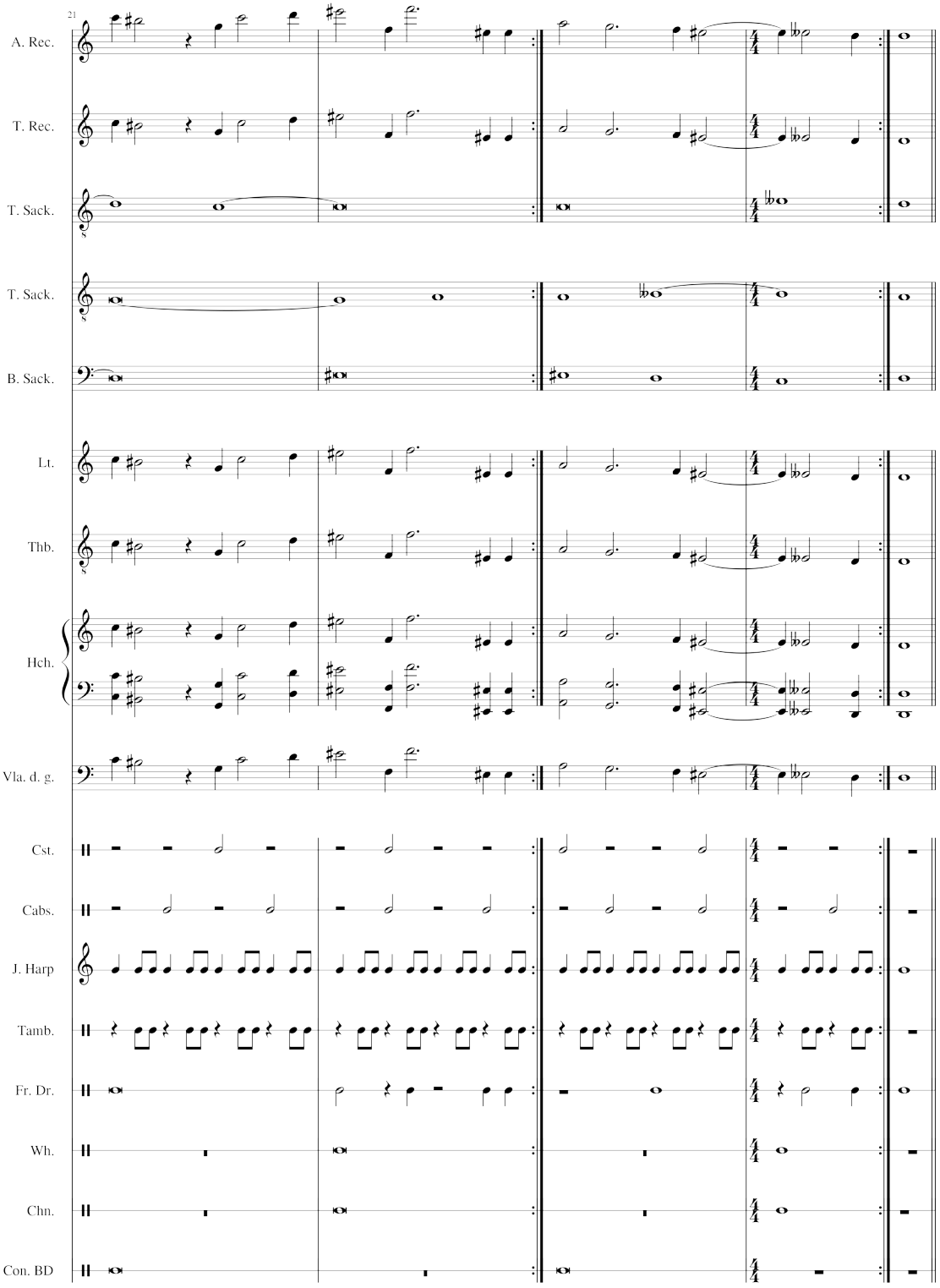
TRACTUS


♩=66 19 edo
Alto Recorder
Tenor Recorder
Tenor Sackbut
Tenor Sackbut
Bass Sackbut
Lute
Theorbo
Harpsichord
Violas da gamba
Castanets
Cabasa
Jaw Harp
Tambourine
Frame Drum
Whip
Chains
Concert Bass Drum


7
A. Rec.
T. Rec.
T. Sack.
T. Sack.
B. Sack.
Lt.
Thb.
Hch.
Vla. d. g.
Cst.
Cabs.
J. Harp
Tamb.
Fr. Dr.
Wh.
Chn.
Con. BD


13
A. Rec.
T. Rec.
T. Sack.
T. Sack.
B. Sack.
Lt.
Thb.
Hch.
Vla. d. g.
Cst.
Cabs.
J. Harp
Tamb.
Fr. Dr.
Wh.
Chn.
Con. BD


17
A. Rec.
T. Rec.
T. Sack.
T. Sack.
B. Sack.
Lt.
Thb.
Hch.
Vla. d. g.
Cst.
Cabs.
J. Harp
Tamb.
Fr. Dr.
Wh.
Chn.
Con. BD
mf
p


21
A. Rec.
T. Rec.
T. Sack.
T. Sack.
B. Sack.
Lt.
Thb.
Hch.
Vla. d. g.
Cst.
Cabs.
J. Harp
Tamb.
Fr. Dr.
Wh.
Chn.
Con. BD

SEQUENCE roughly 30 minutes

All musicians not required for PROFANUS

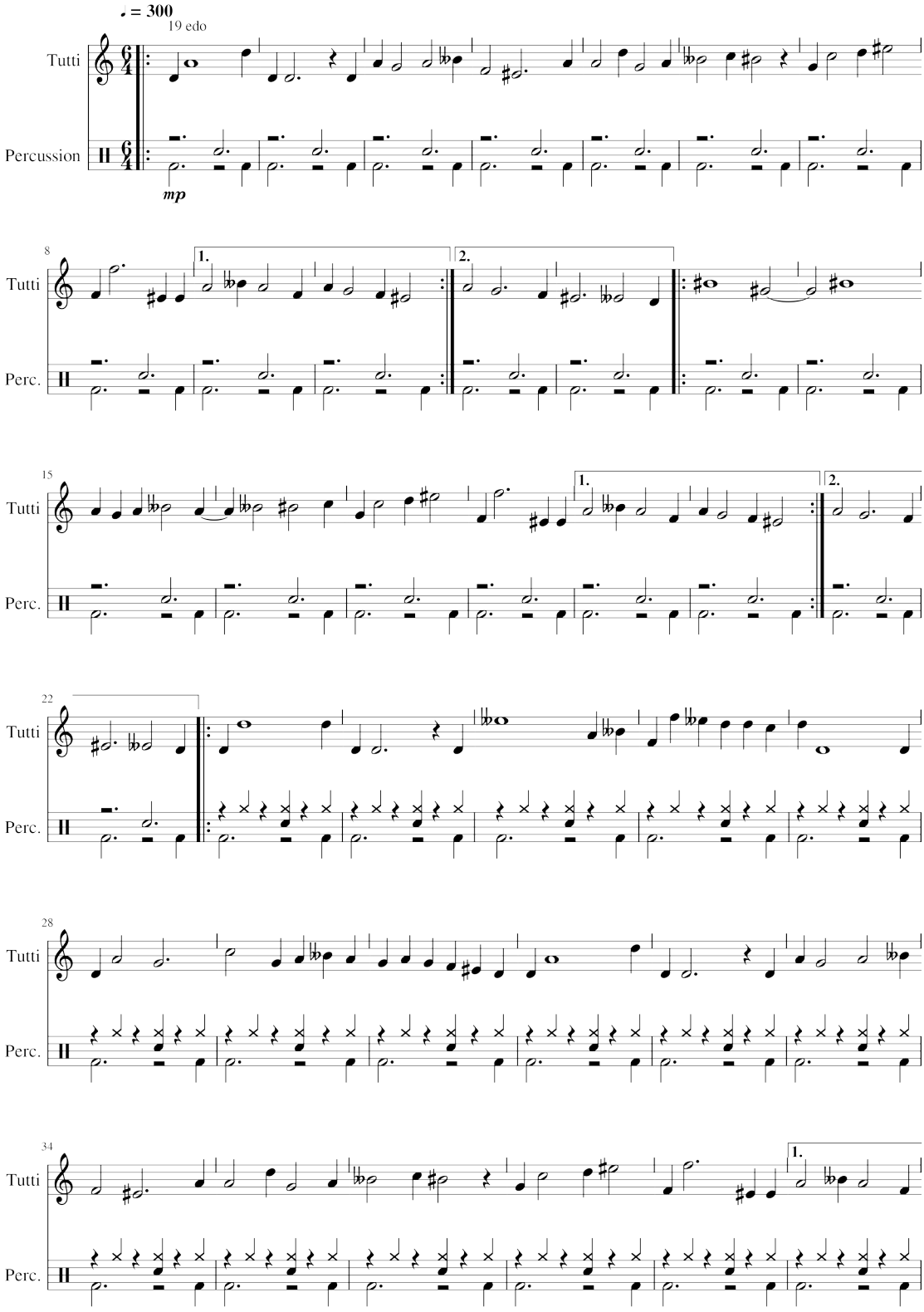
Throughout the space

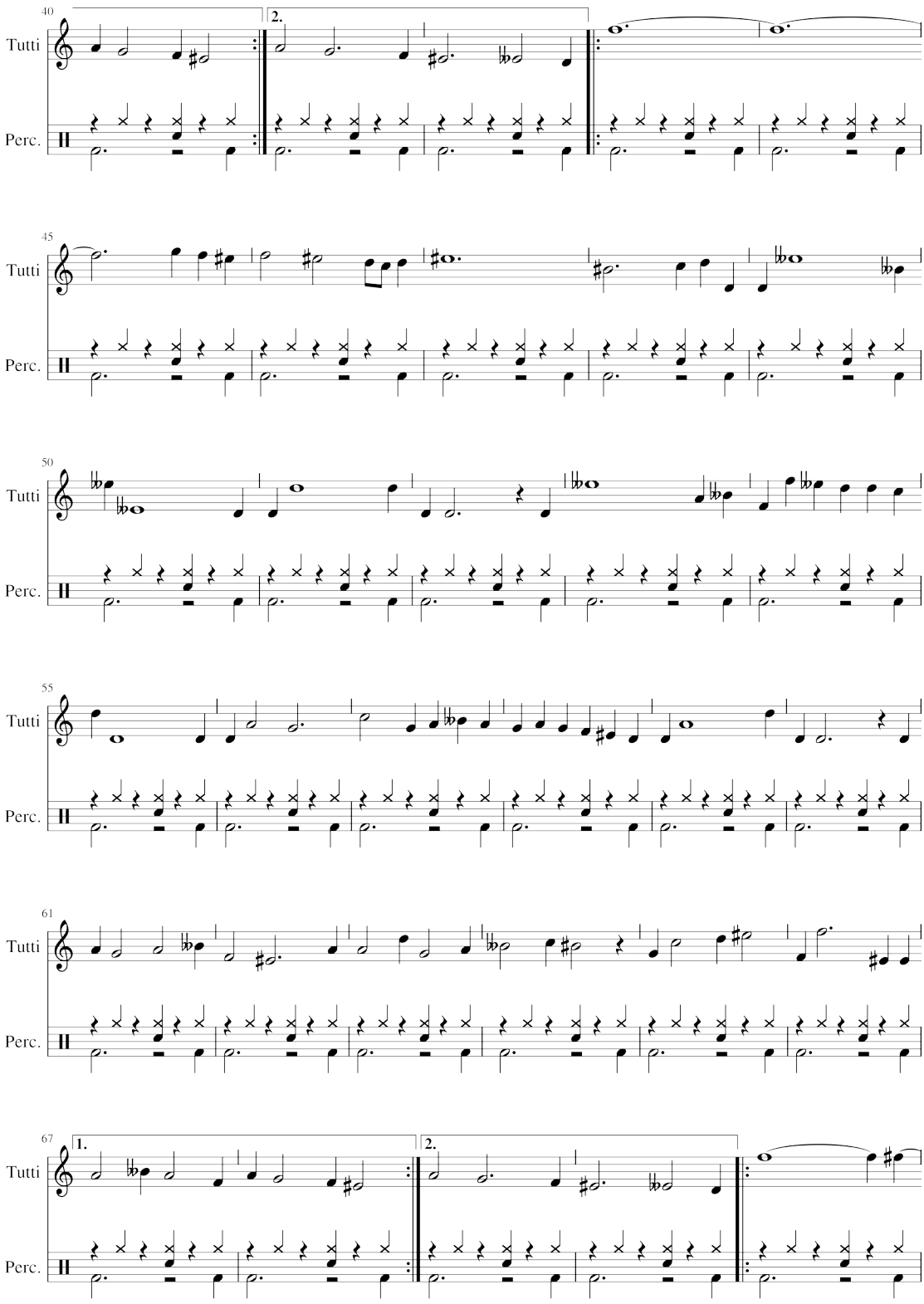
Percussionists bow large monochords made from a piano wire and a resonating body. Two musicians per instrument, two bows per string. The resonating bodies may be wooden boxes, metal washtubs, other instruments, or even parts of the space in which the performance takes place. The string's fundamental is tuned to the lowest and strongest D that it will hold. Try to sustain the sounds you find for a while.

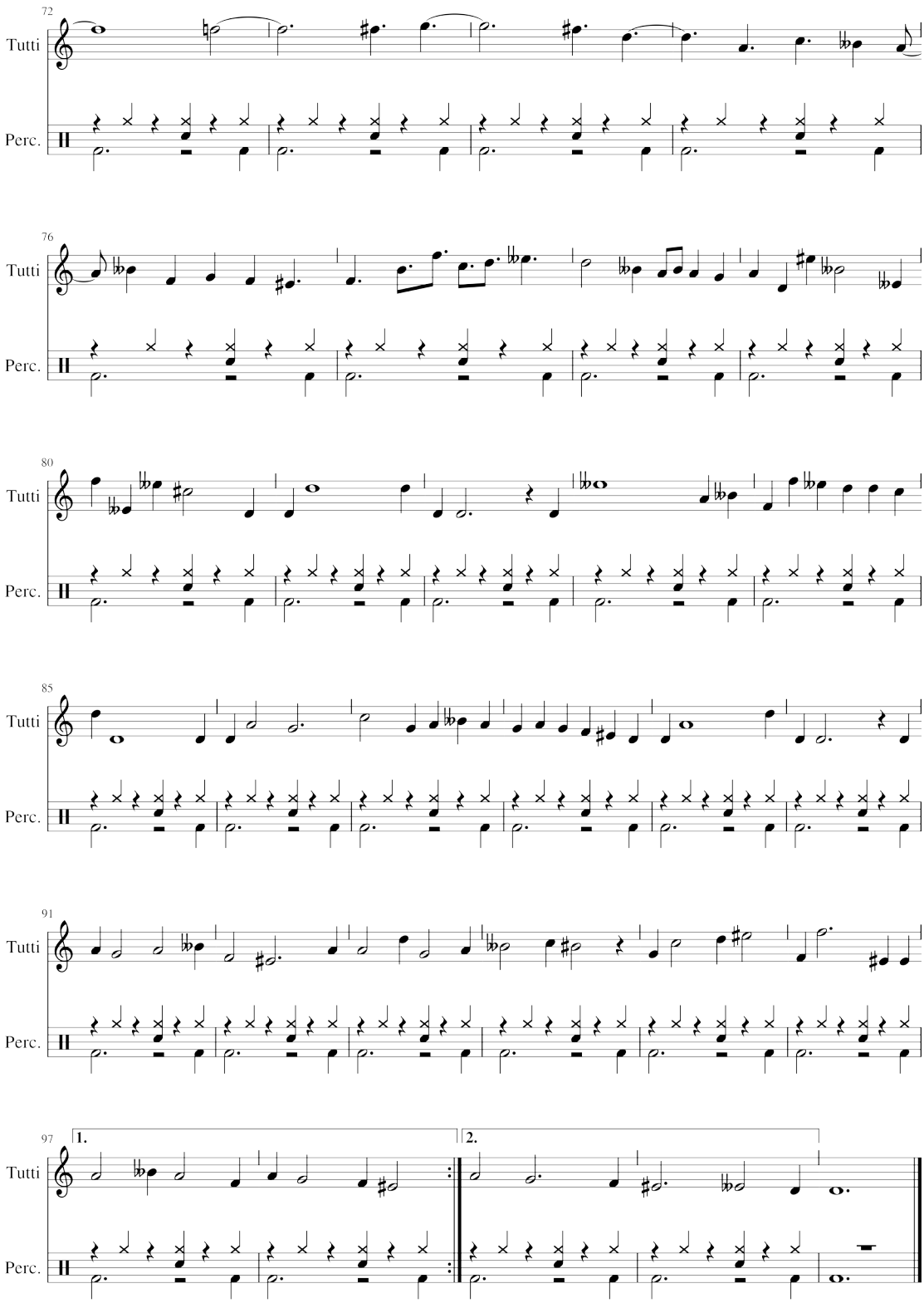
Strings and Brass sustain tones from the D overtone series using them to probe the acoustics of the performance space. Move around trying to find locations that amplify or affect the timbre of the instrument or that have some other interest effect. Begin with harmonics 8, 9, and 7. After some time add harmonics 10 and 11. Later, trade 11 for 6 and then 10 for 4. The PROFANUS ought to have begun by now. Trade 9 for 3 and cut 8. By the time the PROFANUS ends the 7^{th} harmonic is being replaced by the 2^{nd}. The texture gets quieter and there is no more 6^{th} harmonic. Some musicians might play the fundamental and others may drop out entirely as they return to the stage for CAPER SABBATI.

The overall effect of this material is to create a steady drone texture. Eventually the Profanus will be performed over this drone so keep it consistent.

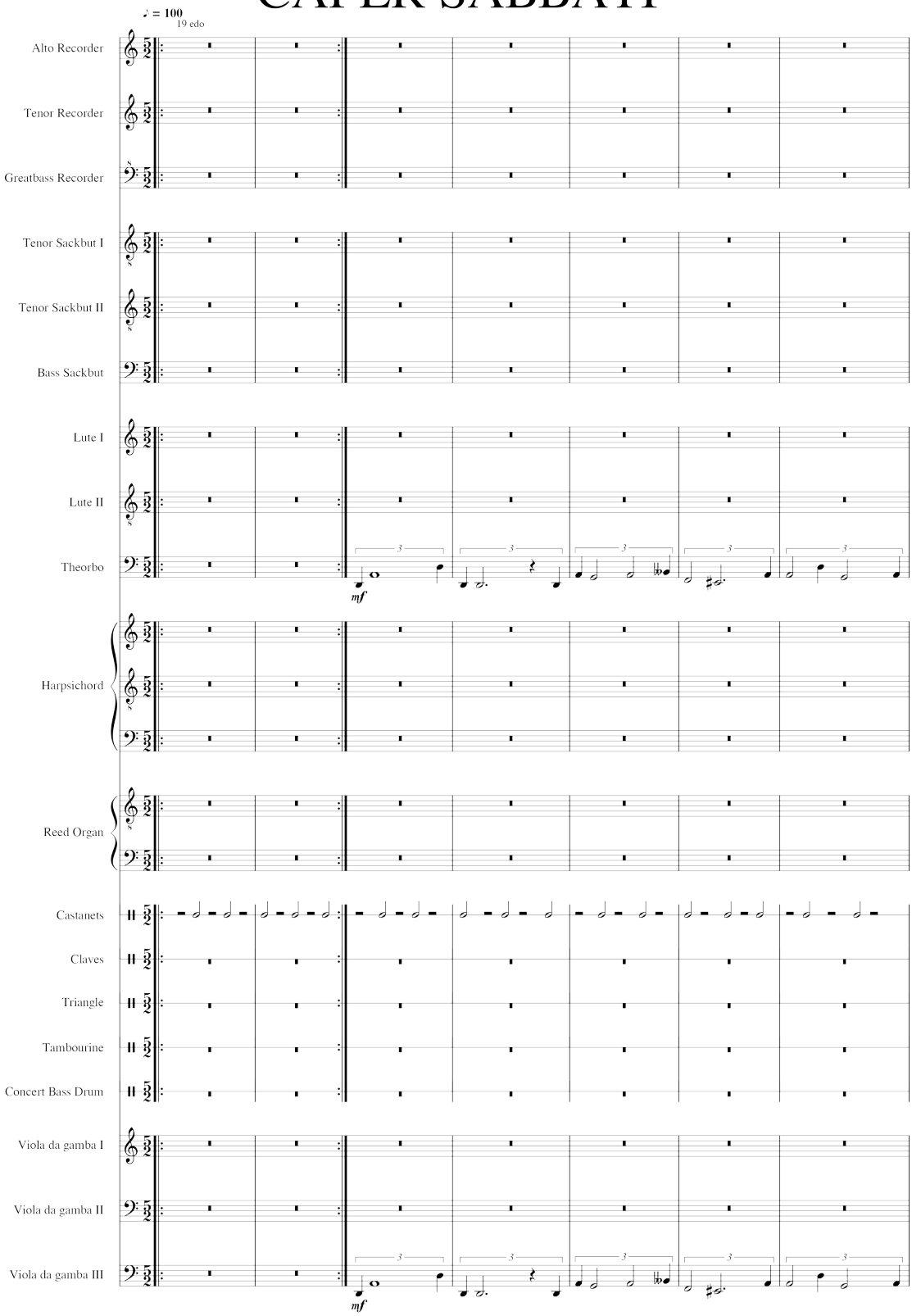
PROFANUS

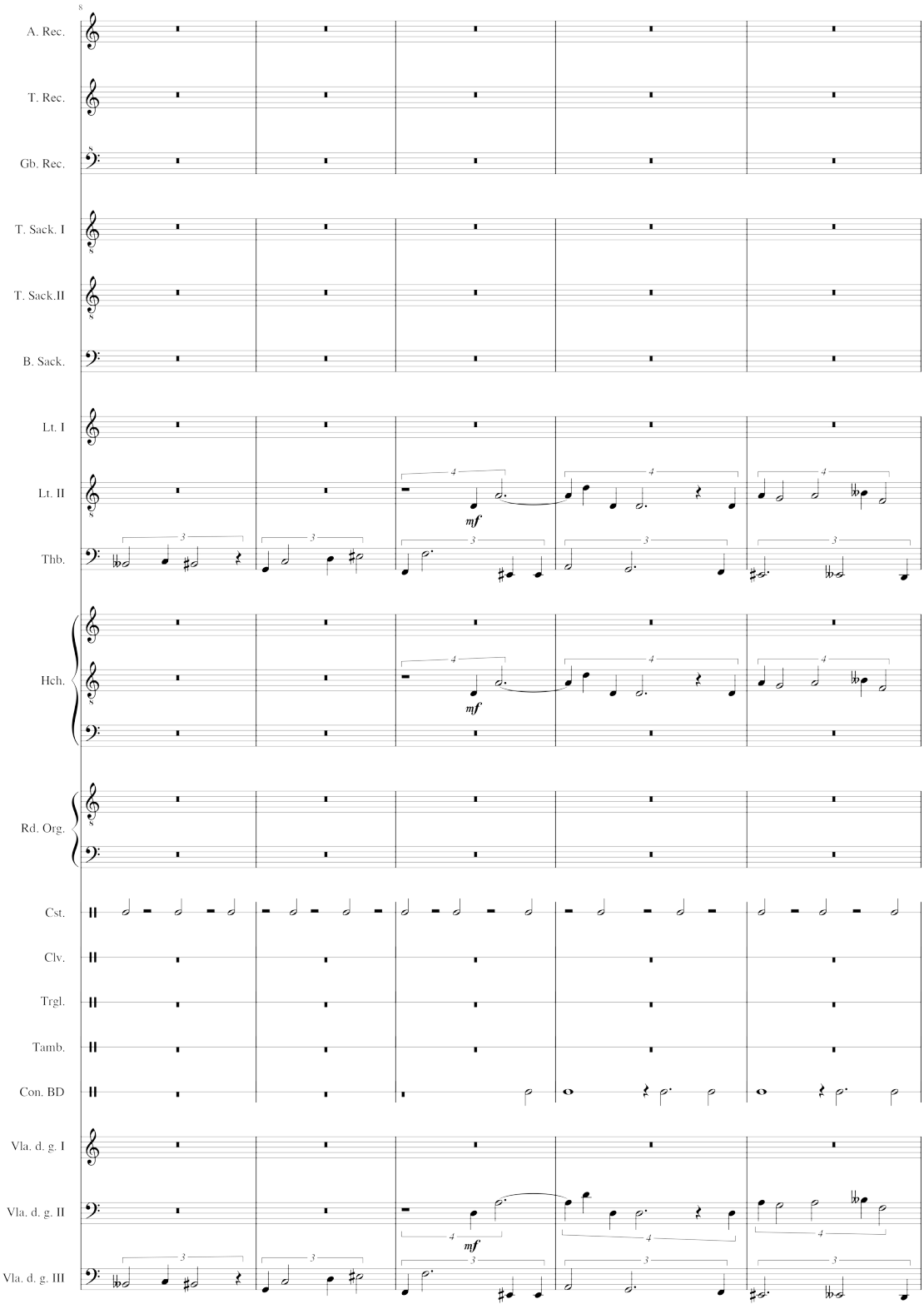

♩ = 300
19 edo
Tutti
Percussion
mp
8
Tutti
Perc.
1.
2.
15
Tutti
Perc.
1.
2.
22
Tutti
Perc.
28
Tutti
Perc.
34
Tutti
Perc.
1.

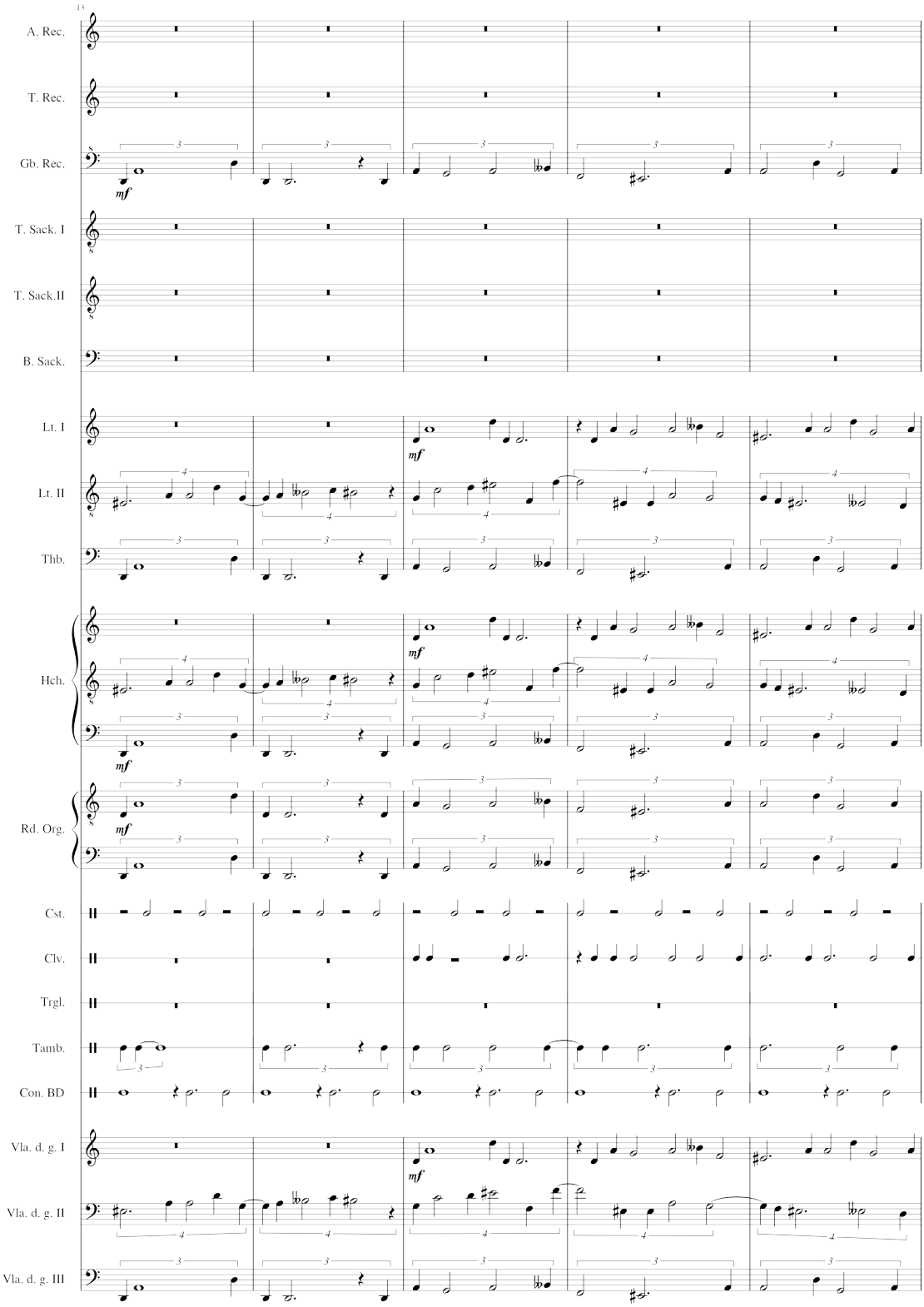

40
2.
Tutti
Perc.
45
Tutti
Perc.
50
Tutti
Perc.
55
Tutti
Perc.
61
Tutti
Perc.
67
1.
2.
Tutti
Perc.

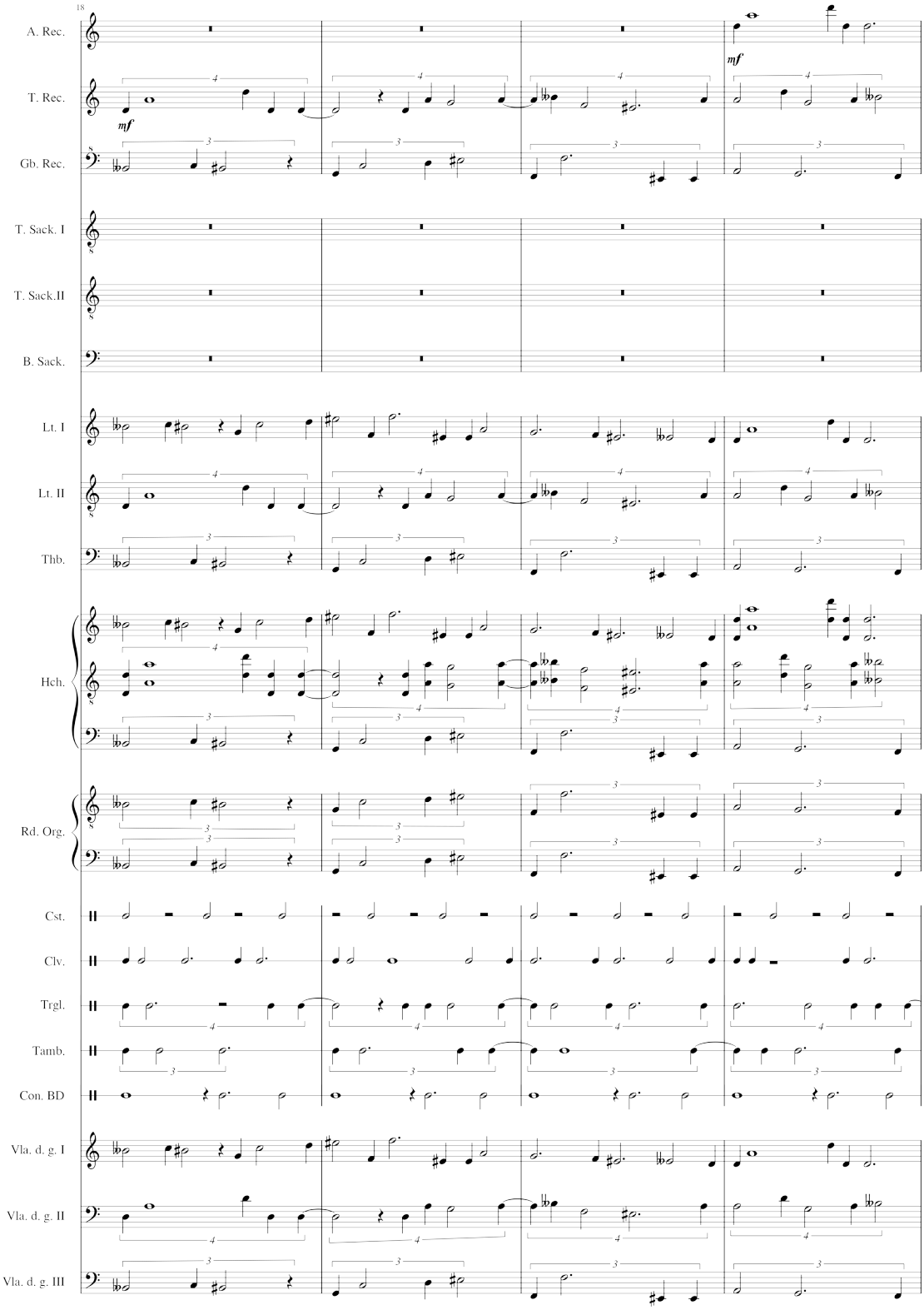

72
Tutti
Perc.
76
Tutti
Perc.
80
Tutti
Perc.
85
Tutti
Perc.
91
Tutti
Perc.
97
1.
2.
Tutti
Perc.

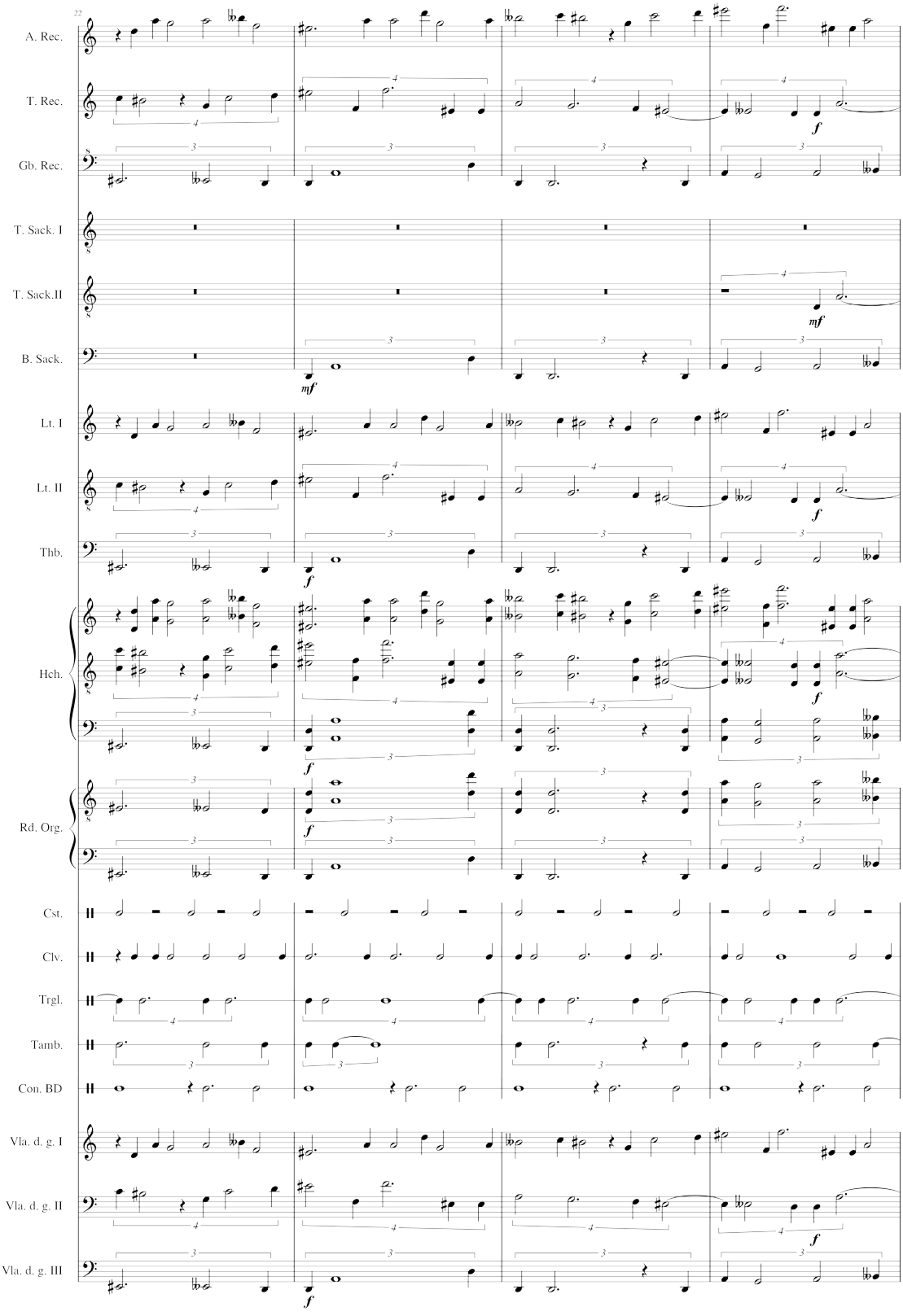
CAPER SABBATI

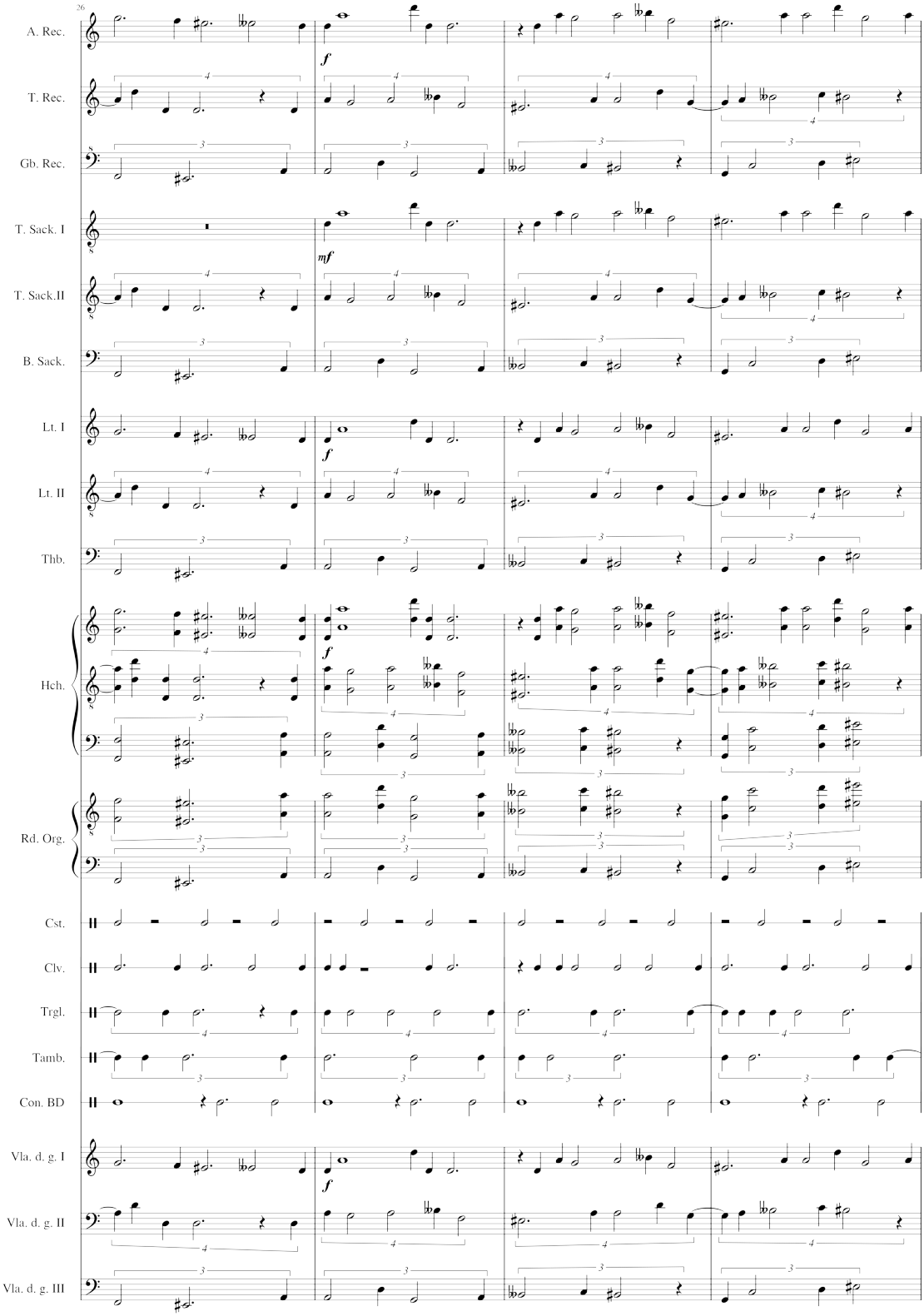


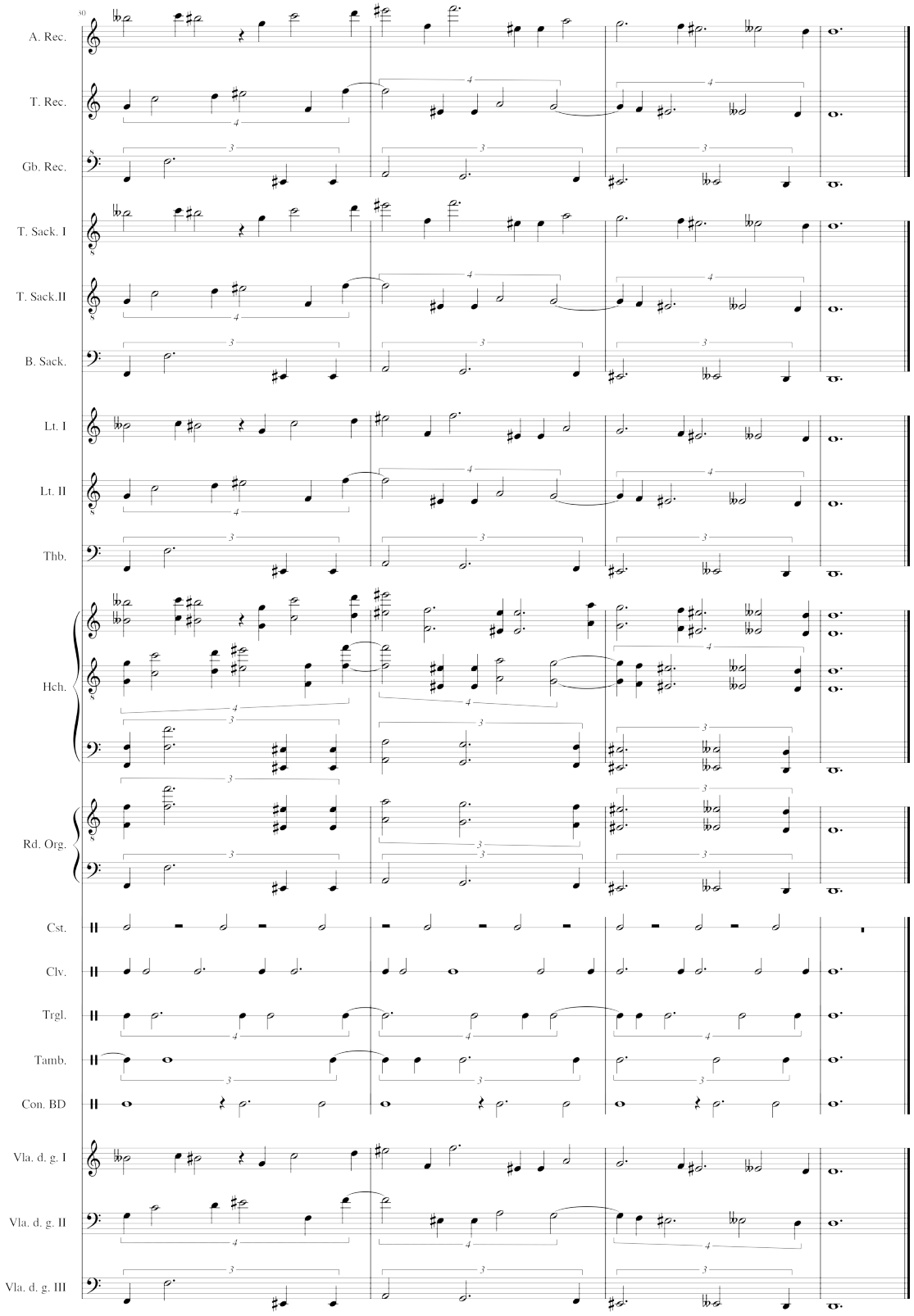

8
A. Rec.
T. Rec.
Gb. Rec.
T. Sack. I
T. Sack.II
B. Sack.
Lt. I
Lt. II
Thb.
Hch.
Rd. Org.
Cst.
Clv.
Trgl.
Tamb.
Con. BD
Vla. d. g. I
Vla. d. g. II
Vla. d. g. III
mf
mf
mf


13
A. Rec.
T. Rec.
Gb. Rec.
T. Sack. I
T. Sack.II
B. Sack.
Lt. I
Lt. II
Thb.
Hch.
Rd. Org.
Cst.
Clv.
Trgl.
Tamb.
Con. BD
Vla. d. g. I
Vla. d. g. II
Vla. d. g. III
mf

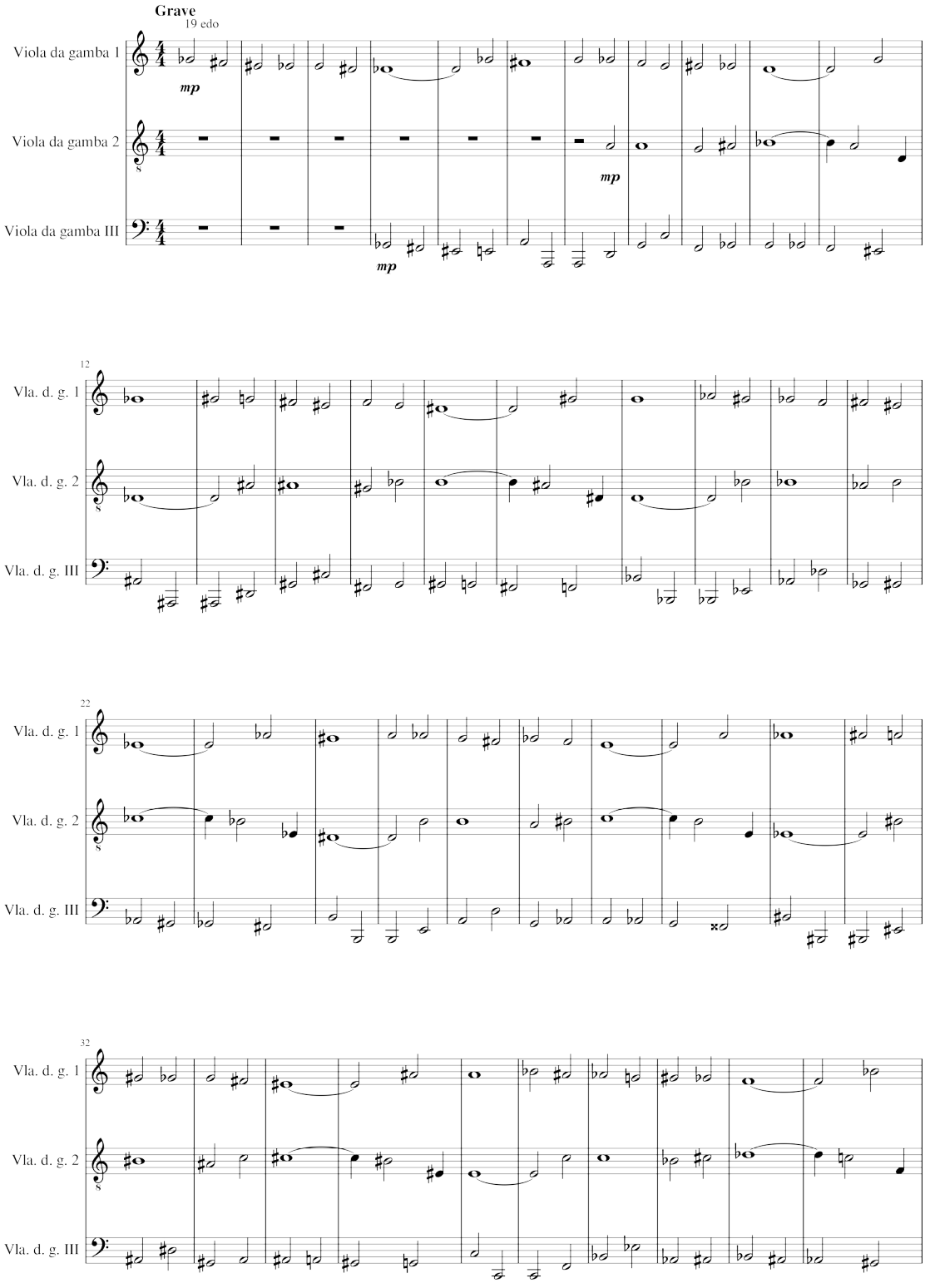

18
A. Rec.
T. Rec.
Gb. Rec.
T. Sack. I
T. Sack.II
B. Sack.
Lt. I
Lt. II
Thb.
Hch.
Rd. Org.
Cst.
Clv.
Trgl.
Tamb.
Con. BD
Vla. d. g. I
Vla. d. g. II
Vla. d. g. III
mf
mf

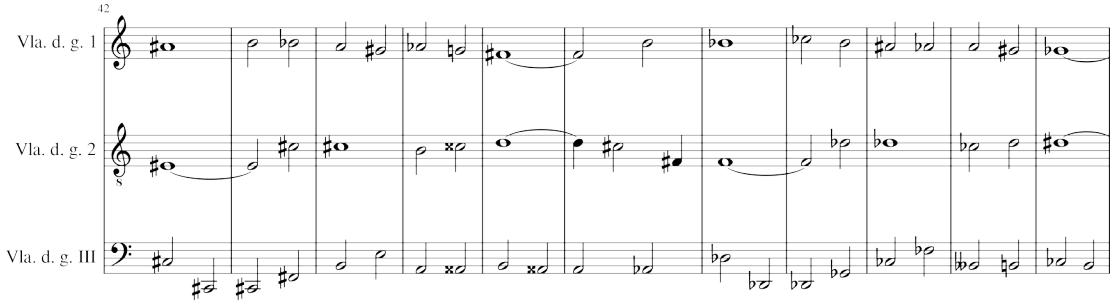

22
A. Rec.
T. Rec.
Gb. Rec.
T. Sack. I
T. Sack.II
B. Sack.
Lt. I
Lt. II
Thb.
Hch.
Rd. Org.
Cst.
Clv.
Trgl.
Tamb.
Con. BD
Vla. d. g. I
Vla. d. g. II
Vla. d. g. III
f
mf

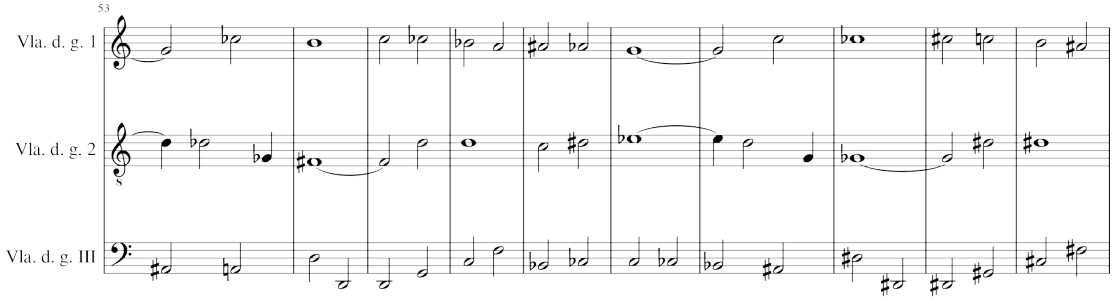

26
A. Rec.
T. Rec.
Gb. Rec.
T. Sack. I
T. Sack.II
B. Sack.
Lt. I
Lt. II
Thb.
Hch.
Rd. Org.
Cst.
Clv.
Trgl.
Tamb.
Con. BD
Vla. d. g. I
Vla. d. g. II
Vla. d. g. III
f
mf

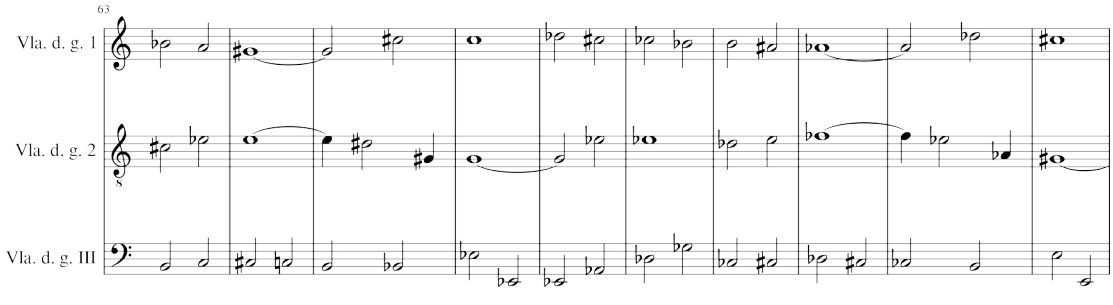

30
A. Rec.
T. Rec.
Gb. Rec.
T. Sack. I
T. Sack.II
B. Sack.
Lt. I
Lt. II
Thb.
Hch.
Rd. Org.
Cst.
Clv.
Trgl.
Tamb.
Con. BD
Vla. d. g. I
Vla. d. g. II
Vla. d. g. III

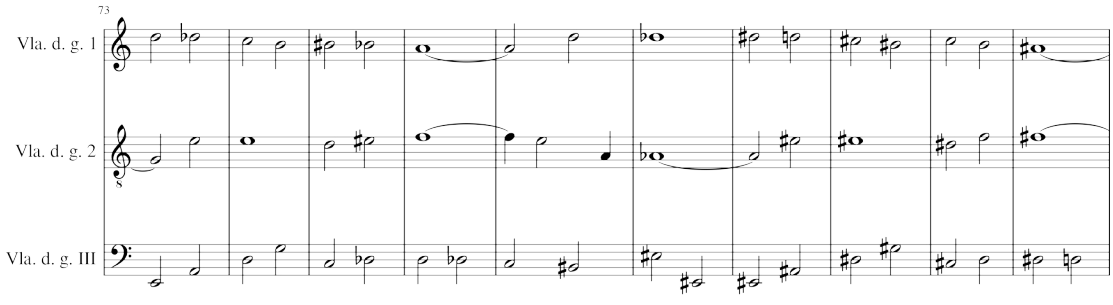
ELEGIA

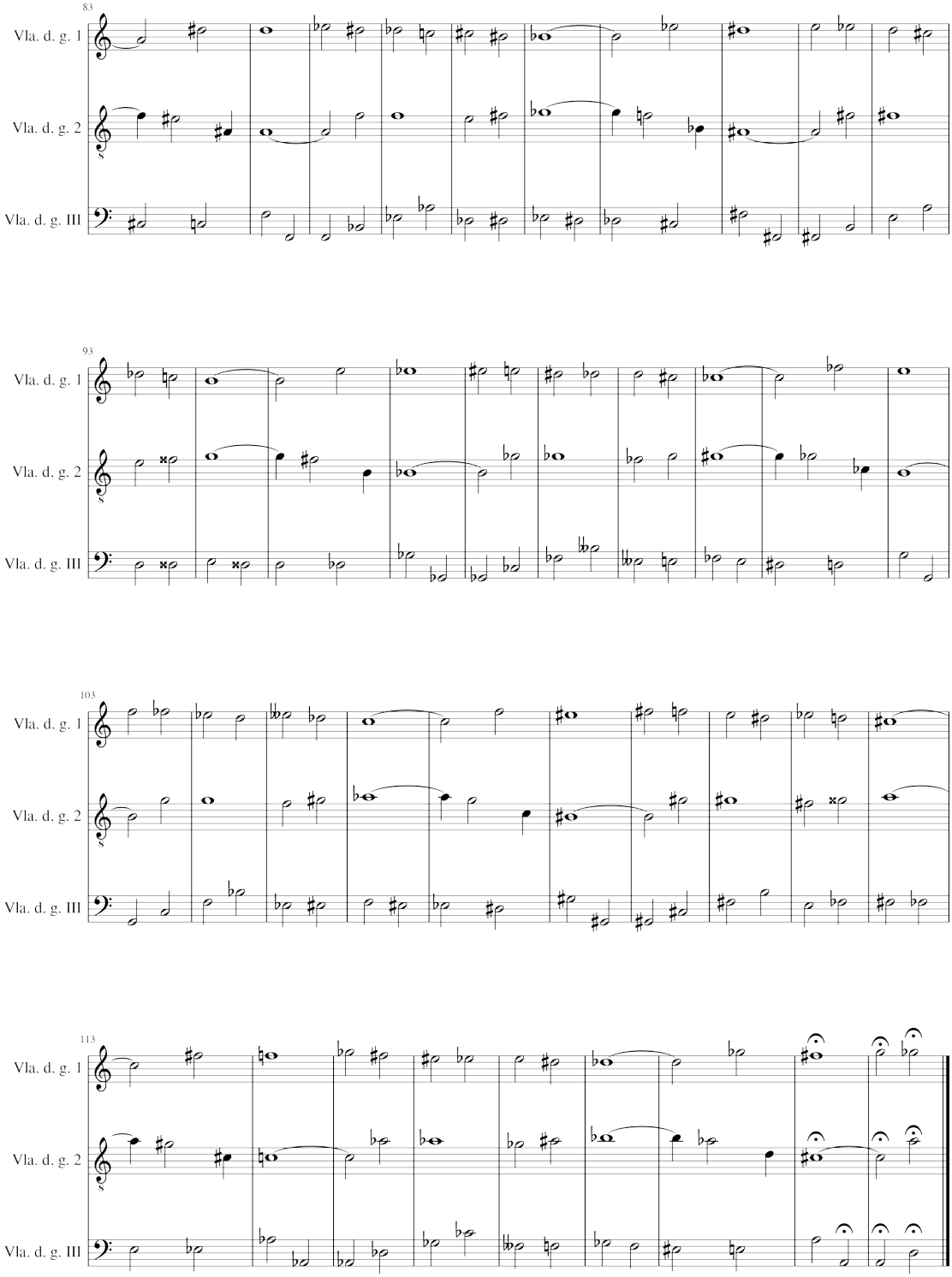

Grave
19 edo
Viola da gamba 1
Viola da gamba 2
Viola da gamba III
mp
mp
mp
12
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III
22
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III
32
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III


42
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III

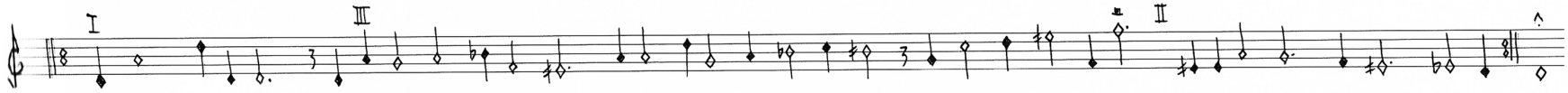

53
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III


63
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III


73
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III


83
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III
93
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III
103
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III
113
Vla. d. g. 1
Vla. d. g. 2
Vla. d. g. III

CANTUS FIRMUS



SUPPLEMENTAL MATERIALS

MIDI realizations for applicable movements:

GRADUAL

TRACTUS

PROFANUS

CAPER SABBATI

ELEGIA

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