

en utilisant différents procédés d'organisation des sons. Selon la nécessité, je peux accentuer la spontanéité ou la rigueur de la pensée froide. Cette technique peut être utile dans n'importe quelle forme, dans n'importe quelle formation vocale, instrumentale ou électro-acoustique.

Peu à peu, je crois que j'ai trouvé ma propre esthétique dans un processus très long et douloureux. J'ai également introduit dans ma musique des différents matériaux sonores selon le principe: dans la musique, tout est la musique. Là je pense à ma dernière oeuvre, "Opéra bestial", un opéra multi-media où j'utilise différentes sources artistiques comme des grands objets gonflables, différents jeux de lumière, la musique spatiale, la musique électronique, le live-electronic, la musique vocale, la musique instrumentale, des ballets, la multi-vision, des rayons lasers et d'autres éléments de la technologie nouvelle.

Je pense que l'esthétique de ma musique est fondée sur le pluralisme des formes où toutes les possibilités technologiques de notre temps peuvent se réunir, sans avoir peur d'être éclectique, parce que l'unité de la pensée reste toujours au premier plan. En même temps, cette esthétique permet de sortir de la fameuse tour d'ivoire de la musique contemporaine, parce qu'elle touche plus facilement les endroits archétypiques chez le public, permet d'espérer que la musique de notre temps trouve une fonction plus sociale.

CONSTRUCTS FOR MODALITY, CA. 1300-1550

Jay Rahn

If one attempts to deal with modal music, a number of phenomena cry out for explanation. For example, what is so special about the four modes sanctioned by medieval theorists? How do these differ from the Ionian, Aeolian, and Locrian modes described by later writers such as Glareanus and Zarlino? Why do theorists lay such stress on distinctions between authentic and plagal ranges, or on the differences among perfect, imperfect, and pluperfect ambituses? How is modal commixture to be understood? Why are certain pitches flattened to avoid melodic or harmonic tritones? Is there any logic to the configurations of initials, and phrase finals or *differentiae*, prescribed by theorists for the various modes? With regard to modal polyphony, why do tenor (2-1) and *superius* (7-8) cadences occur so often, either alone or in conjunction with the contratenor cadence (4-5) in three-part writing, or with the *altus* (5-5) and *bassus* (V-I) cadences in music for four voices? Why are thirds included at the ends of medial sections but not at the ends of entire pieces?

Questions such as these arise over and over again, whether one is dealing with theoretical writings of the time, or with individual pieces of music. Intuitively, one feels that the answers to such questions should be interrelated, for the regularities found in modal pieces and the writings of theorists seem to cohere: both the composers and the theorists appear to have known what they were doing, and gone about their tasks in a consistent manner. Unfortunately, though, capturing in words the apparent unity of a complex tonal system like modality is exasperatingly difficult; the early theorists themselves seem not to have succeeded entirely. However, much the same could be said of pre-Schenkerian theories of major-minor tonality: eighteenth- and nineteenth-century theorists' writings

cohere to a certain extent--as does the music of the period--but the underlying unity of the tonal system has begun to be defined with any precision only recently.

To achieve such an integrated picture of a musical system requires, first, basic concepts. A second requirement is to be thoroughly familiar with the modal system as a system. If a diatonic collection of seven pitch classes is used exclusively throughout a piece, or if such a collection can be considered profitably as referential for any additional pitches (*i.e.*, "chromatic" tones), then a preliminary step is to discover what features are embodied in the diatonic set itself. In this respect, theories of more recent music provide an instructive example, for great advances were made in our understanding of twelve-tone music only when the properties of various rows and groups of rows were laid bare. Thereupon, various compositional practices could be comprehended as "projections" of certain aspects inherent in the system itself. In a similar way, certain modal cadences, conventions for *musica ficta*, and so on, might be viewed as techniques by which special features of the modal system can be exposed or concealed.

All the same, to explain every detail of a predominantly modal piece, or every stray comment by a modal theorist in terms of a Procrustean, "purely modal" framework would be folly, because modality shares certain features with other systems, notably those of major-minor and pentatonic music. Because their interval contents are so similar, the major-minor and pentatonic systems are highly compatible with modality. One frequently encounters passages in early music where pentatonic traits peak through a predominantly seven-tone structure, or where triadic tonality rears its head in an otherwise modal context. It is thus desirable to know what properties are held in common by these three systems, how they overlap, and where they diverge.

The procedure I will adopt, then, is as follows. First, certain basic properties of modal and also major-minor and pentatonic scales will be outlined in

terms of inter-connected constructs (I). Thereupon, prescriptions of medieval theorists and many features which recur time and again in early music will be explained with reference to the proposed constructs (II). Finally, the constructs will be applied to a modal repertoire in order to illustrate how they affect interpretation (III).

I. Basic features of modal, major-minor, and pentatonic systems¹

The diatonic or "white-key" collection has a number of interesting properties, many of which can be described in terms of "bisection." The latter term requires some explanation. If one bisects an odd number in the usual, rational way, the resulting halves contain fractions. For example, 7, 5, and 3 can be bisected rationally into halves containing $3\frac{1}{2}$, $2\frac{1}{2}$, and $1\frac{1}{2}$ units, respectively. On the other hand, if one bisects an odd number intervallically, that is, in terms of integers rather than fractions, the halves are unequal. In the case of a seven-unit quantity, one "half" will consist of three units and the other "half" of four. Five-unit intervals can similarly be bisected into halves of two and three units, and three-unit intervals into halves of one and two units. The latter case, where three is bisected into one plus two ($3 = 1 + 2$), is the most extreme instance of inequality between the halves resulting from intervallic rather than rational bisection.

If the original interval is compared with its intervallic halves, one finds that the interval of the whole is included within, or coincident with, the interval formed by three of the smaller halves laid end to end; also, the whole includes, or coincides with, two of the smaller halves, as in the following cases:

Figure 1. Bisection.

a) whole	. ————— 2 ————— .
3 of smaller halves	. — 1 — . — 1 — . — 1 — .
b) whole	. ————— 5 ————— .
3 of smaller halves	. — 2 — . — 2 — . — 2 — .
c) whole	. ————— 3 ————— .
3 of smaller halves	. — 1 — . — 1 — . — 1 — .

Thus, an intervallic half can range from precisely one-third to precisely two-thirds of the whole. It follows that an interval of 12 semitones can be bisected intervallically in the following ways:

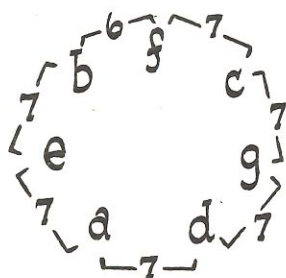
$$12 = 4 + 8$$

$$12 = 7 + 5$$

$$12 = 6 + 6$$

Returning to the diatonic collection, then, one sees first that it consists of a cycle of intervallic halves of the 12-semitone octave:

Figure 2. Cyclic bisection.



Secondly, every interval in the collection is intervallically bisected by a third tone in terms of scale degrees (exactly) and the 12-semitone gamut (approximately). For example, *a-c* is bisected by *b* into 1 + 1 scale degrees and 2 + 1 semitones, *b-d* is bisected by *c* into 1 + 1 scale degrees and 1 + 2 semitones; *c-e* is bisected by *d* into 1 + 1 scale degrees and 2 + 2 semitones. Similarly, *d-f*, *e-g*, *f-a*, and *g-b* are bisected by *e*, *f*, *g*, and *a*, respectively. In much the same fashion, fifths are bisected by thirds:

<i>a-e</i>	is bisected by <i>c</i>	into 2 + 2 scale degrees and 3 + 4 semitones
<i>b-f</i>	" " <i>d</i>	2 + 2 " " 3 + 3 "
<i>c-g</i>	" " <i>a</i>	2 + 2 " " 4 + 3 "
<i>d-a</i>	" " <i>f</i>	2 + 2 " " 3 + 4 "
<i>e-b</i>	" " <i>g</i>	2 + 2 " " 3 + 4 "
<i>f-c</i>	" " <i>a</i>	2 + 2 " " 4 + 3 "
<i>g-d</i>	" " <i>b</i>	2 + 2 " " 4 + 3 "

Similarly, again, seconds are bisected by fifths:

<i>a-b</i>	is bisected by <i>e</i>	into 4 + 4 scale degrees and 7 + 7 semitones
<i>b-c</i>	" " <i>f</i>	4 + 4 " " 6 + 7 "
<i>c-d</i>	" " <i>g</i>	4 + 4 " " 7 + 7 "
<i>d-e</i>	" " <i>a</i>	4 + 4 " " 7 + 7 "
<i>e-f</i>	" " <i>b</i>	4 + 4 " " 7 + 6 "
<i>f-g</i>	" " <i>c</i>	4 + 4 " " 7 + 7 "
<i>g-a</i>	" " <i>d</i>	4 + 4 " " 7 + 7 "

Similarly, the complements of thirds, fifths, and seconds (*i.e.* sixths, fourths, and sevenths) are bisected in terms of both scale degrees and semitones. Thus, there is a perfect coordination between the gamut of twelve semitones and the

diatonic set of seven pitch classes which is selected therefrom.

Another trait of the white-key scale is the coordination of interval sizes expressed in semitones and scale degrees. With one exception, a given number of semitones in an interval determinately implies a certain number of scale degrees in the interval, as is illustrated in the following table:

interval size:

in semitones:	0	1	2	3	4	5	6	6	7	8	9	10	11
in scale degrees:	0	1	1	2	2	3	3	4	4	5	5	6	6

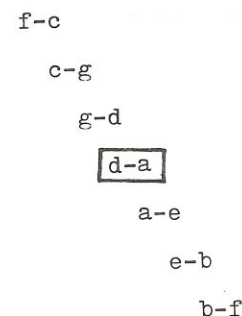
If an interval is of four semitones, for example, it must be of two scale degrees. The exception is the tritone (six semitones) which can correspond to either a fourth (3 scale degrees) or a fifth (4 scale degrees). Thus, the tritone is the only ambiguous interval in the collection, and many of the practices of composers and rules of theorists seem calculated to avoid the confusions which might arise from its indiscriminate use. Otherwise, the semitone and scale degree orderings are perfectly matched.

A related feature is that the linear ordering of pitches in terms of adjacency (e.g., *a, b, c, d, e, f, g, a', etc.*) is coordinated with the cyclic ordering of pitch classes in terms of intervallic bisectors of the octave (e.g., *a, e, b, f, c, g, d, a, etc.*), for it is always the case that pitch classes which are two steps away in the cycle of fifths (such as *a* and *b*, *e* and *f*, *b* and *c*) are adjacent in the linear ordering. In sum, then, the linear and cyclic orderings are coordinated, as are the sizes of intervals expressed in scale degrees and semitones.

A fifth property of the diatonic collection is its symmetry with respect to all intervals, but most importantly, to the fifth. If one fifth (e.g., *d-a*) is considered referential, the other fifths can be arranged symmetrically around it

as follows:

Figure 3. Symmetrical arrangement of dyads.



The referential interval can then define two subsets; these one may term "voices." For example, pitch class *d* can be considered the centre of the "tonic-" or *finalis*-voice, and *a* the centre of the "dominant-" or *confinalis*-voice. In the *a-e* interval, *a* already belongs to the *a*-voice, and *e* to the *d*-voice. Similarly, *b* can be assigned to the *a*-voice, and *f* to the *d*-voice. In the *g-d* interval--on the other side of the symmetrical arrangement of fifths--the *d* is already assigned to the *d*-voice, and *g* can be assigned to the *a*-voice. Similarly, *c* can be assigned to the *d*-voice, and *f* to the *a*-voice. The following scheme summarizes these assignments to subsets, where an arrow indicates that a member of the mode has been assigned to the *d* or *a* voice:

Figure 4. Symmetrical voice-leading arrangement.



A number of points ought to be stressed about this symmetrical arrangement. First, if $d-a$ is considered to be the referential sonority in the sense that $c-e-g$ is referential for C-major, then one can state that c , e , and f are non-referential members of the d -voice, and b , g , and f are non-referential members of the a -voice. Another way of expressing this is to say that c , e , and f are "resolved" into d , and b , g , and f are resolved into a . Secondly, f is special because it belongs to both voices (d and a), and unlike c , e , b , and g , it is not adjacent to a member of the referential dyad, $d-a$. Thus, in terms of voices, there are three sets of scale degrees: d and a , which are referential; c , e , b , and g , each of which is a non-referential member of a single voice, and is adjacent to a referential scale degree; f , which is a non-referential member of both voices, and is adjacent to neither referential scale degrees. Significantly, d and a are not adjacent to themselves (since they coincide with themselves) and are not adjacent to each other.² Also, f bisects $d-a$ and, in turn, a bisects the modular interval $d-d'$. Furthermore, e bisects $d-f$, and g bisects $f-a$ and they are not adjacent to each other, whereas b and c do not bisect any special interval and are, indeed, adjacent to each other. Thus, there is a hierarchy of scale degrees in terms of bisection, adjacency, and reference:

level 1	d	a
level 2	f	
level 3	e	g
level 4	c	b

This dyadic voice-leading scheme can be compared with that of the triadic, major-minor system.³ Here, there are three identical triads: major ($f-a-c$, $c-e-g$, and $g-b-d$) and minor ($d-f-a$, $a-c-e$, and $e-g-b$), respectively. These can be arranged symmetrically around a central or "tonic" triad:

- a) major:
- | | |
|-------------|-------|
| subdominant | f-a-c |
| tonic | c-e-g |
| dominant | g-b-d |
- b) minor:
- | | |
|-------------|-------|
| subdominant | d-f-a |
| tonic | a-c-e |
| dominant | e-g-b |

If, in the $g-b-d$ triad of C-major, the g is assigned to the g -voice of the tonic triad, b can be assigned to the c -voice, and d to the e -voice. Similarly, c , a , and f can be assigned to the c -, g -, and e -voices, respectively, yielding the following symmetrical scheme for voice-leading:

Figure 5. Triadic voice-leading arrangement.



A similar arrangement obtains for minor:

Figure 6. Triadic voice-leading arrangement (minor).



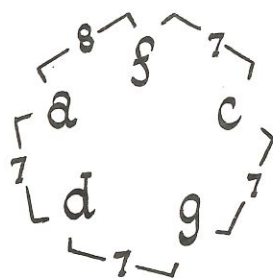
In these cases, the third degree (*e* in C-major or *c* in a-minor) has been accorded full status as a member of the referential triad. Again, on the basis of bisection, adjacency and reference, a hierarchy can be established:

level 1	c	e	g
level 2		d	f
level 3	b		a

Here levels 1 and 2 of the modal scheme are compressed into a single level (one). Otherwise, the arrangements are similar.

Each of these properties is shared by the pentatonic system. In the pentatonic scale, there is cyclic bisection:

Figure 7. Cyclic bisection in pentatonic scale.



Bisection in terms of scale degrees and semitones is coordinated:

f-a is bisected by *g* into 1 + 1 scale degrees and 2 + 2 semitones

<i>g-c</i>	"	"	<i>a</i>	"	1 + 1	"	"	2 + 3	"
<i>a-d</i>	"	"	<i>c</i>	"	1 + 1	"	"	3 + 2	"
<i>c-f</i>	"	"	<i>d</i>	"	1 + 1	"	"	2 + 3	"
<i>d-g</i>	"	"	<i>f</i>	"	1 + 1	"	"	3 + 2	"

f-d is bisected by *a* into 2 + 2 scale degrees and 4 + 5 semitones

<i>g-f</i>	"	"	<i>c</i>	"	2 + 2	"	"	5 + 5	"
<i>a-g</i>	"	"	<i>d</i>	"	2 + 2	"	"	5 + 5	"
<i>c-a</i>	"	"	<i>f</i>	"	2 + 2	"	"	5 + 4	"
<i>d-c</i>	"	"	<i>g</i>	"	2 + 2	"	"	5 + 5	"
<i>f-g</i>	"	"	<i>c</i>	"	4 + 4	"	"	7 + 7	"
<i>g-a</i>	"	"	<i>d</i>	"	4 + 4	"	"	7 + 7	"
<i>a-c</i>	"	"	<i>f</i>	"	4 + 4	"	"	8 + 7	"
<i>c-d</i>	"	"	<i>g</i>	"	4 + 4	"	"	7 + 7	"
<i>d-f</i>	"	"	<i>a</i>	"	4 + 4	"	"	7 + 9	"

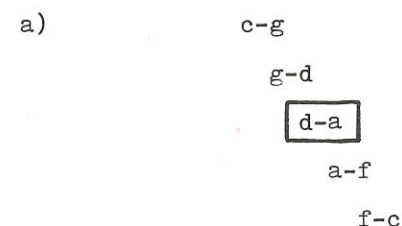
(The same holds for the complementary intervals.)

Interval sizes expressed in semitones and scale degrees are perfectly coordinated. There are not even exceptional intervals, such as the tritone in diatonic music:

semitones	0	2	3	4	5	7	8	9	10
scale degrees	0	1	1	2	2	3	3	4	4

Intervals of half an octave (3 scale degrees) can be arranged symmetrically around a central dyad (*a*) giving rise to a voice-leading scheme (*b*) and a hierarchy of scale degrees (*c*):

Figure 8. Symmetry in pentatonic scale.



b) 

c) level 1 a d
level 2 c
level 3 g f

Most importantly for the present concerns, the pentatonic collection can be expressed as a subset of the diatonic collection in three ways:

diatonic	a	b	c	d	e	f	g
pentatonic	1. a		c	d		f	g
	2. a		c	d	e		g
	3. a	b		d	e		g

To the basic characteristics of the three tonal systems, one can add two notions of a more general nature: proximity and extremity, both of which issue from the relationship of adjacency. By means of its corollary, "proximity," the notion of adjacency can account for hierarchical pitch relationships. For example, in terms of the gamut of twelve semitones, *b* is adjacent to *c* but not to *a*. However, at a higher level, in terms of scale degrees, that is, *b* is adjacent to both *c* and *a*. Thus, *b* can be considered "more adjacent" to *c* than to *a*, since it is adjacent to *c* on a lower level than it is to *a*. A more elegant way of expressing this is to say that *b* is "closer to" or "more proximate to" *c* than to *a*.

Adjacency can be defined in terms of even larger intervals such as a third. In this sense, *b* and *a* are closer together than *e* and *g*, or than *f* and *d*, or *f* and *a*. Finally, *d* and *a* are adjacent only in terms of the referential interval of a fifth, and *d*'s from various registers are only adjacent in terms of the modular

interval of an octave. If it is remembered that a semitone is half a major second, which is half a third, which is half a fifth, which is half an octave, the following hierarchy of proximity relationships emerges:

level 1	minor second	one semitone
level 2	major second	one scale degree
level 3	third	one triadic degree
level 4	fifth	one dyadic degree
level 5	octave	one modular degree (i.e., one register)

Adjacency also serves to explain the special nature of the extremes of any sequence of values. For example, if some adjacent members of a scale are aligned, two elements will appear to be exceptional: the highest and lowest. For all the other pitches except these are adjacent to two other pitches, whereas the extremes are adjacent to only one. For instance, among the following pitches, *e* is adjacent to *d* and *f*, *f* to *e* and *g*, *g* to *f* and *a*, but *d* is only adjacent to *e*, and *a* is only adjacent to *g* (braces join adjacent scale degrees):

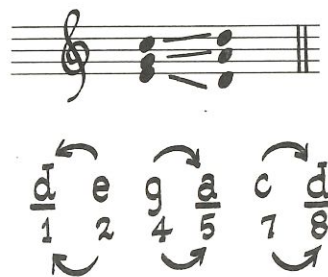


In this sense, *d* and *a* can be considered special.

With several properties of the modes and two related notions outlined, one can begin to account for some of the regularities in early music and certain comments by medieval theorists.

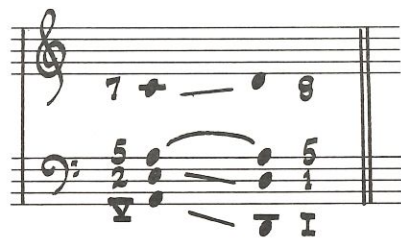
II. Examples of the models' explanatory capacities

First, the tenor (2-1), *superius* (7-8) and contratenor (4-5) cadences that are found in passages for three or fewer voices can be understood as products of the voice-leading scheme described above:



Ex. 1

In the typical four-part cadence of the late Middle Ages or early Renaissance, the above resolutions to the tonic (2-1 and 7-8) are preserved in the *superius* and tenor parts. In penultimate sonorities, versions of the dominant or *confinalis* appear in both the *altus* and *bassus*. Since the dominant belongs to the tonic dyad, it need not be resolved, save in the bass voice. It constitutes the lowest point of a simultaneity, that is, a textural extreme; there it is resolved to the only scale degree which is higher in the referential hierarchy, the tonic itself:



Ex. 2

All of these are final modal cadences in that they end on the referential dyad rather than introduce the bivalent third degree. Though the third is admitted in the middle of pieces, the end and beginning are set to higher levels of the referential tonal hierarchy. Such ends and beginnings are another instance of extremes: in this case, the ordering of adjacencies is in terms of time-moments rather than pitches.

The tones which begin or end a given piece, or conclude a section thereof, appear to have been considered decisive in characterizing a given mode. Every psalm-tone had its special *differentiae* or degrees on which its medial cadences might end. For later modal theorists, such as Aaron and Gafurius, each mode had pitches which were preferred at the outset or at the ends of phrases. Just which notes were chosen for such extreme positions can be accounted for in terms of the pentatonic subsets of the seven-tone scale.

The three pentatonic subsets have three pitches in common (*g, d, a*), and others which differ from subset to subset:

- 1) c g d a f
- 2) c g d a e
- 3) b g d a e

The first can be distinguished from the other two by the presence of *f* rather than *e*, and the third can be distinguished from the rest by the presence of *b* instead of *e*.

For *differentiae*, and prescribed initials and finals, the modes are characterized as follows:

Tone number	Pentatonic subset number	Tone number	Pentatonic subset number
I	1	II	1, 2
III	1, 2, 3	IV	1, 2
V	1	VI	1
VII	2 and 3	VIII	1

Modes characterized by *differentiae*, initials or phrase finals from the first pentatonic subset (1) cadence or begin on *f*, but not on *e* or *b*; they also conclude sections or begin the piece as a whole on *c*, *g*, *d*, or *a*. Those modes marked by collections 1 and 2 end sections or begin the entire piece on *f* or *c*, as well as on *g*, *d*, or *a*, but not on *b*. Modes featuring the second and third subsets do not begin or end sections or the whole piece on *f*, and modes featuring all three subsets are unrestricted in their choice of initials or finals.

Strikingly, the pitches of the first subset are used or prescribed most frequently: in seven of the eight modes, and with no other pitches, in four modes (I, V, VI, VIII). The pitches of the second subset appear in four modes (II, III, IV, VII), but never alone. And the pitches of subset 3 appear in only two modes, and again, never on their own. Selection of initials and cadence pitches appears, then, to be skewed in favour of the first pentatonic subset: *f*, *c*, *g*, *d*, *a*. This does not seem to be an isolated aspect of mediaeval music, for the so-called "chromatic" pitches b-flat and e-flat can be accounted for in terms of the first collection, too.

In Gregorian chant, the first "black-keys" to be introduced into the otherwise "white-key" system are those for b-flat and, to a smaller extent, e-flat. These flattened pitches are alternate versions for *b* and *e*. In a given passage, any of three combinations of the four pitches can be found: *b* and *e*, b-flat and *e*, or b-flat and e-flat. If b-flat and e-flat are added to the first pentatonic

collection, a new diatonic scale with all the properties of the modes described above results:

e-flat b-flat f c g d a

If b-flat and *e* are added to the first collection, a similar result ensues:

b-flat f c g d a e

And if *b* and *e* are added, the original diatonic collection itself results:

f c g d a e b

In other words, the first pentatonic collection is the only subset which is strictly compatible with the chromaticisms usually found in chant.

Frequently, pitches are flattened in accord with the conventions of *musica plecta*. A typical instance occurs when *f* and *b* constitute the extremes of a melodic progression:⁴



Ex. 3

or when there is a leap between *f* and *b*:⁵



Ex. 4

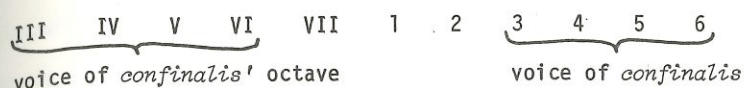
As pointed out before, extremes are special. Leaps, too, are special since, in this style at least, they represent a departure from progression by adjacent scale degrees. When the intervals between extremes or members of a leap involve three or four scale degrees (*i.e.*, a fourth or fifth), their special quality is even greater because of the role of these intervals as half octaves which define the referential dyads, voice-leading, and so on of a modal piece. Thus, such conventions of *musica ficta* remove the ambiguity of the six-semitone interval and substitute the determinacy and consistency of perfect intervals.

The question of how the ranges of modes should be classified is thorny: on this topic medieval theorists range from the taciturn to the prolix, and their comments frequently appear to conflict.⁶ However, if one applies the voice-leading model to their remarks, a clearer picture of their differences emerges.

One can define the extremes in ambitus of authentic modes as the voices of the *finalis* and its octave:

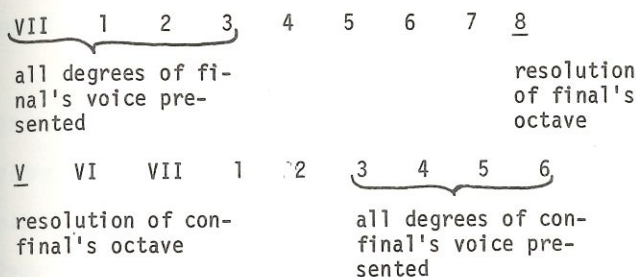


Corresponding to this is the definition of the plagal modes' ambituses as the range from the voice of the *confinalis* to its octave:



Thus an authentic mode might range from VII or 1 to 7, 8, 9, or 10; a plagal could range from III, IV, V, or VI to 3, 4, 5, or 6.

Within this framework, a number of theorists make certain distinctions. For example, Marchettus of Padua terms melodies which range from VII to 8 "perfect" authentics, and those which range from V to 6 perfect plagals.⁷ The "perfection" of these ranges is manifest in two ways. All the degrees of the lowest voice of authentics and highest of plagals are presented, and the scale degrees at the opposite extremes are resolved by the presence of a member of the tonic dyad (*i.e.*, 8 and V, respectively):



In contrast, Marchettus describes as "imperfect" authentic modes those which descend only to the final, and plagal melodies which rise only to the fourth or fifth degrees. He also uses the term "imperfect" for authentics which reach only the seventh degree above the final, and plagals which reach only the sixth degree below it (VI).⁸ In the first case, at least one degree belonging to the extreme voice is missing (VII and 6 or 5, respectively). In the second case, the voice of the other extreme is implied by a degree (such as 7 or VI), but that degree is not resolved; hence the "imperfection."

To complete the scheme, Marchettus specifies that authentic modes which reach the ninth or tenth "degrees" (*i.e.*, the octaves of 2 or 3), and plagal modes which reach the fourth degree below the final (*i.e.*, IV) are "more than perfect."⁹ In this instance, the octave of the final or confinal is not only reached, resolving the degrees in its voice, but other members of its voice are presented. Thus, there is "pluperfection."

Despite the clarity of Marchettus' account, other writers--some writing even later than he--introduce complications into this elegant scheme. Some deny perfection to authentic Lydian modes which range from VII to 8 because the lowest degree is a semitone below the final.¹⁰ This would appear to be an indirect censure of the highest degree of pitch proximity found in the modal system, and possibly a recognition of the pentatonic aspects of much Chant. The pentatonic scales lack semitones,¹¹ and the presentation of such an interval in an extreme position might bring undue attention to it.

A number of theorists consider the ranges 1-8 and V-5 normal for authentic and plagals. Significantly, some of these writers consider melodies with ambituses of V-7 as plagal rather than mixed.¹² In this case, the criterion of resolution seems to have preempted voice membership. In terms of resolution, a tune ranging from V to 7 would be plagal because the final's octave is not presented. If it were (as in the range V-8), the range would be considered mixed.

The theorists' failure to determine whether the members of the dyad or the voices which they define should form the basis for classifying ranges results in a number of dilemmas discussed by Tinctoris.¹³ Although he can decide cases involving ranges such as VII-7 (authentic) or VI-6 (plagal), more problematic ambituses such as VII-6 and VI-7 are treated in terms of a third criterion: the frequency with which upper or lower tones in a range--especially V, 1, 5, or 8--are sounded. Ultimately, this gives rise to arbitrary decisions, since the frequencies

of plagal and authentic features can turn out to be the same. None of these difficulties would have arisen if writers had adhered to Marchettus' scheme, based on voices rather than on the dyad.

Marchettus also deals with commixture. To judge from the examples which he and Tinctoris provide, such a shift of tonal center can be implied by a leap, by the introduction of *musica ficta*, or by a triadic progression. Leaps, as was pointed out above, represent pairs of pitches temporally adjacent, but tonally non-adjacent. If such progressions are found between 1 and 5, 5 and 8, or V and I of the referential mode of a piece, no difficulty arises: both degrees are "resolved" into the referential dyad.¹⁴ However, if other degrees are involved and form an interval of a perfect fourth or fifth as, for example, in leaps from 2 to 5, 3 to 7, and VI to 2, then a non-tonic dyad can be considered temporarily referential.



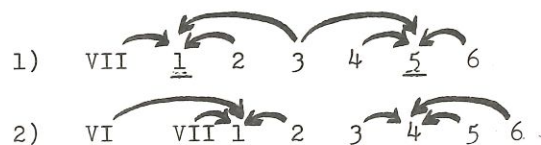
Ex. 5

Commixture of fourth tone with first by leap (after Marchettus, *Lucidarium*, p.115).

The introduction of chromaticism by *musica ficta* similarly requires resolution in an interpretation. Typically, the "false" tone (for example, b-flat) forms a perfect fourth with a diatonic pitch (such as f), and the two are emphasized either as the members of a leap or as the extremes of a melodic progression. Interestingly, in such cases theorists regard the interval between f and b-flat not as the referential sonority of b-flat Lydian, but as a characteristic dyad of

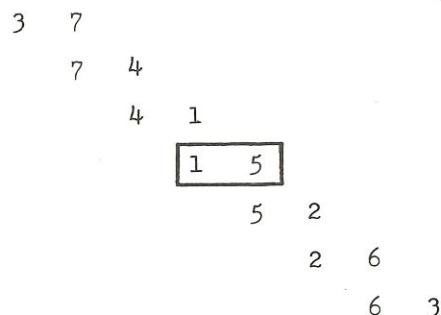
f-Lydian. Similarly, an emphasis on the interval *d-g* in a *d*-Dorian melody is not necessarily viewed as a move to *g*-Mixolydian. Rather, according to the theorists' precepts, it can be considered as consistent with the Dorian mode. Two principles seem to be at work here. First, the more proximate of two possible modes is considered to be implied in any instance. For example, the diatonic *f* rather than the chromatic *b*-flat, and *d* rather than *g* are considered to be the finals in a *d*-Dorian context. Such a principle introduces economies into an interpretation. Secondly, two alternate forms of modality appear to be inferable in such cases. The second type can be considered an "inversion" of the first:

Figure 9. Inverse modal forms.



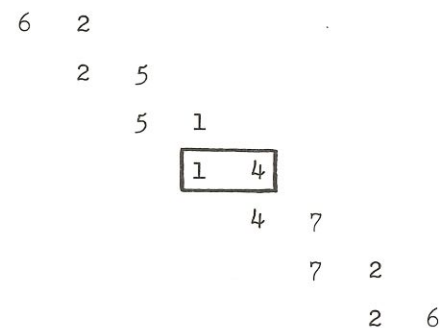
Whereas the first arises from a symmetrical arrangement of fifths:

Figure 10. Symmetrical arrangement of fifths.



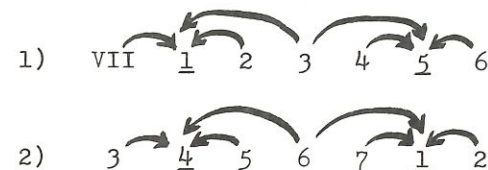
the second arises from an arrangement of fourths (the mod-7 inversions, or complements of fifths):

Figure 11. Symmetrical arrangement of fourths.



The second type of structure can be regarded in several ways. In a sense, it is equivalent to the first type, with the relationships of the first transposed down a fifth:

Figure 12. Inverse forms as transpositions of each other.



This accords well with the fifth transpositions found frequently in late medieval music where, for example, passages in *d*-Dorian are often transposed to *g*. In another sense, it can be regarded as a result of the dyadic structure of modal music.

If the dyad formed by *d* and *a* is referential, there is no systematic reason why *d* rather than *a* should be considered the tonic (or *vice versa*). And if *g-d* is referential, either *g* or *d* could be considered the tonic. This is reflected in the theorists' recognition that a piece can end on its *confinalis* rather than on its *finalis*. That is, if the referential dyad is *d-a*, the piece can end on *a* rather than on *d*. By and large, the theory and practice of later Renaissance music shows a preference for the first type of arrangement, but the second can certainly be mixed with the first. Indeed, if the two are seen to coexist, another reason for the confusion surrounding the sixth and seventh degrees can be advanced. According to the first scheme, the seventh degree belongs to the voice of the tonic and the sixth to the voice of dominant whereas, according to the second, both degrees belong to the voice of the tonic.



Ex. 6

Commixture of sixth tone with first by chromaticism
(after Marchettus, *loc. cit.*).

Lastly, commixture can be implied by the presentation of triadic members. For example, in *d*-Dorian the progression *g-b-d* implies a shift to *g*-Mixolydian for the upper levels of that mode (*i.e.*, the tonic dyad, *g-d*, and its bisector, *b* are emphasized). This, too, can be considered a case where the shift is not from *d*-Dorian to *g*-Mixolydian but from Scheme 1 to Scheme 2 of *d*-Dorian. Indeed, the possible ambiguities between the authentic form of Dorian and the plagal of Mixolydian are discussed by theorists of the time.¹⁵ Nevertheless, in conformity with

their preference for structures represented by Scheme 1, they generally view such cases as commixtures of Mixolydian with Dorian.



Ex. 7

Commixture of seventh tone with first by triadic outline
(after Marchettus, *loc. cit.*).

Finally, a number of contrapuntal features can be accounted for in terms of the proposed models. First, the sliding-scale of consonance and dissonance with perfect intervals (unisons, octaves, fifths) at one end, imperfect intervals (thirds and sixths) in the middle, and full-fledged dissonances (seconds and sevenths) at the opposite extreme corresponds to the hierarchies of scale degrees and proximities. Just as in major-minor music every triad or scale-step is like a key in that it is referential for non-harmonic tones, it would appear that the simultaneities of early music form temporary tonal aggregates to which dissonances are resolved. At the ends of pieces even the imperfect consonances are resolved into perfect harmony.

At cadences, a number of chromatic conventions, such as flattening the tenor (*b2-1*) and sharpening the superius (*#7-8*), appear to be calculated to increase proximity between a melodic dissonance and its resolution. By and large, these chromaticisms involve only *b-flat*, *e-flat*, *f-sharp*, and *c-sharp* which, when substituted for *b*, *e*, *f*, and *c* of the diatonic collection, need not disrupt its properties of cyclic bisection, coordination of cyclic and linear orderings, or correlation of gamut and scale orders. When more remote tones are used, as in the

"secret chromatic art," these features disappear; usually, however, the practices which encourage chromaticism, such as imitation at the perfect fifth, are handled in a way that does not threaten the referential collection's basic properties.

III. A case study in modality

One of the best repertoires for demonstrating both the melodic and polyphonic aspects of modality is French monophonic song *ca.* 1500. Whereas Gregorian chant is monophonic and unmeasured and composed polyphony of the time is contrapuntal and mensural, French monophonic song has features of both traditions: it is monophonic and measured. Before considering this repertoire as a whole from the point of view of the proposed models, one can gather some idea of the individual pieces in the corpus by inspecting a single song, "Hellas, Olivier Basselin."

Ex. 8

The piece as a whole is in *d*-Dorian. The last pitch of the song, as well as of the first and last phrases of the refrain and of the last phrases of each half of the *strophes pairs*, is *d*. Phrases in the middle of sections end on the confinal *a*, and the piece's initial is the bivalent third degree *f*. Thus, *d*, *f*, and *a*--especially *d* and, to some extent, *a*--are emphasized by their positions at major temporal extremes of the work.

The members of this tonic triad appear in metrically special positions in the first and last phrases of the refrain. In the middle phrase, the initial tone and succeeding "accented" tones similarly present the members of the tonic triad (marked "x").¹⁶ This passage is immediately transposed up a perfect fifth in the second half of the phrase. Here members of the triad *a-c-e* are presented in accented or extreme positions (marked "y"). One can thus consider the second half of the middle phrase to represent a shift to the dominant. In this way, the overall tonal form of the refrain is recursive: it begins in *d*, moves to *a* and returns to *d*.

The middle section (b) begins and ends on *d*. In its first phrases, the

pitches *a*, *e*, and *e* (marked "y" again) are emphasized by their metrical positions, as they were in the refrain. In its second phrase, *d*, *f*, and *a* are metrically highlighted in a passage which resembles the first and last phrases of the refrain. Thus, the *strophes pairs* also present a recursive tonal form, beginning on *d*, moving to the triad of the dominant, *a*, and returning to the tonic triad.

In each phrase, the cadence is of the tenor type (2-1) and the pitch of the first tone of the penultimate measure corresponds to the third degree above the phrase final. Thus, a 3-2-1 progression is emphasized at each cadence. Furthermore, the antepenultimate measure begins with the fifth degree above the phrase final in each case, so that one can discern a 5-3-2-1 progression at the end of each phrase. Just as 3 bisects the dyad 1-5, the attack of the third degree bisects the time interval between 5 and 1:

Figure 13. Bisection of pitch- and time-intervals.



In its range the song is imperfect in descent and pluperfect in ascent. Thus, no extreme scale degrees are left unresolved.

The only leaps which occur are of a third, so that other modes are not implied by a direct melodic progression of a fourth or fifth. Even the "dead intervals"¹⁷ between phrases are not tonally ambitious: *a-f* between phrases 2 and 3, and *d-d'* between phrases 3 and 4.

In the repertoire as a whole, many of the features of this song are found to recur. Other regularities, inferable only from a large corpus, are discernible

as well.¹⁸ For example, the most prevalent initial tones are those on the first, third and fourth degrees (Table 1).

Table 1.

scale degree:	1	2	3	4	5	6	7
frequency:	108	12	46	10	54	1	7

Also, the melodies typically conclude on the *finalis*; the *confinalis* forms the end of only one song.

The octave species chosen include preeminently the Dorian, Ionian, Aeolian, and Mixolydian *maneriae*. Cases of Lydian *maneria* are few. In most instances, rules of *musica fiata* effectively turn these "Lydian" examples into Ionian melodies. Phrygian and Locrian do not appear at all (Table 2).

Table 2. Frequencies with which various *maneriae* appear in monophonic sources, ca. 1500.

Greek name:	Ionian	Dorian	Phrygian	Lydian	Mixolydian	Aeolian
Frequency:	81	118	0	4	10	29

Significantly, the four most prevalent modes are those which feature perfect intervals between the first and fifth, fifth and second, and first and fourth degrees:

	4		1		5		2
Dorian	g	b	d	f	a	c	e
Ionian	f	a	c	e	g	b	d
Aeolian	d	f	a	c	e	g	b
Mixolydian	c	e	g	b	d	f	a

Thus, the preferred modes feature a triad of perfect triads. This "triad of triads" is to be distinguished from that which is so important for major-minor music,

in that the thirds which bisect the perfect fifths are not consistently either major or minor. Although Ionian and Aeolian feature consistently major and minor thirds, respectively, Dorian and Mixolydian include both major and minor forms.

Related to this preference for certain octave species are the various frequencies with which scale degrees are emphasized as phrase finals. Here the ecclesiastical norms for *differentiae*--which, as was shown above, reflect various pentatonic scales underlying the seven-tone modes--are not adhered to: phrases end on just about any scale degree, regardless of mode. However, the frequencies with which various degrees are selected to end a phrase vary considerably. The first degree is most frequent, followed by the fifth. The second and third degrees are less frequent than the fifth, but more frequent than the seventh and fourth. And the sixth degree is rarely chosen as a phrase final (Table 3).

Table 3. Frequencies of phrase finals on various degrees in monophonic sources, ca. 1500.

Degree:	1	2	3	4	5	6	7
Frequency:	676	192	176	57	215	20	114

Thus, members of the "tonic triad" are most frequent, followed by members of the "dominant" and "subdominant" triads. Within each triad, the root is more frequent than the fifth; it, in turn, is found more often than the third. These frequencies suggest that the underlying triad of triads determines, to a certain extent, the choice of phrase finals. (If one returns to Table 1, one can observe that a similar pattern underlies the frequencies with which various degrees are chosen as initials, though a much larger proportion is accorded to members of the tonic triad.)



Ex. 9

Example 9 incorporates the most frequent cadential formulas in French monophonic song around 1500; these appear in 10 per cent of the songs or more. Most frequent are cadences of the tenor (2-1) type, followed by those of the *superius* (7-8). The penultimate measures of cadences tend to begin on the third degree above the phrase final, whereas those of the *superius* type tend to begin on the degree of the final itself. Thus, the tenor progression tends to be 3-2-1, and that of the *superius* is 8-7-8. Were these combined, they would form the following contrapuntal progression:



Ex. 10

Here the cadence is prepared by a sonority on the tonic which appears to be similar in function to the cadential 6-4 chord of later tonality. In several cases, the 5-3-2-1 progression appears as described above with regard to "Hellas, Olivier Basselin."

Table 4. Frequencies with which leaps occur between various degrees in monophonic song, ca. 1500.

Interval: Degrees involved in leaps:	
4th	V-1 VI-2 VII-3 1-4 2-5 3-6 4-7 5-8 6-9 7-10
	24 17 31 69 78 29 10 30 2 1
5th	V-2 VI-3 VII-4 1-5 2-6 3-7 4-8 5-9
	1 1 1 109 3 3 2 1
6th	V-3 VI-4 VII-5 1-6 2-7 3-8 4-9 1-10
	2 0 3 3 0 0 0 0
8ve	V-5 VI-6 VII-7 1-8 2-9 3-10
	1 0 0 1 0 0

Table 4 illustrates the number of times leaps greater than a third occur in the repertoire. Such leaps, defining commixtures in some cases, reveal a pattern. Jumps from one member of the tonic dyad to its octave or its other member occur most frequently. Next in frequency are leaps between a member of the tonic dyad and another, non-referential pitch. Less frequent still are leaps from the third to a non-referential degree. Other kinds of leaps are quite infrequent.

Finally, the tendencies for ambituses are quite revealing. In Table 5 one can observe that the ranges of all the melodies lie within the boundaries (III-10) prescribed by the theorists, and accounted for in the voice-leading model. Within this spread, the upper and lower tones tend to lie between the confinal's octave (V) and the final's octave.

Table 5. Frequencies with which given degrees appear as lowest and highest tones in monophonic song, ca. 1500.

Lowest tone:	III	IV	V	VI	VII	1		
Frequency:	1	10	33	23	86	89		
Highest tone:	3	4	5	6	7	8	9	10
Frequency:	7	12	75	38	34	50	20	6

From all this there emerges the picture of a repertoire in which pentatonicisms play almost no role, but where dyadic and triadic forms of modality are highly integrated. Tendencies in the choice of octave species, phrase finals and initials appear to anticipate the onset of major-minor tonality as the predominant system for Western music. At the same time, cadential formulas, leaps, and ambituses reflect an older, modal style of composition.

One should not expect every modal repertoire to have the same characteristics as French monophonic song ca. 1500. In some, the phrase finals chosen might reflect the *differentiae* prescribed in ecclesiastical music.¹⁹ In others only the tonic and dominant may be preferred as initial pitches (for the tenor).²⁰ In yet others, pentatonisms might be observable at cadences or in the melodic ornamentation.²¹ Depending on the type of early music considered, leaps, cadences, chromaticisms, initials, finals or other features might project one type of modal organization rather than another. Thus, one should not generalize about "modality" but, rather, about modality in given repertoires. Further studies of specific corporuses of modal music are needed. In such studies, it may be useful to apply the models proposed here for modal music.

NOTES

- 1 For a more general formulation, see the author's "Some Recurrent Features of Scales," *In Theory Only*, 2, No. 11-12 (Feb.-March 1977), pp. 43-52.
- 2 That is, they are not adjacent in terms of scale degrees. For a sense in which they can be considered adjacent, see below, pp. 16-17.
- 3 Cf. Benjamin Boretz, "Musical syntax (II)," *Perspectives of New Music*, 10 (1971), pp. 232-70, esp. p. 240.
- 4 See Jean Tinctoris, *Concerning the nature and propriety of tones: De natura et proprietate tonorum*, trans. Albert Seay, Colorado College Music Press translations, No. 2 (Colorado Springs: Colorado College Music Press, 1967), p. 13.
- 5 *Loc. cit.*
- 6 See Klaus Wolfgang Niemöller, "Zur Tonus-Lehre der italienischen Musiktheorie des ausgehenden Mittelalters," *Kirchenmusikalisches Jahrbuch*, 40 (1956), pp. 23-32, for a survey of theorists who discuss range in some detail.
- 7 See Marchettus of Padua, *Lucidarium musicae planae* in Martin Gerbert, comp., *Scriptores ecclesiastici de musica sacra potissimum* (Milan: 1931), vol. 3, pp. 64-121, esp. Chaps. II-III, pp. 101-03.
- 8 *Loc. cit.*
- 9 *Loc. cit.*
- 10 For example, Book 3, Chap. 3 of Nicolas Wollick, *Enchiridion musices* (Paris: 1512; repr. Geneva: Minkoff, 1972), and Chap. 23 of Nicolo Burzio, *Musices opusculum* (Bologna: 1487; repr. Bologna: Forni, 1969).
- 11 And, of course, tritones.
- 12 For instance, Wollick, *loc. cit.*
- 13 *Op. cit.*, Chaps. 21, 30, 34-36.
- 14 One might also add leaps between 1 and 4 to this list. See below, p. 27.
- 15 For example, Franchino Gafurio, *Practica musicae* (Milan: 1496; repr. Farnborough: Gregg, 1967), Chap. 15.
- 16 Not in the sense of a dynamic or "stress" accent, but rather in the Renaissance sense of "good" and "bad" parts of the measure, for which see Edward Lowinsky, "Early scores in manuscript," *Journal of the American Musicological Society*, 13, No. 1 (1960), pp. 126-71.

- 17 Cf. Knud Jeppesen, *The style of Palestrina and the dissonance* (Oxford: Oxford University, 1946; repr. New York: Dover, 1970), p. 57, for the notion of "dead" intervals, that is, those found between phrases.
- 18 The following remarks are based on the author's "Melodic and textual types in French monophonic song, ca. 1500", Diss. Columbia University 1978, Chap. 4.
- 19 This appears to be the case in Josquin's Mass settings. See Leeman L. Perkins, "Mode and structure in the Masses of Josquin," *Journal of the American Musicological Society*, 26, No. 2 (Summer 1973), pp. 189-239.
- 20 For instance, polyphonic *chansons* of the Ockeghem generation, as represented by the examples transcribed in Geneviève Thibault et al., eds., *Trois chansonniers français du XVe siècle* (Paris: 1927).
- 21 Thus, Central European versions of Gregorian hymns tend to cadence with the pentatonic progression 6-8 (i.e., 4-5 in pentatonic) rather than with the seven-tone "superius" sequence 7-8 which is used in West and South European versions of the tunes. Also in chant, the quilisma sign tends to appear on b's, suggesting that, in pentatonic fashion, these "pien-tones" could vary in intonation. See on the first point Curt Sachs, *The Wellsprings of music* (The Hague: Martinus Nijhoff, 1961; repr. New York: McGraw-Hill, 1965), p. 155; on the second point, Joseph Yasser, "Medieval quartal harmony - Part I," *Musical Quarterly*, 23, No. 2 (1937), pp. 181-93.