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# Diatonic and Tonal Functions in the Polyphonic Virelai of the 14<sup>th</sup> Century

Christophe GUILLOTEL-NOTHMANN\*

## Introduction

In her article “Modal Discourse and Fourteenth-Century French Song”, Sarah Fuller acknowledges that “modern scholarship has forged no consensus on the theoretical constructs by which pitch relationships in 14<sup>th</sup> century secular polyphonic song are to be construed”<sup>1</sup>. Research has been divided on whether these works should be considered cases of burgeoning tonality, illustrations of polyphonic modality or examples of the importance of solmisation for compositional practice. Christian Berger adopts a resolutely historicist position when he declares that he wants “to recover a specifically medieval perspective on this music and its performance”, arguing that without it “the music [...] can not be properly transcribed and certainly not analysed”<sup>2</sup>. He concludes ultimately that this secular repertoire is part of the ecclesiastical modes<sup>3</sup>. Peter Lefferts on the other hand,

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\* Chargé de recherche, CNRS, *Institut de Recherche en Musicologie* (UMR 8223). I am indebted to my colleagues Anne-Emmanuelle Ceulemans and Nicolas Meeùs for their many thoughtful suggestions and ideas. I also wish to thank Aidan O'Donnell for his careful translation. Thanks finally to the anonymous reviewers for their helpful suggestions.

<sup>1</sup> Sarah FULLER, “Modal Discourse and Fourteenth-Century French Song: A ‘Medieval’ Perspective Recovered?”, *Early Music History*, 17 (1998), p. 61.

<sup>2</sup> Christian BERGER, *Hexachord, Mensur und Textstruktur: Studien zum französischen Lied des 14. Jahrhunderts*, Stuttgart, Steiner, 1992, p. 86: “Denn, so meine These, das Mittelalter hatte eine ganz spezifische, auf seine eigenen musikalischen und aufführungspraktischen Bedürfnisse hin zugeschnittene musikalische Anschauungsform, die sich von derjenigen, die spätestens seit dem 18. Jahrhundert unser Denken über Musik bestimmt, grundlegend unterscheidet. Daraus ergibt sich die Konsequenz, dass die Musik jener Zeit ohne diese musikalische Anschauungsform nicht adäquat übertragen, geschweige denn analysiert werden kann“.

<sup>3</sup> *Ibidem*, p. 17: „Aus dieser Untersuchung ergab sich als notwendige Konsequenz die uneingeschränkte Gültigkeit der Modus-Lehre in der Musik des 14. Jahrhunderts“. (“This research led to the inevitable conclusion that modal teaching held unrestricted validity for music of the fourteenth century”. Translation according to Sarah FULLER, “Modal Discourse and Fourteenth-Century French Song”, p. 63.)

working in the wake of Harold Powers, proposes a theory of tonal types that uses modern concepts and categories to supply a systematic vision of tonality in the polyphonic chansons of the *ars nova*<sup>4</sup>. These two perspectives have been criticised, at times by the same authors. Sarah Fuller rejects the idea that the ecclesiastical modes are a governing force in the polyphonic chanson of the *ars nova*<sup>5</sup>. At the same time, she argues that a process-based approach, sensitive to the work's unfolding in time, calls into question the tonal unity imputed to the work by the theory of tonal types<sup>6</sup>. These positions and the debate they have provoked reflect the considerable room for interpretation that surrounds this repertoire, which has no explicit link to the ecclesiastical modes and which is scarcely discussed by the theorists of the time. However, these positions are also a reflection of deeper epistemological and methodological tensions.

On one level there is a methodological conflict between an emic approach, which aims at understanding the works from within their socio-cultural context, and an etic approach, which seeks to clarify terminology and taxonomy from a would-be neutral, modern, perspective<sup>7</sup>. On another level, the debate is about the nature of tonal organisation and the best way to understand it. This debate introduces two opposing views<sup>8</sup>: firstly, a logical-formal vision that is essentially static and quantitative and which aims to understand a body of work through objective and stable taxonomic categories, with no recourse to context (as in the case of the theory of tonal types). A second point of view is dynamic and qualitative in nature: it considers the question of how tonality unfolds in an individual piece and it examines the subjectivity involved in identifying tonal relations (in line with Sarah Fuller's position<sup>9</sup>).

This opposition between emic and etic positions, on the one hand, and logical-formal and rhetorical-hermeneutic approaches, on the other, needs to be reconsidered. In musicology, the nomothetic paradigm, focused as it is on the formulation of general laws from established facts, has always co-existed with the idiographic paradigm, centred on the study of individuals<sup>10</sup>. It is entirely legitimate to put existing theoretical thought to one side temporarily and use the power of quantitative

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<sup>4</sup> Peter LEFFERTS, "Signature-Systems and Tonal Types in the Fourteenth-Century French Chanson", *Plainsong and Medieval Music*, 4/2 (1995), p. 144.

<sup>5</sup> Sarah FULLER, "Modal Discourse and Fourteenth-Century French Song", p. 103. See also the reservations expressed in Ursula GÜNTHER, "Calixtone von Solage: Ein ungewöhnliches Werk", *Modality in the Music of the Fourteenth and Fifteenth Centuries*, Neuhausen-Stuttgart, Hänssler-Verlag, 1996, pp. 65-74.

<sup>6</sup> Sarah FULLER, "Exploring Tonal Structure in French Polyphonic Song of the Fourteenth Century", *Tonal Structures in Early Music*, Cristle Collins JUDD (ed.), New York and London, Garland Publishing, pp. 63-65 and pp. 75-79.

<sup>7</sup> On the emic-etic distinction in musicology see Anne-Emmanuelle CEULEMANS, "Lassus, Meier, Powers: la réalité des modes sous la loupe", *Revue belge de musicologie*, 72 (2018), p. 85-110. [Special issue "Le plus que divin Orlando", Henri VANHULST (ed.) published after an international conference in Mons, 10 July 2015.]

<sup>8</sup> On this distinction see François RASTIER, *Faire sens. de la cognition à la culture*, Paris, Garnier, 2018, pp. 227-239.

<sup>9</sup> Sarah FULLER, "Exploring Tonal Structure", p. 62 and p. 79.

<sup>10</sup> Rens BOD, *A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present*, Oxford, Oxford University Press, 2013.

approaches in a search for tonal patterns. The identification of internal structures however is always based on subjective choices and so this quantitative approach must be accompanied by critical reflection on the qualitative value of any chosen categories: What assumptions are they based on? What is their relationship to historical theoretical thinking? What do they tell us about our own understanding of musical language and, more precisely, about our understanding of the modal-tonal system?

The present study<sup>11</sup> examines these questions through French polyphonic virelais from the 14<sup>th</sup> century. They are the starting point for a juxtaposition of Lefferts' theory of tonal types with analytic criteria that distinguish between what I will term diatonic and tonal qualities and functions. This double perspective will allow for a reconsideration of certain structural characteristics of the music, while examining the meaning of these qualities and functions and the degree to which they constrain the pieces' modal-tonal behaviour.

This approach knowingly eschews the socio-cultural context of composition and performance. This is not meant to imply that context is unimportant for understanding the works and how they engage with tonality; it is rather a methodological decision. I aim to establish a historical argument based on the pieces as a point of departure of a musical hermeneutics. Only on this basis will higher levels of context be able to fully contribute to a reflection on the history of musical language.

## 1. The Polyphonic Virelai of the 14<sup>th</sup> Century

The virelai is one of the three *formes fixes*, with the ballade and the rondeau, which predominated in French poetry and chanson in the 14<sup>th</sup> and 15<sup>th</sup> centuries. Most virelais date from the 14<sup>th</sup> century and in all, about 142 monophonic and polyphonic pieces have survived<sup>12</sup>. This study uses 108 polyphonic pieces that are extant and are either fully conserved or complete enough in terms of text and music to be analysed according to the criteria outlined below (see appendix 1).

Two thirds of these works are anonymous, with the other third written by composers such as Guillaume de Machaut (c. 1300-1377), Jacob de Senleches (fl. 1382-1383), Johannes de Ciconia (c. 1370-1412), Solage (fl. end of the 14<sup>th</sup> century), Borlet (c. 1397-1409), Matheus de Perusio (fl. 1400-1416) and Bartholomeus de Bononia (fl. 1405-1427). This material, which runs through a 'long' 14<sup>th</sup> century, is held in about thirty different sources of which the most important are the Reina Codex (F-Pn 6771), the Modena manuscript (I-MOe 5.24), the Chantilly Codex (F-CH 564) and the Cyprus Codex (I-Tn9)<sup>13</sup>.

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<sup>11</sup> This is a fuller, English-language version of the paper "Fonctions diatoniques et fonctions tonales dans la polyphonie pré-modale. Les répertoires profanes de l'*ars subtilior*" delivered at the 9th European Music Analysis Conference 2017, Strasbourg 28 June – 1 July 2017.

<sup>12</sup> Jehoash HIRSHBERG, "Virelai", *Musik in Geschichte und Gegenwart*, Sachteil, vol. 9, Kassel, Bärenreiter, 1998, col. 1711.

<sup>13</sup> The call numbers follow RISM conventions. For a complete account of the sources, see the prefaces and critical apparatuses of the four modern editions used for this article.

The pieces have been studied using four editions – those of Leo Schrade, Richard Hoppin, Willi Apel and Gordon Greene – which, with some overlapping, contain the entire corpus of 108 virelais<sup>14</sup>. Although they don't affect the conclusions of this study, the choices in these editions – particularly as regards accidentals – can affect the categories and analytical results provided by the theory of tonal types. Their effect will be discussed in detail in section 4.6. below in the context of a critical examination of the theory's analytical criteria.

The virelai can be distinguished from the other two *formes fixes* both quantitatively and qualitatively. It is the least common of the three and is treated with less prestige in the manuscripts, often relegated to the bottom of a page<sup>15</sup>. Unlike the ballade, it doesn't seem to have been part of the pomp of major celebrations and it held no function as a panegyric. Its simple structure compared to the other *formes fixes* ultimately locates it close to popular and oral traditions<sup>16</sup>. Its particular status is an important argument in favour of exploring the virelai in a study that seeks to understand repertoires that lie at the edge of theoretical codification and ecclesiastical modes.

The characteristics of the virelai as a poetic-musical form can be seen in Matheus de Perusio's *Ne me chaut* (example 1). The piece is divided into five parts: three central sections which correspondent to an A-B-B stanza (*piede I, piede II, volta*), framed at each end by a *ripresa*<sup>17</sup>. The *volta* is the key characteristic of the virelai; it is built with the same rhyming scheme as the *ripresa* (a8-a8-a8-a8 in this example) and uses the same musical material (A). The *pie di* however use distinct musical material (B) and a separate rhyming scheme (b8, c8 in example 1). While they allow the composer considerable liberty, these divergences and repetitions in the poetic form dictate to a certain degree the main outline of the musical composition.

	Ripresa	Piede I	Piede II	Volta	Ripresa
Poetic structure	a8, a8, a8, a8	b8, c8	b8, c8	a8, a8, a8, a8	a8, a8, a8, a8
Musical structure	A (clos)	B (ouvert)	B (clos)	A (clos)	A (clos)

**Example 1:** Matheus de

Perusio, *Ne me chaut*, poetic and musical structure<sup>18</sup>

<sup>14</sup> See the *Sources* section of the bibliography.

<sup>15</sup> For a quantitative comparison of the virelai with the two other forms see WILKINS, Nigel, "Virelai", *Grove Music Online*, <https://doi.org/10.1093/gmo/9781561592630.article.29490>, accessed 22 February 2019, tables 1 and 2.

<sup>16</sup> See Gordon GREENE (ed.), *French Secular Music*, vol. 4, Monaco, Éditions de l'Oiseau-lyre, 1981-1989, vol. 4, p. ix.

<sup>17</sup> Italian terminology has been favored over French terminology (*refrain, ouvert, clos, tierce*) to avoid the systematic association of the second section (*pie de I*) with an *ouvert*, i.e. a poetic and/or musical instable section.

<sup>18</sup> The lowercase letters indicate the rhyming scheme and the figures indicate the number of syllables.

Cadential incises are particularly important in this regard. In the model of the *virondellus simplex*<sup>19</sup> seen in example 1, the two *piedi* use an open (*ouvert*) cadence and a closed cadence (*clos*) respectively<sup>20</sup>. This particular interplay of tension-resolution, which is crucial for the form's dynamism, is abandoned only in exceptional cases<sup>21</sup> such as the virelai *En mon cuer a un descort* (example 2) where the two *piedi* are punctuated by the same conclusive cadence.

	Ripresa	Piede I	Piede II	Volta	Ripresa
Poetic structure	a7, a7, b4, b7, a4, a7, b4	b7, b7, a4	b7, b7, a4	a7, a7, b4, b7, a4, a7, b4	a7, a7, b4, b7, a4, a7, b4
Musical structure	A (clos)	B (clos)	B (clos)	A (clos)	A (clos)

**Example 2:** Guillaume de Machaut, *En mon cuer a un descort*, poetic and musical structure

Another configuration, that of the *virondellus duplex*, reinforces the form's dynamism by constructing the ripresa and the volta from two identical sections that use an *ouvert* and a *clos* cadence respectively. This case is relatively frequent in the monophonic virelais, but only appears once in a polyphonic piece, the anonymous *Ja Falla* (example 3)<sup>22</sup>.

Poetic structure	Ripresa	Piede I	Piede II	Volta	Ripresa
Musical structure	A (ouvert   clos)	B (ouvert)	B (clos)	A (ouvert   clos)	A (ouvert   clos)

**Example 3:** Anonymous, *Ja Falla*, musical structure

The musical tension generated by the *ouvert* cadence and its resolution through the *clos* cadence is decisive for the form's inner coherence. To explore this organisation and its relation to tonality as defined below, it is first necessary to explore the analytical criteria that this study will juxtapose.

## 2. The Theory of Tonal Types

The theory of tonal types proposed by Lefferts aims to grasp the foundations, the constraints and the range of choices relating to tonality in 14<sup>th</sup> century French polyphonic song. According to its author, tonality is the result of how properties inherent in the hexacordal system, and by extension in the diatony, are exploited in a work:

<sup>19</sup> The distinction between *virondellus simplex* and *duplex* is discussed in Egidius de MURINO, “*Tractatus de musica*”, Charles Edmond de COUSSEMAKER (ed.), *Scriptorum de musica medii ævi*, vol. III, Paris, Durand et Pedone-Lauriel, 1869, p. 128.

<sup>20</sup> The distinction between the *ouvert* and *clos* cadence is discussed by theorists from Johannes de Grocheo (c. 1300) onwards. See Stanley SADIE (ed.), “Ouvret”, *Grove Music Online*, <https://doi.org/10.1093/gmo/9781561592630.article.20605>, accessed 22 February 2019. In sections 4.2 and 4.3 below, these concepts will be considered with reference to actual cadential structures found in the corpus.

<sup>21</sup> The use of the same melodic degree for *piede* I and *piede* II concerns about 6% of the corpus: virelais 15, 24, 28, 37, 59, 84 and 104.

<sup>22</sup> This virelai is without text and so has been excluded from the corpus.

A tonality is a particular way of negotiating this background tonal system; it is a particular hierarchy of tonal functions impressed on the neutral raw material of the system by a composer in a given chanson. Tonality is defined melodically and harmonically by which pitches are stable or unstable, stronger or weaker, more or less important. [...] Clearly, if the term ‘tonality’ is not to merely be synonymous with ‘individual tonal behaviour’, a middle ground needs to be sought that draws the line after a certain number of criteria and says, congruences here between chansons mean that they share a tonality; to this degree they are alike.<sup>23</sup>

In order to create distinct homogenous tonal categories, the theory of Lefferts, like that of Powers, is based on minimal markers. These are the cantus final<sup>24</sup>, its register and the tenor part’s key signature. These markers mean there are three main principles that underlie the identification of a tonal type:

1. Transposition of the diatonic system. Lefferts maintains that the diatonic system undergoes transpositions, basing his argument on the presence of cadential points and unstable melodic degrees. Transposition of the diatonic system is considered real and observable because these phenomena remain constant in number and maintain the same relationship to the underlying system: “For a given signature-system the unstable pitches are the same regardless of final, and they transpose with system transposition”<sup>25</sup>.
2. Distinguishing modes by their position in the diatony. Three pairs of modes – *alpha*, *beta* and *gamma* – are identified through their position in the diatony: the *alpha* modes correspond to degrees I and II of a diatonic scale on C; the *beta* modes are located on degrees V and VI and the *gamma* modes are built on degrees III and IV of this same diatonic scale<sup>26</sup>. This classification is justified in quantitative terms: the *alpha* class is more frequent than the *beta* class, which in turn is more frequent than the *gamma* class<sup>27</sup>.
3. Major-Minor Distinction. Alongside the ternary distinction between tonalities on *ut*, *re* and *mi* that is made by Cristle Collins Judd<sup>28</sup>, Lefferts’s theory introduces an additional classification level in distinguishing modes according to the quality of the third above the final: major (M) or minor

<sup>23</sup> Peter LEFFERTS, “Signature-Systems and Tonal Types”, pp. 129-130.

<sup>24</sup> Lefferts prefers the final of the cantus over that of the tenor because he believes that “the cantus line had conceptual priority over the tenor, so the composer worked ‘from the top down’ in making important choices about tonal behaviour”. See *Ibidem*, p. 119. For the present study, the choice between cantus and tenor has almost no effect on the results. Of the 108 virelais, the final’s pitch class only differs between cantus and tenor in five pieces: the virelais 11, 32, 54, 76 and 106, which all conclude on an empty fifth.

<sup>25</sup> *Ibidem*, p. 128.

<sup>26</sup> Here and in the pages that follow, the degrees of the diatonic system are always indicated with roman numerals: c = I, d = II, e = III etc. (see example 4). Notes reckoned in terms of the final are represented by numbers with a circumflex: ^2, ^3, etc.

<sup>27</sup> See Peter LEFFERTS, “Signature-Systems and Tonal Types”, pp. 133-134.

<sup>28</sup> See Cristle Collins JUDD, “Modal Types and *Ut*, *Re*, *Mi* Tonalities: Tonal Coherence in Sacred Vocal Polyphony from about 1500”, *Journal of the American Musicological Society*, 45/3 (1992), pp. 428-467.

(m). Once again, the grouping is justified quantitatively: the modes with a minor third are more numerous than those with a major third in the *alpha* modes while, inversely, the modes with a major third predominate in the case of *beta* modes<sup>29</sup>.

System	Alpha		Gamma		Beta	
	M	m	m	M	M	m
	I	II	III	IV	V	VI
bbb	E $\flat$	F	G	A $\flat$	B $\flat$	C
bb	B $\flat$	C	D	E $\flat$	F	G
b	F	G	A	B $\flat$	C	D
c	C	D	E	F	G	A
#	G	A	B	C	D	E
##	D	E	F $\sharp$	G	A	B

**Example 4:** Tonal type classification and the diatonic system<sup>30</sup>

The table in example 4 summarises the relationship between tonal types, the diatonic system and the final. For example, a piece with one  $\flat$  and a G final in the cantus belongs to the *alpha* minor category while a piece with one  $\sharp$  and a D final in the cantus belongs in the *beta* major category. The greyed boxes indicate configurations that Lefferts did not encounter in his corpus of about 400 secular works from the French *ars nova*.

The application of this classification to the 108 virolais tends to confirm the situation observed by Lefferts and is summarised in example 5. The *alpha* modes (85%) predominate quantitatively over the *beta* modes (11%), which are more frequent in turn than the *gamma* modes (4%). Within the *alpha* category, modes with a minor third (54%) are more frequent than modes with a major third (31%), while the situation is reversed in the *beta* modes.

System	Alpha		Gamma		Beta		Total
	M	m	m	M	M	m	
	I	II	III	IV	V	VI	
bbb							
bb	3 (3%)	11 (10%)					14 (13%)
b	12 (11%)	22 (20%)			3 (3%)	2 (2%)	39 (36%)
c	19 (18%)	25 (23%)		4 (4%)	7 (6%)		55 (51%)
#							
##							
Total	34 (31%)	58 (54%)		4 (4%)	10 (9%)	2 (2%)	108 (100%)

**Example 5:** Classification of the 108 polyphonic virolais by tonal type

<sup>29</sup> See Peter LEFFERTS, “Signature-Systems and Tonal Types”, pp. 133-134.

<sup>30</sup> The theory of tonal types also considers the octave in which the final occurs. For the sake of clarity and simplification this criterion has not been taken into account here.



This quantitative disparity seems to reflect particular tonal properties. However, the theory of tonal types stops short of suggesting a reason for the predominance of certain categories or identifying the significance for the modal-tonal organisation of pieces. The theory “does not tell us why specific choices were made in any given piece, as a sensitive critic might hope to suggest to us, but offers knowledge of the range of choices available in certain areas of tonal behavior”<sup>31</sup>. It’s an approach that “enables us to differentiate – in the way that the more detailed analysis of a single piece cannot – between the conventional, the traditional and the unique”<sup>32</sup>.

The epistemological area to which Lefferts confines his theory – that of representing one aspect of musical reality – is not only justifiable but is prudent, given the uncertainty that surrounds much of the inner working of this repertoire. However, the tonal types bypass an aspect that is fundamental to any theory: an ability to explain the phenomena that have been brought to light.

Of the criteria outlined by Stephen W. Littlejohn for evaluating a theory<sup>33</sup> – theoretical scope, parsimony, heuristic value, appropriateness, validity – the theory of tonal types satisfies theoretical scope and parsimony: it can be applied to a large corpus and it is straightforward in its application. Up to a certain point, it is also capable of producing new analytical observations and of stimulating theoretical reflection. However, the theory of tonal types struggles to satisfy the criteria of validity – does the theory reconcile the internal organisation of pieces and the theory’s concepts, and their interrelations? – and of appropriateness – does the theory adequately describe the tonal functioning of pieces?

A purely quantitative approach that doesn’t seek to explain the phenomena under consideration also invites the following reservation: how can we be certain that the categories and concepts on which the theory is based and which weigh so heavily during classification – transposition, major-minor distinction and the position of the final in the diatonic system – are pertinent for an understanding of the internal organisation of the musical language and for how the underlying tonal system is used? To better understand the forces and principles that are at work in tonal type categorisation, the characteristics and workings inherent to the diatonic system and tonality need to be examined.

### 3. Diatony and Tonality

The analytic reading that follows does not seek to classify pieces into rigid, pre-established categories. It aims rather to identify the constraints and hierarchies that govern the pieces so as to better understand their tonal organisation and their relationship to the underlying diatonic system<sup>34</sup>.

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<sup>31</sup> See Peter LEFFERTS, “Signature-Systems and Tonal Types”, pp. 144.

<sup>32</sup> See *Ibidem*.

<sup>33</sup> See Stephen W. LITTLEJOHN, *Theories of Human Communication*, Belmont, Wadsworth Publishing Company, 1989, pp. 2-31. See also Gilles WILLET “Paradigme, théorie, modèle, schéma: qu’est-ce donc?”, *Communication et organisation* 10 (1996), <http://journals.openedition.org/communicationorganisation/1873>, accessed 22 February 2019.

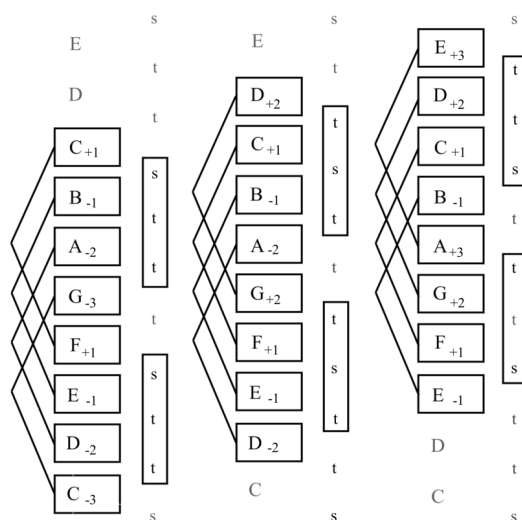
<sup>34</sup> In this regard, the analytical criteria can be aligned with the position adopted by Jennifer Bain. Rather than classify pieces into individual tonal categories, she identifies the network of tonal relations that exist between pieces. See

### 3.1 Diatonic Qualities and Functions

The diatonic system, with its characteristic organisation into tones (t) and semitones (s), is fundamentally asymmetrical. Within the system, four-note sequences have a particular status: they represent the system's most efficient definition, since any diatonic configuration can be reduced to one of them.

While the t-t-t sequence only occurs once in the diatonic system and covers an augmented fourth (F-G-A-B), the other three sequences are found twice and have the range of a perfect fourth because of their semitone. What follows will concentrate on these three tetrachordal sequences: t-t-s, t-s-t and s-t-t.

There are four distinct qualities which result from the semitone's position inside the tetrachord. In example 6, this is expressed in terms of the distance between a given note and the semitone. For example, in the lower of the two t-t-t tetrachords, the notes C, D, E and F derive their character from their respective positions: three degrees beneath the semitone (C<sub>-3</sub>), two degrees below the semitone (D<sub>-2</sub>), one degree below the semitone (E<sub>-1</sub>) and one degree above the semitone (F<sub>+1</sub>).



**Example 6:** Tetrachords and diatonic qualities

Each tetrachord occurs twice and so the notes of the analogous tetrachords that lie a fifth or fourth apart have common qualities. This relationship is shown in example 6 with lines that connect analogous notes: in the t-t-s tetrachord, the notes C and G, D and A, E and B, F and C have affinities because of their common distance from the semitone.

A note with the same name can have more than one quality. This occurs both within tetrachords of the same shape (for example the two t-t-s tetrachords) and between different tetrachords (for example the t-t-s and t-s-t tetrachords). The note C, for example, can represent both a quality of -3 (below the semitone) and of +1 (above the semitone). This polysemy does not however affect the number of qualities, which is limited to four due to the tetrachordal form.

From an historical point of view, these four qualities crystallise in the four *modi vocum* described in chapter VII of Guido d'Arezzo's *Micrologus*:

Since there are just seven notes – seeing that the others, as we have said, are repetitions – it suffices to explain the seven that are of different modes and different qualities. The first mode of notes arises when from a note one descends by a tone and ascends by a tone, a semitone, and two tones, as from A and D. The second mode arises when from a note one descends by two tones and ascends by a semitone and two tones, as from B and E. The third is that in which one descends by a semitone and two tones but ascends by two tones, as from C and F. The fourth goes down by a tone but rises by two tones and a semitone, like G.<sup>35</sup>

Nicolas Meeùs argues that what Guido d'Arezzo describes here is not the four *maniere*, i.e. the four pairs of authentic and plagal ecclesiastical modes but the structure of the diatonic system based on four qualities<sup>36</sup>. Only in a second step are these qualities associated with the modal system. Guido's description also testifies to a strong link with hexacordal solmisation: it systematically describes the four qualities in a context of six notes<sup>37</sup>. The four qualities can thus be grasped through the solmisation syllables *re*, *mi*, *fa* and *sol* framed by the syllables *ut* and *la*.

Berger describes the relationship between ecclesiastical modes and hexacordal solmisation as a mutual dependence: "Without knowing the mode, it is impossible to choose two among the three possible hexachords. On the other hand, the execution of a piece whose mode is known is still impossible without the correct identification of the hexachords"<sup>38</sup>. Meeùs however postulates that

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<sup>35</sup> Guido d'AREZZO, "Micrologus", *Scriptores ecclesiastici de musica sacra potissimum*, Martin GERBERT (ed.), vol. 2, St. Blaise, Typis San-Blasianis, 1784, p. 7: "Cum autem septem sint voces, quia, ut diximus, aliae, id est, octavae voces sunt eadem, septenas sufficit explicare, quae diversorum modorum, et diversarum sunt qualitatum. Primus modus vocum est, cum vox tono deponitur, et tono et semitono, et duobus tonis intenditur, ut A. et D. Secundus modus est, cum vox duobus tonis remissa, semitono et duobus tonis intenditur, ut B. et E. Tertius est modus, qui semitono et duobus tonis descendit, duobus vero tonis et semitono ascendit, ut C. et F. Quartus vero tono deponitur, surgit autem per duos tonos et semitonium, ut G." Translation from Claude V. PALISCA (ed.), *Hucbald, Guido, and John on Music. Three medieval treatises*, translated by Warren Babb, New Haven and London, Yale University Press, 1978, p. 63.

<sup>36</sup> Nicolas MEEÛS, "Modi vocum: réflexions sur la théorie modale médiévale", *Con-Scientia Musica: Contrappunti per Rossana Dalmonte e Mario Baroni*, Anna Rita ADDESSI, Ignazio MACCHIARELLA, Massimo PRIVITERA, Marco RUSSO (eds.), Lucca, LIM, 2010, pp. 21-34.

<sup>37</sup> The only exception is the fourth quality described in the ambitus of a fifth.

<sup>38</sup> Christian BERGER, "Hexachord und Modus: Drei Rondeaux von Gilles Binchois", *Basler Jahrbuch für historische Musikpraxis*, 18 (1992), S. 77: "Ohne den Modus zu kennen, ist die Entscheidung über die Auswahl der beiden unter den drei möglichen Hexachorden nicht zu treffen. Andererseits ist eine Ausführung eines Stückes, dessen Modus ich

the modes derive their characteristics from the notes with which they are associated. Accordingly, the four qualities with their solmisation syllables have their origin in the structure of the diatonic system, independently of any modal functions. From this perspective, the four church modes with their authentic and plagal variants are the logical consequence of the four diatonic qualities. They arise from the position of the four diatonic qualities within the modal octave and their relationship to the final.

This reasoning can be extended to the pseudo-classical system if the hexachordal frame is transcended in favour of a heptachordal one that implies two semitones. As seen in example 7, this heptachordal space leads to seven pairs of authentic and plagal modes of which the unused pair on B can be set aside, leaving six pairs of modes.

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*zwar kenne, ohne Kenntnis der zugehörigen Hexachorde ebenso unmöglich*". See also Christian BERGER, *Hexachord, Mensur und Textstruktur*, pp. 105-109.



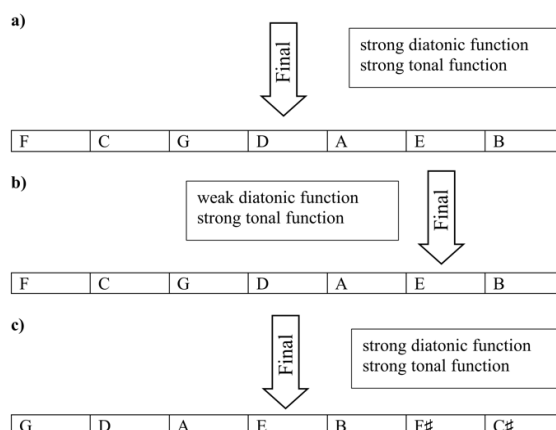
Because of the position of the semitones within the system, the diatony's inherent qualities carry hierarchies within them (see sections 4.1 and 4.5 below). The way these hierarchies are integrated into a work depends however on the period, the composer and each individual piece. It is possible to exploit these hierarchies by working with them or against them. This is why a distinction is necessary between diatonic quality and diatonic function. The former is inherent to the system. The latter refers to how this quality is applied and used, within the musical language and style of a given piece.

### ***3.2 Tonal Quality and Function***

The diatonic hierarchies are complemented by hierarchies of a separate kind. They are tied to specific degrees within a given mode or tonality and imply the identification of a tonal reference note. These are what I will call tonal qualities, to be understood here in the broadest sense. They correspond to scale-step qualities and cover all the phenomena that are defined in terms of a given reference note within a modal-tonal scale: for example the tonic, the modal division of the octave, or the modal ambitus. Just like diatonic qualities, these tonal qualities can be either confirmed or negated in compositions. The final, as a typical tonal quality, for example, can be highlighted from the first moments of a work and then emphatically confirmed at the close or, on the contrary, it may be avoided and exist only as a slight presence in the background. This is why it is useful to distinguish here again between abstract qualities and their concrete exploitation through tonal functions.

In certain cases, diatonic and tonal qualities converge, such as when a diatonic degree that is strong, due to its stable position with a whole tone above and below – D for example – is used as the tonal centre of the piece (example 8a). But diatonic and tonal qualities can also conflict such as when a degree that is weak, due to its position beneath the semitone – like E – acts as the final. In modality, where diatonic hierarchies predominate over tonal ones, this creates the particular case of the *mi* mode (example 8b). In harmonic tonality on the other hand, the tonal hierarchies are so strong that they recreate the diatonic hierarchies by shifting the entire underlying system (example 8c).

The next section will explore how diatonic and tonal qualities operate through functions in the 108 *virelais* under consideration. It will then be established how these functions explain the quantitative groupings that the theory of tonal types identifies.



**Example 8:** Diatonic function and tonal function

#### 4. The corpus of virelais

This exploration of diatonic and tonal functions will take as its point of departure a systematic analysis of the cadences found within the 108 virelais. Extracts from the virelai *Belle sans per* of Matheus de Perusio (example 9) demonstrate the principal cadence types identified in the corpus. In the great majority of cases, the cadential structure involves an imperfect consonance moving to a perfect consonance by stepwise descending movement in the tenor ( $^2 - ^1$ ) and stepwise rising movement of the cantus ( $^7 - ^8$ )<sup>39</sup>. This is what I will call a *clausula simplex* (example 9a). The cantus formula can be decorated by having it descend to the sixth before it rises to the octave ( $^7 - ^6 - ^8$ ): this situation is seen in example 9b and corresponds to the Landini cadence. Some cadences are reinforced by having a dissonant suspension ( $^8 - ^7 - ^8$ ) precede the imperfect consonance, which reinforces the teleology inherent in the movement. In this case the cadence corresponds to the *clausula formalis* shown in example 9c.

The cadential effect can be strengthened by the use of a melodic semitone. In most cases this is the formula of a rising semitone in the cantus (example 9a-c). It can also occur however by descending movement in the tenor (example 9d). It then represents the Phrygian cadence. In each case the semitone is either inherent to the diatony (example 9b-d), or is artificially created by the addition of *musica ficta* (example 9a).

<sup>39</sup> An alternative arrangement consists of moving from a fifth to an octave by descending stepwise movement in the tenor and an ascending third in the cantus.

**Example 9:** Matheus de Perusio, *Belle sans per*, Apel (1970-1972), vol. I, no. 55, a) mm. 12-13, b) mm. 16-17, c) mm. 28-29, d) mm. 43-44<sup>40</sup>

A considerable number of contrapuntal structures can be identified which, although they resemble cadences, do not actually function as cadences in terms of the piece's formal structure. This is why only those formulas that mark line-endings and the main incisives (*ripresa*, *piedi* and *volta*) have been considered. Intermediary incisives inside lines have occasionally been included where they occur at the end of a word. In all, 1148 cadences have been identified across the 108 virelais and the following characteristics have been noted for each: the cadence type used, the diatonic degree on which the cadence rests and the position of this degree in terms of the final.

Other criteria play a role when it comes to theorising the cadence in the time of Machaut, notably the disposition of the parts, the vertical sonorities and the complexity of the elaboration of different formulas<sup>41</sup>. These have been examined but will not be considered further as they are not directly relevant to this study.

#### 4.1 Finals, diatony and cadential degrees

A simultaneous examination of cadential degrees and finals in the pieces provides the first indications on the use of diatonic and tonal functions. The table in example 10 shows the notes on which the cadences occur (columns) with the finals of the pieces classified according to the tenor's

<sup>40</sup> The treatment of the poetic text is extremely melismatic and so the text has not been included in the example.

<sup>41</sup> On this point, see Jennifer Lynne BAIN, "Theorizing the Cadence in the Music of Machaut", *Journal of Music Theory*, 47/2 (2003), pp. 325-362.



signature (rows). The overall frequency of use of each cadence point appears at the bottom of the table.

The cadences fall across the circle of fifths in a remarkably regular pattern, clustered mainly around G and D. This tendency doesn't hold however as regards individual tonal types: the cadential degrees whose frequency most surpasses the overall averages noted in the lower line have been marked in black in example 10. Generally, these cadences confirm the piece's final: pieces with a final on F have a preponderance of cadences on F; pieces with a final on C use cadences on C, *etc.*<sup>42</sup>. This means that a tonal function is at work here, one that uses the final as a tonic for the virelais and thus undermines the diatonic hierarchies. This is what justifies distinguishing the pieces in terms of their final. It is also this aspect that suggests these pieces are tonal, in the broadest sense. This does not mean that the composers never obscure the reference note or that several tonal centres never coexist in a single piece<sup>43</sup>. However, these compositional choices do not necessarily negate the tonality and may actually exploit it by operating against the shared conventions that have crystallised in this corpus.

The light grey squares in example 10 indicate the cadential degrees whose percentage most surpasses the general averages after the main cadences (in black)<sup>44</sup>. These secondary cadence points don't immediately suggest clearly defined trends. A closer reading shows however that they are the result of an interaction between diatonic and tonal qualities.

In seven of the eleven tonal types that occur in these virelais, these secondary cadences are situated two fifths above the final, on degree  $\wedge 2$ . As a consequence, a tonal quality appears to be at work. This quality however overlaps with diatonic hierarchies: the secondary cadences are generally located on the sharp side of the circle of fifths<sup>45</sup> and in eight of the eleven tonal types ( $\flat\flat$ -B $\flat$ ,  $\flat\flat$ -C,  $\flat$ -B $\flat$ ,  $\flat$ -F,  $\flat$ -G,  $\flat$ -D,  $\natural$ -C,  $\natural$ -D), they occur on the Phrygian degree. The tonal quality inherent to the second degree and the diatonic quality of the Phrygian degree converge in certain cases ( $\flat\flat$ -C,  $\flat$ -G,  $\flat$ -D,  $\natural$ -D) but also occur independently. To better grasp how these characteristics are exploited in the pieces and to better understand their interaction, it is necessary to examine how the pieces are articulated formally.

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<sup>42</sup> The only exceptions to this rule are pieces on B $\flat$  with a  $\flat$  in the tenor's signature. But the rarity of this category here, represented by only one piece in the corpus, does not allow for any useful deductions.

<sup>43</sup> Jennifer Lynne BAIN, *Fourteenth-Century French Secular Polyphony*, p. 127.

<sup>44</sup> For example, in the pieces with a final F and a  $\flat$  in the tenor signature, it's the note A which occurs at an above-average rate, after the note F.

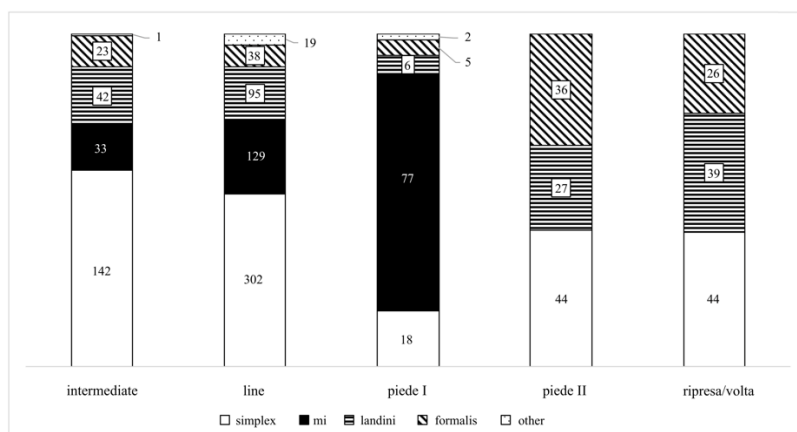
<sup>45</sup> The only exception is found in the mode  $\flat$ -B $\flat$  whose final (B $\flat$ ) occurs less frequently than the secondary cadential degrees.

	E ♭	B ♭	F	C	G	D	A	E	B	F#	Total
b-B ♭	2% (2)	40% (8)	10% (2)	10% (2)	15% (3)	25% (5)					100% (20)
b-C		3% (3)	3% (4)	48% (60)	13% (17)	25% (31)	6% (7)	1% (1)			100% (126)
b-B ♭		25% (1)				25% (1)	50% (2)				100% (4)
b-F			38% (48)	14% (18)	20% (26)	5% (6)	17% (22)	6% (7)			100% (127)
b-C		3% (1)		44% (17)	13% (5)	26% (10)	8% (3)	8% (3)			100% (39)
b-G		2% (5)	4% (12)	7% (20)	51% (139)	11% (29)	23% (63)	2% (5)			100% (273)
b-D					11% (1)	56% (5)		33% (3)			100% (9)
b-F			28% (8)	28% (8)	31% (9)	3% (1)	3% (1)	7% (2)			100% (29)
b-C			2% (4)	47% (83)	13% (23)	20% (35)	3% (6)	13% (23)	1% (1)		100% (175)
b-G		1% (1)	2% (2)	5% (5)	38% (36)	20% (19)	21% (20)	11% (10)	1% (1)		100% (94)
b-D			3% (7)	5% (12)	9% (23)	48% (122)	15% (39)	19% (48)		0% (1)	100% (252)
Total	0% (2)	2% (19)	8% (87)	20% (225)	25% (282)	23% (265)	14% (163)	9% (102)	0% (2)	0% (1)	100% (1148)

**Example 10:** Cadential points and finals

## 4.2 Musical and Poetic Structure

The bar chart of example 11 represents the cadence types (*clausula simplex*, *mi* cadence, Landini cadence, *clausula formalis*) which coincide with the virelais' incises (intermediate, line, *pie*de I, *pie*de II, *ripresa/volta*). It shows a clear interdependence between cadence articulation and the structure of the virelai. Simple cadences are generally used at minor incises, at the end of a line or at internal subdivisions. The Landini cadence and the *clausula formalis* – elaborate and more conclusive – are found at the main incises: the end of the *ripresa*, the *volta* and *pie*de II. The *mi*-cadence, which is fundamentally unstable, generally marks the *pie*de I<sup>46</sup>.



**Example 11:** Cadences and poetic structure

The choice of cadential formulae is thus part of a dynamic process that crystallises in the rhetoric of the *ouvert-clos* dynamic of the *pie*di. This is seen in example 12, taken from the anonymous virelai *En ties en latin*. The intrinsically unstable Phrygian cadence on E at the end of *pie*de I contrasts with the stable cadence on D at the end of *pie*de II. Stability and instability are mutually reinforced by means of contrast: a deliberate contradiction of the diatonic hierarchy at the end of *pie*de I is reversed at *pie*de II. In this regard, the Phrygian cadence plays a decisive role in the teleology inherent to this poetic-musical form.

<sup>46</sup> In order to make for a more uncluttered presentation, cadences that belong to several categories (for example a Landini cadence that is also Phrygian) are placed in only one group by means of the following logic: 1. Cadences on E are systematically placed in this category regardless of any of their other qualities. 2. Non-Phrygian *clausulae formales* are all placed in this category even if they also contain elements of the Landini cadence.

17

1. 2.

Ich min dich, wil tu mir trauwen? Tam dul-citer;  
 Ne say fors tant mes-ler au - - we Vi-o-len-ter.

**Example 12:** Anonymous, *En tiés en latin*, Apel (1970-1972), vol. III, no. 193, mm. 17-23

In the present case, the *ouvert* cadence marks the question “*wil tu mir trauwen?*” (“Will you marry me?”), which is asked “so sweetly” (“*tam dulciter*”) by the narrator. Jacques Handschin had already drawn attention to the exegetical nature of the descending semitone – *plorant semiton* – in the thirteenth century<sup>47</sup>. Its use to depict lamentation is attested from Dufay onwards, and it becomes widespread in the 16<sup>th</sup> century, as Bernhard Meier and Ute Ringhandt have both demonstrated<sup>48</sup>.

Historically, the central role of the Phrygian formula in signifying opening, development and interrogation – a role it will maintain until the 19<sup>th</sup> century as what Ariane Jeßulat calls a “musical topos of interrogation”<sup>49</sup> – may be partly connected to the *ouvert-clos* distinction that is part of the formal dynamics of 14<sup>th</sup> century *formes fixes*. It cannot be excluded either that the musical teleology inherent to the *ouvert-clos* articulation may have its counterpart in the semantic and syntactical tensions that are inherent to the poetic text, an idea which seems at least partially corroborated here by the opposition *dulciter* – *violenter*.

Unquestionably, the tonal and diatonic functions identified in the corpus would benefit from a dedicated study that considers the poem’s meaning and syntax. This confrontation will however have to take place in a separate study. Given the complexity of text-music relations in the *formes fixes*<sup>50</sup>, this article has chosen to set aside that question in order to better focus on the poetic-musical structure at a macroscopic level.

<sup>47</sup> See Jacques HANDSCHIN, *Der Toncharakter: Eine Einführung in die Tonpsychologie*, Zürich, Atlantis Verlag, 1948, p. 11 and p. 14.

<sup>48</sup> See Bernhard MEIER, *Die Tonarten der klassische Vokalpolyphonie*, Utrecht, Oosthoek, Scheltema & Holkema, pp. 253-262 and Ute RINGHANDT, *Sunt lacrimae rerum: Untersuchungen zur Darstellung des Weinens in der Musik*, Sinzig, Studio, 2001, pp. 25-27 and pp. 75-118.

<sup>49</sup> See Ariane JEBULAT, *Die Frage als musikalischer Topos. Studie zur Motivbildung in der Musik des 19. Jh.*, Berlin, Studio Verlag Schewe, 2001, pp. 69-71.

<sup>50</sup> See Gilles Dulong’s doctoral thesis dedicated to the relationship between text and music in the polyphonic ballad. Gilles DULON, *La ballade polyphonique à la fin du Moyen-Age: de l’union entre musique naturelle et musique artificielle*, PhD dissertation, Université François Rabelais, 2000. See in particular the chapter dedicated to relations between musical and poetic form, pp. 167-185.

### 4.3 *Piede I*: Phrygian Degree and Scale Degree

The graph in example 13 shows the occurrences of the tonal scale degrees used for the cadences that close the *piede I* in the 108 virelais. Phrygian cadences are marked in dark grey. It is unsurprising that degrees  $\wedge 1$ ,  $\wedge 4$  and  $\wedge 5$  are rarely employed and are never associated with the Phrygian cadence: an open cadence on degree  $\wedge 1$  (whether Phrygian or not) would cancel out the open-closed dialectic<sup>51</sup> – a Phrygian cadence on degrees  $\wedge 4$  and  $\wedge 5$  would mean a final on the notes B ( $\wedge 4 = E$ ), F ( $\wedge 4 = B$ ), A ( $\wedge 5 = E$ ) or E ( $\wedge 5 = B$ ). Of these solutions, only the final on A (and to a lesser extent on F) is really feasible, since the others imply a Phrygian cadence which would weaken the opposition between *piede I* and *piede II*.

Given the importance of degree  $\wedge 2$  used for two thirds of the cadences in the 108 virelais it is unsurprising that several analytical studies have identified it as the main cadential point of the *ouvert* cadence<sup>52</sup>. The results shown here however mean this view needs to be revised as far as the present corpus is concerned. They show that in 75% of cases, the choice of degree  $\wedge 2$  is correlated to its Phrygian character and its intrinsic diatonic, oppositional, quality compared to the regular cadence. Although diatonic and tonal characteristics partly overlap and although in 25% of cases the scale degree  $\wedge 2$  is used for its intrinsic tonal quality, diatonic quality seem to outweigh tonal quality in the choice of this cadence point. Two arguments support this hypothesis. On the one hand, the choice of cadential degrees other than  $\wedge 2$  – degrees  $\wedge 3$ ,  $\wedge 6$  and  $\wedge 7$  – is always dictated by their Phrygian aspect<sup>53</sup>. On the other hand, in the corpus considered as a whole, it is the Phrygian aspect of the cadential incise which predominates (71%) over its tonal quality as a supertonic (64%).

The status of the cadence on *mi* is reflected in the 14<sup>th</sup> century advice dispensed by Egidius de Murino concerning the rondeau:

The first part of the rondeau has an open ending and when it ends on *ut* [this ending] must be made at the tenth, and when it ends on *la* it must be at the fifth – the second part includes a conclusive clausula.<sup>54</sup>

The two syllables *ut* and *la* indicate the notes C, F, G and A, D, E in hexachordal solmisation. The cadential degrees situated at a third and a fifth respectively are thus in both cases E, A, B. The recommendations by Egidius, which are followed in part in the corpus, thus amount to favouring

<sup>51</sup> This situation can be found for example in piece 37.

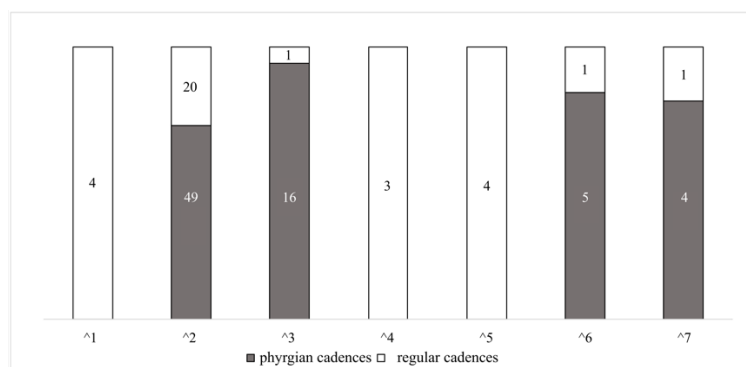
<sup>52</sup> See Stanley SADIE (ed.), “Ouvert” and Peter LEFFERTS, “Signature-Systems and Tonal Types”, pp. 136-137. See also Yolanda PLUMLEY, *The Grammar of 14<sup>th</sup> Century Melody. Tonal Organization and Compositional Process in the Chansons of Guillaume de Machaut and the Ars Subtilior*, New York, London, Garland Publishing, 1996, p. 12 and p. 84.

<sup>53</sup> Of the 28 cadences found on these degrees only three are not Phrygian.

<sup>54</sup> Egidius de MURINO, “*Tractatus de musica*”, p. 128: “*Item Rondellus habet apertum ante, quando finitur in ut, et debet esse decima; et quando finitur in la, debet esse [sic] quinta, et retro clausum*”.

cadential degrees which are solmised *mi*<sup>55</sup>. It is not in fact because these cadences represent “exceptions to a simpler rule of thumb that finds the medial goals on  $\wedge^2$  or  $\wedge^6$ ”<sup>56</sup> that they are the only ones explained by Egidius. On the contrary, it’s actually the scale degree  $\wedge^2$  which is the special case in an approach that’s based on the Phrygian nature of the *ouvert* cadence.

I insist so much on the interaction of the diatonic and tonal hierarchies in the open cadence of the *piede* I because this interaction is decisive for the modal-tonal organisation of these pieces. The desire to contrast the stability of the final with a cadence that a) implies a Phrygian ending and b) is located in the immediate proximity of the final, implicitly constrains the choice of the reference note. It leads to a preference for finals on D and C, the *alpha* modes in the theory of tonal types. To better identify these constraints, it is necessary to understand how the diatonic space is exploited, in particular via the vocal part’s ambitus.



**Example 13:** Phrygian degree and scale degree in the *ouvert* cadence

#### 4.4 Ambitus

The ambitus of the 108 virelais (appendix 2) involve particular configurations. The tenor almost always has as its lower limit the final (or a second below the final) with an authentic ambitus of about an octave above. While in two-voice pieces the ambitus of the cantus is relatively varied and larger than the tenor’s ambitus, it generally shifts by a fourth or a fifth above the tenor to a plagal ambitus in pieces with at least three voices. In four-part pieces, the triplum either matches the cantus or has the same ambitus a fourth above.

<sup>55</sup> It is the case in the tonal types  $\sharp$ -C,  $\flat$ -F and  $\flat\flat$ -B $\flat$ , which have main secondary cadential degrees on E, A and D, located a tenth from the final. As the corpus does not include any pieces on A, it is not possible to test this case. See example 10.

<sup>56</sup> See Peter LEFFERTS, “Signature-Systems and Tonal Types”, pp. 136-137: “These two cadential goals may have been singled out by the author because they are the major exceptions to a simpler rule of thumb that finds the medial goals on  $\wedge^2$  or  $\wedge^5$ , either a step above or a third below the cantus final”.

Ambitus in these pieces appears then to be organised in relation to the final. It has a clear tonal function and emphasises the tonal centre of the piece by setting upper and lower limits for the melodic material of different voices. Thus, the tonal centre is not a localised element limited to the end of the virelai. On the contrary, it can govern an entire piece not only through cadence points but also through the disposition of the voice ranges.

Some pieces however do not adhere to the configuration outlined above: on the one hand the virelais 22, 28 and 91 with F as a final in a non-transposed *gamma* major mode, on the other the virelais 77, 94 and 99 with G as a final in a non-transposed *beta* major mode. In each of these pieces the tessitura of the tenor (and of the countertenor in three-voice pieces) is offset by a lower fourth or a fifth compared to the standard arrangement and appears to follow a plagal configuration. The cantus, which has a broader ambitus than the tenor, is located a fifth above in virelais 94 and 99 but doesn't otherwise follow trends observed in the other pieces.

These configurations are accompanied by a very different tonal organisation. The table in example 14 summarises the ambitus of the tenor in these six pieces, along with their cadential structure. The major cadential incises of the *ripresa* and of the *piede* are shown in bold and the intermediary incises in grey. With the exception of virelai 91 (Machaut's *Se je souspir*) the cadential degree of *piede* II never corresponds to the final cadence point of the *ripresa*. This configuration, also found in three other virelais<sup>57</sup>, is exceptional in terms of the corpus. It suggests that the tenor's ambitus is established in relation to the final of *piede* II and only indirectly according to the final of the *ripresa*. The importance of the *piede* II's final as a tonal centre is also confirmed by the secondary cadential incises of pieces 22, 77, 94 and 99.

Work	Tenor ambitus	Line + intermediate	Ripresa	Line + intermediate	Piede I	Piede II
22	C3-C4	C, D, E, C, E	F	D, E	D	C
28	C3-A3	F, C, G, G, G, C	F	G, G	C	C
91	C3-D4	G, E, C, F	F	G	E	F
77	C3-D4	D, A, E, C, D, E	G	D, A	E	D
94	C3-D4	D, A, C, D, G, C, D, G, D	G	G, E, D, G, G, G, D	E	D
99	C3-D4	C, D, G, B, A	G	D, G	E	C

**Example 14:** Tenor ambitus and cadential incises in virelais 22, 28, 9 and 77, 94, 99

In these works corresponding to Lefferts's beta and gamma modes, the endings of *piede* I and II thus reproduce the standard configurations of the *alpha* modes with typical closed incises on C and D and open incises, generally Phrygian, located at the upper second or third<sup>58</sup>. It is highly indicative that the final and the closed incises, while distinct, have affinities in terms of diatonic qualities: the final F and the closed incise on C are both located above the semitone and share two solmisation syllables (*ut* and *fa*). The final G and the incises on D also have analogous positions in the diatonic

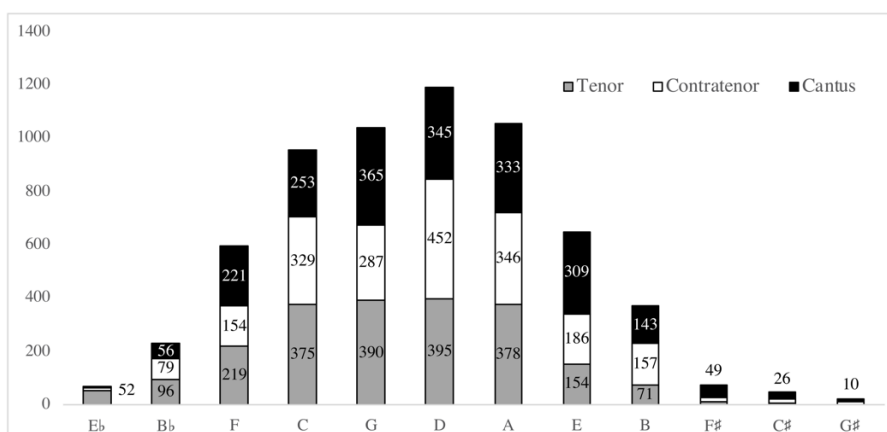
<sup>57</sup> Pieces 24, 32 and 104 all have D as final and either A (pieces 24 and 104) or G for the cadential degree of the closed strophe.

<sup>58</sup> Pieces 28 and 91 are exceptions.

system and also share two solmisation syllables (*sol* and *re*). It appears then that in these particular cases tonal affirmation is understood via the diatonic qualities of the solmisation hexachord. These examples also suggest that the categories proposed by tonal type theory include different degrees of homogeneity. The *beta* and *gamma* modes bring together disparate arrangements because their particular diatonic configuration does not allow for the recreation of the configurations found in the *alpha* modes.

#### 4.5. Diatony, Tessitura and Voice-parts

A more detailed pitch analysis of a subcorpus of 13 three-voice virelais is shown in example 15<sup>59</sup> where the notes are grouped across the circle of fifths and where their durations are summed<sup>60</sup>. This statistical analysis has been carried out using an MEI encoding of the virelais. Only the alterations present in the manuscript sources have been considered; any editorial accidentals have been excluded<sup>61</sup>.



**Example 15:** Sum of note durations in a selection of 13 virelais

When the notes are organised along the circle of fifths, with D in the centre, the total duration of the notes decreases as we move outwards to a greater number of sharps and flats. Furthermore, the hierarchy shows the dominance of a hexatonic core (F, C, G, D, A, E) within which is found a tetratonic fundament (C, G, D, A). This representation shows once again that diatonic hierarchies are at work and that they affect the tonal organisation of the pieces.

<sup>59</sup> Pieces 10, 15, 20, 21, 26, 38, 50, 59, 81, 94, 96, 101 and 102 were selected in order to represent the main tonal configurations encountered in the 108 virelais.

<sup>60</sup> The note durations have been summed by assigning each note a value proportionate to its duration: crotchet = 1, quaver = 0.5, semi-quaver = 0.25 etc.

<sup>61</sup> On the *Music Encoding Initiative* (MEI), see <https://music-encoding.org/>, accessed 22 February 2019.



If one considers how the individual voices exploit the diatonic space, it becomes clear that the tenor (indicated in grey) operates slightly towards the flat side of the circle of fifths while the cantus (indicated in black) tends towards the sharp side. In the pieces without partial key signatures, these two diatonic registers are linked through the ambivalence of the note B, with its two manifestations  $\flat$  or  $\natural$ . In the tenor part of example 16 (Matheus de Perusio's *Dame souvrayne*), the descending stepwise movement in measures 19-20 means the flattening of B. In measures 24-25 of the cantus however, the rising movement introduces  $B\sharp$  for a double leading note cadence (with  $F\sharp$ ) on C.

**Example 16:** Matheus de Perusio, *Dame souvrayne*, Apel (1970-1972), vol. I, no. 56, mm. 17-25

This ambivalence affects the position of the Phrygian cadence within the diatonic system. In measures 14-15 of example 17 the flattening of B creates a Phrygian cadence on A, the sixth degree of the diatonic scale. This secondary incise anticipates the final cadence on G in measures 18-19, which punctuates the last line of the *ripresa*.

In solmisation theory, the two versions of the note B coexist without any particular hierarchy and both belong to *musica vera*. The note's double nature and the extended diatony it implies thus allow for a Phrygian cadence just above the final, which is the configuration sought by the composers. The use of  $\flat$  would have meant a Phrygian degree on E, a third below. Accordingly, one can suggest that this expanded diatony (with  $B\flat$  and  $B\sharp$ ) is being employed deliberately to create the cadential dynamic that is inherent to the form's teleology.

**Example 17:** Anonymous, *Pour vous reveoir*, Apel (1970-1972), vol. III, no. 217, mm. 13-19

These considerations suggest that the link between tessitura and diatonic region shown in example 15 can be explained in part by the standard arrangement of cadential formulae: the typical descending semitone movement of the Phrygian clausula corresponds to the tenor formula and this is generally where it occurs (see example 17, mm. 14-15), while the rising semitone movement, characteristic of the regular cadence, is generally used in the cantus (see example 16, mm. 24-25). The tonal unity of the pieces is not undermined by this double diatonic space. In fact, in example 17 the contrasting Phrygian cadence on A actually helps to establish the final G as the reference note. Accordingly, it is less a “bi-tonality”<sup>62</sup> which is at work here than a bi-diatony. Although this bi-diatony is employed locally, it is brought about above all through the use of partial signatures.

#### 4.6. Partial Key Signatures and Transposition

Approximately half of the 108 virelais are notated with partial signatures that generally imply an extra  $\flat$  in the lower voices (see appendix 2). These affect the cadential articulations significantly. For instance, the additional  $\flat$  in the tenor part of example 19 leads to a Phrygian open cadence at the end of *pie*de I, whose instability is resolved by the closed cadence of *pie*de II.

This bi-diatony invites the following question: are the partial signatures used, at least to some extent, to generate Phrygian cadences on scale degree  $\hat{2}$ ? The table in example 18 groups the *pie*de I cadences from the 108 virelais according to: a) the presence or not of partial signatures, and b) a Phrygian cadence on degree  $\hat{2}$ . The table indicates the number of occurrences in the corpus with, in brackets, the theoretical frequency if the two variables were independent.

	$\hat{2}$ and phrygian = True	$\hat{2}$ and phrygian = False	Total
Partial signature = True	31 (24)	20 (27)	51
Partial signature = False	20 (27)	37 (30)	57
Total	51	57	108

**Example 18:** Partial signatures and Phrygian cadences on  $\hat{2}$  at the end of *pie*de I

A significant dependence can be deduced between the use of partial signatures and the Phrygian cadence on scale degree  $\hat{2}$ <sup>63</sup>. This dependence suggests that partial signatures respond, in part at least, to practical considerations surrounding the individual tonal needs of the virelais: they serve to supply the accidentals that are necessary for the *ouvert-clos* opposition, in line with the work’s reference note.

<sup>62</sup> See Willi APEL, “The Partial Signatures in the Sources up to 1450”, *Acta Musicologica*, 10/1-2 (1938), p. 5 and p. 9; cf. also Richard HOPPIN, “Partial Signatures and Musica Ficta in Some Early 15<sup>th</sup>-Century Sources”, *Journal of the American Musicological Society*, 6/3 (1953), pp. 200-204 and p. 210.

<sup>63</sup> The  $\chi^2$  test gives a result of 7.13 with a p-value of 0.0076, which places the null hypothesis (no dependency between the variables) at a probability of less than 1%.

Edward Lowinsky saw in the Phrygian and Dorian cadences a possible origin of partial signatures<sup>64</sup>. The results obtained here confirm his hypothesis as regards the Phrygian cadence. At the same time, they place it in a new and more circumscribed theoretical context: partial signatures respond to a desire to unite diatonic and tonal functions – the Phrygian function and the  $\wedge^2$  degree function – so as to assure the formal coherence of the virelai. What then is the relationship between partial signatures and the transposition on which tonal type theory is based?

In terms of the physical sources, the modern editions that Lefferts uses and which also serve as the starting point for this study suggest a more systematic and unequivocal approach to partial signatures than the manuscripts imply. In reality, there is considerable ambiguity surrounding accidentals and their placement: their identification can be arbitrary and their quantity can vary, not just from one source to another but also between different sections of the same part<sup>65</sup>.

The tenor part in the anonymous virelai *La grant biauté*, for example, has no key signature in its only complete source, the manuscript F-Pn 6771 (see example 19a). It is only after the first ligature that the altered notes E $\flat$  and B $\flat$  appear. These accidentals have been seen as a partial signature in Greene's transcription (example 19c), but not in Apel's (example 19b). Individual editorial choices like these directly affect the classification proposed by the theory of tonal types. Here, they lead to assigning this piece, with a final on C, either to the non-transposed *alpha* major mode or the transposed *alpha* minor mode.

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<sup>64</sup> Edward E. LOWINSKY, "The Function of Conflicting Signatures in Early Polyphonic Music", *The Musical Quarterly*, 31/2 (1945), p. 242 *sq.*

<sup>65</sup> On this question, see Jennifer Lynne BAIN, *Fourteenth-Century French Secular Polyphony*, pp. 31-36.

a) 

b) 

c) 

**Example 19:** Anonymous, *La grant biauté*, a) Manuscript F-Pn6771, fol. 58v-59r, tenor part, b) Apel (1970-1972), vol. III, no. 205, mm. 36-39, c) Greene (1980-1989), vol. XXI, no. 41, mm. 36-39

Theoretically, the concept of transposition presumes that the hierarchies which typify each tonal type respect the transposition and that once they have been ‘de-transposed’ these hierarchies maintain their shape. To test this hypothesis, the cadential points are noted separately for each tonal type and each tenor signature in appendix 3. Their comparison allows for the following deductions. Firstly, it should be noted that not all modal configurations get transposed. Moving flatside, *alpha* modes are preferred, and particularly the *alpha* minor modes. This is in line with Lefferts’s observations, but can’t be explained through the theory of tonal types. The results here invite the hypothesis that a preference for *alpha* modes is linked to a need to deform the diatony: i.e. to generate a situation where the Phrygian degree matches scale degree  $\hat{2}$  or  $\hat{3}$ . The distribution of the cadential points nonetheless suggests, at least to a certain extent, real phenomena of transposition. In the case of the major and minor *alpha* modes, the cadential hierarchies move by fifths in line with the number of flats in the tenor’s signature. Tonal functions (dictated by the position of the degrees relative to the final) thus appear sufficiently strong to imply phenomena that can be associated with transposition.

It is revealing however that, as we move flatside, the Phrygian cadence as a secondary cadential point – on A in a  $\flat$  system and on D in a  $\flat\flat$  system – becomes more frequent compared to cadences

on other degrees. This is true for the pieces in *alpha* minor mode, but even more so for those in the *alpha* major mode and the *gamma* major mode. This tendency suggests once again that the deformation of the diatony is partly linked to the Phrygian degree: it serves to artificially generate situations where the Phrygian cadence occurs at a second or a third above the final.

Similar conclusions can be made for the *beta* major modes. In their case, the hierarchies of the cadential incises vary considerably with ‘transposition’ and render the idea of a single tonal category debatable<sup>66</sup>: the cadential hierarchies of the transposed  $\flat$ -C *beta* major mode belong more to that of the  $\sharp$ -C *alpha* major mode than to those of the  $\sharp$ -G non-transposed *beta* major mode (see appendix 3).

What Lefferts considers *en bloc* as “transposition” should be relativised and put in perspective. Unquestionably, there *are* phenomena of tonal displacement in the corpus but these can only be partly reconciled with the concept of transposition because: a) it is less a case of displacing a diatonic space of constant size than of extending this space flat-wards, b) the displacements are not systematic and the diatonic and tonal hierarchies interact differently as they’re put into operation, and c) the process is not neutral in terms of the configurations chosen and actually implies a selection which favours *alpha* modes.

Edward Kottick, in his study on flats, modality and *musica ficta* in early Renaissance chansons, asked if flats were used to “transpose” the mode or if, on the contrary, they were the consequence of other phenomena<sup>67</sup>. The results shown here suggest that the use of accidentals, and similarly the phenomenon of transposition, are at least in part the indirect consequence of the conjunction of tonal and diatonic functions which underlie a piece’s tonal organisation.

## 5. Tonal Types, Diatonic Functions and Tonal Functions

What we have seen so far supplies a better understanding of the groupings carried out by the theory of tonal types. The choice of the final (B $\flat$ , F, C, G, D) that stems from the diatonic hierarchy is decisive for the internal organisation of the pieces. The final is confirmed as the work’s reference note by different tonal functions: in particular by the main cadences that end the *ripresa* and the *clos* of *piede* II (as discussed above in section 4.2), as well as by the ambitus (section 4.4). These functions allow us to assert that the pieces are tonal in the broadest sense.

The choice of the final however interferes with how the diatonic system is exploited. Composers use the Phrygian cadence as a secondary structural incise and prefer situations where this cadence occurs immediately above the final or at a third (section 4.3).

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<sup>66</sup> Yolanda PLUMLEY, *The Grammar of 14<sup>th</sup> Century Melody*, p. 32 has already shown that whereas transposition seems to have been in use during the Middle Ages, “the individual tonal types constituting a specific tonal class are not identical in their behavior, a phenomenon that may go some way to explaining the variation of notation”.

<sup>67</sup> Edward L. KOTTICK, “Flats, Modality, and Musica Ficta in Some early Renaissance chansons”, *Journal of Music Theory*, 12/2 (1968), p. 266.

Example 20 shows the final (.) and the Phrygian degree (.) of each tonal type built on degrees I to VI in the  $\flat\flat$ ,  $\flat$  and  $\natural$  systems. The number of tonal types and open Phrygian cadences in the corpus are indicated underneath. For example, “19/10” under the tonal type  $\natural$ -C indicates that of the 19 pieces in this category just over half of them (10) have a Phrygian cadence at the end of *pie*de I. In certain cases, the pieces use the Phrygian degree on degree VII of the diatonic system as well as on III. This is why two Phrygian degrees are sometimes indicated: for example, the tonal type  $\flat$ -F uses both A (5 times) and E (twice). Modes which are not found in the corpus – for example the *mi* mode – have been greyed out.

The diagram illustrates the final and Phrygian degrees for various tonal types across three systems:  $\flat\flat$ ,  $\flat$ , and  $\natural$ . The categories are Alpha (major and minor), Gamma (minor and major), and Beta (major and minor). The modes are labeled I through VI. The final and Phrygian degrees are indicated by dots on the staff, with the number of pieces and the number of Phrygian cadences indicated below. For example, in the  $\flat\flat$  system, the final is  $\flat\flat$  and the Phrygian degree is  $\flat$ . In the  $\flat$  system, the final is  $\flat$  and the Phrygian degree is  $\flat$ . In the  $\natural$  system, the final is  $\natural$  and the Phrygian degree is  $\natural$ . The numbers below the staff indicate the total number of pieces and the number of Phrygian cadences. For example, in the  $\flat\flat$  system, the final is  $\flat\flat$  and the Phrygian degree is  $\flat$ , with 12 pieces and 5 Phrygian cadences.

**Example 20:** Tonal types, finals and Phrygian open cadences

Although by definition the mode’s reference note is always related to degree  $\wedge 1$ , the position of the Phrygian cadence fluctuates in terms of this degree. This relative position of the Phrygian degree is decisive for the formal dynamic of the pieces (see section 4.3). It is also this criterion that drives the preference for what Lefferts calls *alpha* modes: the modes built on diatonic degrees I and II are preferred because they imply the Phrygian degree at the upper second or upper third. This proximity criterion also explains the more frequent use of minor modes in this alpha category: the Phrygian cadence is found directly above the final on degree  $\wedge 1$  in *alpha* minor modes, while it is at a distance of a third ( $\wedge 3$ ) in the major modes.

The almost total absence of *gamma* modes is intrinsic to the tension between strong tonal function (final function) and weak diatonic function (Phrygian degree function). A mode built on degree III of the diatonic system (E in the natural system) amounts in reality to a suspension of the distinction between *ouvert* and *clos* cadences (see section 4.4). In the case of the modes on degree IV (F in the natural system), the semitone between degrees  $\wedge 4$  and  $\wedge 5$ , as well as the tritone in relation to degree  $\wedge 1$  are the reasons for their almost total absence (five instances). These conflicts do not exist in the *beta* modes, which explains their comparatively more frequent use. However, the relative position

of the Phrygian degree – a third (^6) or a fourth (^5) below the final – is the reason for their weaker presence, compared to the *alpha* modes.

In order to secure situations that are analogous to the *alpha* modes (with Phrygian cadences at a second or third above the final), the diatonic system is deformed by flats. The use of B $\flat$  in the modes on F and G (by  $\natural$ ) produce Phrygian degrees on ^2 and ^3 respectively. The same applies for the use of E $\flat$  in the modes on B $\flat$  and on C. This partial deformation of the diatonic system means some of the potential *beta* and *gamma* modes come to match the *alpha* modes and suggests that the system in its entirety has been transposed. This displacement is indicated by the arrows with unbroken lines in example 20.

The addition of B $\flat$  to the major *alpha* mode in  $\natural$ -C means it now matches the minor *alpha* mode in B $\flat$ -C whose Phrygian degree is situated immediately above the final. This situation, represented by the dotted arrow in example 20, occurs in example 19, taken from *La grant biauté*, where the *ouvert* and *clos* are associated with cadences on D and C respectively. As shown above (section 4.6), the identification of B $\flat$  in the lower voice parts – and consequently classifying the piece as of the B $\flat$ -C category (and not  $\natural$ -C) – is an editorial decision. This ambivalence is inherent to the notation and suggests that diatonic deformation is a relatively superficial phenomenon which should be reconsidered both in terms of theory and musical interpretation. What is referred to as a whole as “transposition” in fact results partly from deformation of the diatonic system (often local and passing) that is limited to the tenor and / or countertenor and, in some cases is restricted to cadential structures.

The asymmetrical groupings identified by the theory of tonal types reflect the need to unite a tonal function – the suspense of the ^2 degree – with a diatonic function – the instability intrinsic to the Phrygian cadence. This hypothesis is confirmed by the fact that an increasing number of secondary Phrygian incises are used as the “transpositions” move flatside (see section 4.6).<sup>68</sup> A classification by tonal types does not however show the cause of this asymmetry in the results. The theory tends to obscure the forces at play because it bestows an overly systematic character on the transpositions and because, inversely, it neglects deformation that is nonetheless decisive for the modal-tonal organisation of the pieces.

The fact that not only the *gamma* major  $\natural$ -F and *beta* major  $\natural$ -G modes, but also the *alpha* major B-F and *alpha* minor B-G modes use Phrygian cadences on E (see example 20) shows that the criterion of partial signatures tends to classify as separate what are actually analogous phenomena. This can be seen also with the *beta* major B-C and *beta* minor B-D modes. In some cases, these modes use E for Phrygian cadences (and not the regular Phrygian degree A), which aligns them with major and minor *alpha* modes respectively, as shown by the dotted lines in example 20. This is the case in the Johannes Alanus virelai *S'en vos por moy*, one of only two pieces in the *beta* minor category. The cadential articulation in this virelai, starting with the *ouvert-clos* articulation of example 21, can't

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<sup>68</sup> The use of open Phrygian cadences in the corpus stands at 63% in the  $\natural$  system and reaches 78% in the B system and 92% in the B $\flat$  system.

be distinguished from that of a piece in *alpha* minor mode. Here again, the criteria used by the theory of tonal types flatten and obscure analogous mechanisms by categorising them in a way that prevents us from seeing the main causes of the disproportion between categories. To identify these phenomena and the mechanisms at work in the pieces, it is critical to identify how the tonal and diatonic hierarchies interact in the formal dynamics of a composition.

20

1. 2.

En mon cuer de - sir, res - jo - ir, En pen-sant a vos corps gent,  
Tant so - vent com-me mon vo - loir De - si - re tres ar-da-ment.

**Example 21:** Johannes Alanus, *S'en vos por moy*, Apel (1970-1972), vol. I, no. 1, mm. 19-26

In her study *The Grammar of 14<sup>th</sup> Century Melody*, Yolanda Plumley argues that stylistic constraints and compositional conventions conditioned chanson composition in the *Ars Nova* according to two fundamental elements: the large-scale formal structure determined by the genre and the use of standard tonal models to articulate the work on a number of structural levels<sup>69</sup>. For Plumley, the *ouvert-clos* articulation plays a central role in this context as it articulates the large-scale structure. The importance of the *ouvert-clos* alternation is fully confirmed by this case study on the virelai. The specific relationship between the tonal constraints and the individual work needs however to be reconsidered in light of the findings presented above. In accordance with Lefferts's theory, Plumley argues that the patterns of tonal behavior identified in the fourteenth century "were working within the constraints of a coherent tonal system"<sup>70</sup>. This goes hand in hand with the idea that by selecting a tonal type, "the composer defined the tonal environment that would characterise the work" and that "tonal structures determined by the tonal type articulate the chanson on different levels"<sup>71</sup>. This study has shown however that the relationship may in fact be the other way around: the question is not simply to know how tonality constrains the works but also how compositional patterns found in the works may constrain tonality. This means understanding how the works lead to specific tonal configurations which may, only at a secondary level, partly crystallise through what Lefferts calls tonal types. This also means that the tonal types can not be precompositional but only retrospective in nature: they are the consequence of the exploitation of diatonic and tonal qualities through specific functions. Accordingly, the goal is not so much to assign a work to a specific tonal type than to fully understand the work's characteristics from within.

<sup>69</sup> Yolanda PLUMLEY, *The Grammar of 14<sup>th</sup> Century Melody*, p. 301.

<sup>70</sup> *Ibidem*, p. 91.

<sup>71</sup> Yolanda PLUMLEY, *The Grammar of 14<sup>th</sup> Century Melody*, p. 301.



## Conclusion

What, then, does this mean for the questions posed in the Introduction: How pertinent are the categories outlined in this study for describing inherent properties of the musical language? What are the links between the categories and historical theoretical thought? What can we learn about our own understanding of musical language and, more specifically, about the modal-tonal system?

The theory of tonal types uses categories that seem justified since they allow for the identification of statistically significant trends. There is however no guarantee that these categories – here, the *alpha*, *beta* and *gamma* modes with their major and minor variants – are as relevant for the intrinsic qualitative functioning and organisation of the musical language. Much more than the grouping obtained, it is the reflection on its essence, its interpretation and its explanation which is decisive. A process of hermeneutics is needed here to have these categories enter into dialogue with the pieces, the analyst's subjectivities and the historical theory so as to confirm or, if necessary, adjust the initial analytical criteria.

In this study, the tonal types have been examined with analytical criteria which focus on the distinction between diatonic and tonal hierarchies and functions. This choice too, is not neutral: it stems from a particular reading of historical theory (most notably that of the *modi vocum*) reinterpreted in the light of today's understanding of musical language and its evolution. This particular perspective has shown that the theory of tonal types reflects – to a certain extent and without being able to fully apprehend them – phenomena which derive from the formal dynamic of the virelais and their specific use of diatonic and tonal functions.

It would however be premature to abandon the hermeneutic process at this point, since other perspectives could enrich this analytical perspective. The properties identified here for the virelai for example may be better understood in the light of other *formes fixes*, such as the ballade<sup>72</sup>. And although this article has concentrated on the scalar properties of the pieces, the study of their melodic properties would likely bring further understanding of the application of diatonic and tonal function. I hope to have shown nonetheless that the modal-tonal organisation of secular polyphony in the 14<sup>th</sup> century benefits from a quantitative and comparative reading of an ensemble of pieces. As we have seen, this comparative approach does not aim to reduce the pieces to single categories but on the contrary seeks to describe how individual pieces exploit diatonic and tonal qualities that interact in a network of systemic similarities and differences.

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<sup>72</sup> Gilles Dulong draws attention to the 'teleological relationship' between strophe and refrain. See Gilles DULONG, *La ballade polyphonique à la fin du Moyen-Age*, p. 293: "C'est bien plutôt dans l'idée d'une relation *téléologique* entre strophe et refrain, et dans le fait que la structure entière est *orientée* vers un seul élément que réside une adéquation entre le plan poétique et le plan musical tout à fait spécifique à la ballade. Le fait que le refrain constitue pour ainsi dire le vecteur de la forme est la finalité interne commune à la ballade poétique et à la ballade notée, leur sens commun." ("It's in the *idea* of a teleological relationship between strophe and refrain, and in the fact that the entire structure is *turned* towards a single element that is found the perfect match between poetic and musical levels so specific to the ballade. The fact that the refrain constitutes so to speak the vector of the form is *the* internal finality common to both the poetic ballad and the musical ballade. It is their shared meaning".)

This approach, which remains fundamentally qualitative and focused on the internal organisation of the pieces, is not irreconcilable with quantitative methods. It is in fact on the basis of a statistical study of the corpus that it has been possible to confirm the qualitative hypothesis of a relationship between a piece's formal dynamic, its cadential incises and its reference note. Quantitative approaches thus constitute a powerful lever for the reflection on meaning that is at the heart of scientific inquiry in the humanities.

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## Appendix 1: The corpus of 108 Virelais.

Work number	Schrade 1956	Hoppin 1963	Apel 1970-1972	Greene 1980-1989	Composer	Title	Tonal type
1			53, 181	18, 7	Anonymus	A mon pooir	♭-d4
2			53, 182	21, 16	Anonymus	A qui Fortune	♭-c4
3			53, 180	21, 17	Anonymus	Adeu mon cuer	♭-g4
4			53, 48		Francesco Landini	Adyou adyou	♭-d4
5			53, 37	19, 91	Grimace	Alarme alarme	♭-c4
6			53, 13		Johannes de Ciconia	Aler m'en veus	♭-d3
7		27			Anonymus	Amours me dit qu'il me fera joir	♭-g4
8			53, 183	21, 18	Anonymus	Au Tamps	♭-c4
9		25			Anonymus	Ayés pitié de vostre creature	♭-d4
10			53, 54	21, 7	Matheus de Perusio	Belle sans per	♭-c4
11			53, 185	21, 20	Anonymus	Besier a acoler	♭-d4
12		19			Anonymus	Bien ha choisi mon cuil quant vous amay	♭♭-c4
13			53, 186	21, 22	Anonymus	C'estoit ma douce nourriture	♭-c4
14			53, 187	21, 23	Anonymus	Combien que j'aie	♭-d4
15			53, 188	21, 24	Anonymus	Contre le temps	♭-f4
16		15			Anonymus	D'amers souspirs, de pointe et de dolour	♭-c4
17				21, 27	Anonymus	D'une dragme de confort	♭♭-c4
18	29				Machaut	Dame mon cuer emportes	♭-f3
19			53, 189	21, 25	Anonymus	Dame par le dolz plaisir	♭-d4
20			53, 55	21, 8	Matheus de Perusio	Dame que j'aym	♭♭-c4
21			53, 56	21, 9	Matheus de Perusio	Dame souverayne	♭-c4
22	32				Machaut	De tout sui si confortee	♭-f3
23				19, 100a	Oswald von Wolkenstein	Der May mit lieber Zal	♭-g4
24			53, 190	21, 26	Anonymus	Donne moy	♭-d4
25			53, 191	21, 28	Anonymus	E Dieus commant	♭-d4
26			53, 91	21, 3	Jacob de Senleches	En ce gracieux tamps	♭♭-c4
27			53, 192	21, 29	Anonymus	En gage de retourner	♭-c4
28	24				Machaut	En mon cuer a un descort	♭-f3
29				22, 85	Anonymus	En nuit (seconde section exclusivement)	♭-b♭3
30			53, 193	21, 30	Anonymus	En tiés en latin	♭-d4
31		51			Anonymus	Est ce maufait, Raison, se veuil servir	♭-d4
32			53, 194	21, 31	Anonymus	Et je ferai	♭-d4
33			53, 195	21, 32	Anonymus	Fait fut pour vous	♭-d4
34			53, 196	21, 33	Anonymus	Fist on Dame	♭♭-b♭3
35		17			Anonymus	Garison, gente figure	♭-f4
36			53, 197	21, 36	Anonymus	Ge la remiray	♭-g4
37			53, 12	19, 89	Borlet	Hé tres doulz roussignol	♭-g4
38			53, 57	21, 10	Matheus de Perusio	Helas avril	♭-d4
39			53, 58	21, 11	Matheus de Perusio	Heylas que feray	♭-d3
40		37			Anonymus	Il n'est amant qui n'a le cuer espris	♭-d4
41		6			Anonymus	J'ai mon cuer mis de tres loialle amour	♭-g4
42		9			Anonymus	Ja Nuls ne porra tant loer	♭-f4
43			53, 199	21, 35	Anonymus	Je languis	♭-c4
44			53, 200		Anonymus	Je ne puis avoir	♭-c4
45		45			Anonymus	Je prens d'amour noriture	♭-d4
46		1			Anonymus	Je sens mon cuer d'un tres amoureux point	♭-f4
47		49			Anonymus	Je sui trestout d'amour raimpli	♭-g4
48			53, 202	21, 38	Anonymus	Je voy le bon tens	♭-g4
49			53, 101	19, 97	Solage	Joieux de cuer	♭-c4
50			53, 203	21, 39	Anonymus	Kere dame	♭-g4
51			53, 204	21, 40	Anonymus	La Cornailhe	♭-c4
52		11			Anonymus	La douceur de vostre niau vis	♭-f4
53			53, 205	21, 41	Anonymus	La grant biauté	♭-c4 // ♭♭-c4
54			53, 92	19, 67	Jacob de Senleches	La harpe de melodie	♭♭-c4

# Appendix 1: The corpus of 108 Virelais (continued).

Work number	Schrade 1956	Hoppin 1963	Apel 1970-1972	Greene 1980-1989	Composer	Title	Tonal type
55				18, 10	Petrus Fabri	Laus detur multipharia	b-b3
56		3			Anonymus	Le mois de mai, qui tout plein est de joye	b-f4
57			53, 206	21, 42	Anonymus	Ma Dame voies	c-c4
58			53, 46	21, 6	Johannes de Janua	Ma douce amour	b-f4
59			53, 12a	19, 89a	Borlet	Ma trêdol rosignol	c-d4
60			53, 207	21, 43	Anonymus	Mais qu'il vous legne	c-c4
61	26				Machaut	Mors suis, se je ne vous voy	c-g3
62	31				Machaut	Moult sui de bonne heure nee	b-g3
63			53, 59	21, 12	Matheus de Perusio	Ne me chaut	b-f4
64				22, 87	Anonymus	Ne me porroit	b-c4
65			53, 209	21, 45	Anonymus	Nulle pitié	c-g4
66			53, 210	21, 46	Anonymus	Onques ne fu	b-g4
67			53, 211	21, 47	Anonymus	Or m'assaut	b-f4
68			53, 212	21, 48	Anonymus	Or sus vous dormez trop	b-g4
69			53, 115	19, 100; 21, 4	Johannes Vaillant	Par maintes foyes	b-g4
70			53, 213	21, 49	Anonymus	Par mon serment	b-f4
71			53, 214	21, 50	Anonymus	Petit guerredon	b-f4
72			53, 86	19, 90	Pykini	Plasanche or tost	c-c4
73	28				Machaut	Plus dure que un dyament	c-d4
74			53, 215	21, 13	Anonymus	Plus onques dame	c-d4
75				21, 51	Anonymus	Plus que l'aloce	b-c3
76			53, 216	21, 52	Anonymus	Pour l'amour	b-f4
77			53, 217	21, 53	Anonymus	Pour vous revêoir	c-g4
78			53, 218	21, 54	Anonymus	Prenés l'abre	b-g4
79			53, 219	21, 55	Anonymus	Puis qu'autrement	c-c4
80			53, 220		Anonymus	Puis que l'aloë	b-c4
81			53, 60	21, 14	Matheus de Perusio	Puisque je sui	b-g4
82		7			Anonymus	Quant je verrai vostre figure	b-c4
83				21, 2	Bartholomeus de Bononia	Que pena major	b-g4
84			53, 221	21, 56	Anonymus	Que puet faire	b-g4
85			53, 222	21, 57	Anonymus	Restoés restoés	c-c4
86		23			Anonymus	S'aucun amant doit s'amie chierir	b-g4
87			53, 1	21, 5	J. Alanus	S'en vos por moy	b-d4
88		13			Anonymus	S'espoir ne fust vers moi si gracieus	c-d4
89			53, 224	21, 59	Anonymus	Sans mal penser	b-g4
90		59			Anonymus	Saucunnes fois m'avient que ne puis rire	b-g4
91	30				Machaut	Se je souspir	c-f3
92			53, 77	21, 15	Paolo Tenorista	Sofrir m'estuet	b-c4
93			53, 225	21, 60	Anonymus	Soit tart tempre	c-d4
94			53, 14		Johannes de Ciconia	Sus un' fontayne	c-g3
95			53, 227	21, 62	Anonymus	Tant que mon cuer	b-g4
96			53, 93	21, 4	Jacob de Senleches	Tel me voit	b-c4
97	23				Machaut	Tres bone et belle	c-c4
98			53, 228	21, 63	Anonymus	Tres dolz et loyaus amis	c-c4
99			53, 229	18, 5	Anonymus	Tres douce, playant figure	c-g4
100			53, 230	21, 64	Anonymus	Tres douche plasant bergiere	b-g4
101			53, 102	18, 13	Solage	Tres gentil cuer	c-d4
102			53, 8	21, 1	Anthonello de Caserta	Tres nouble dame	b-g4
103		60			Anonymus	Tres purement je amerai	c-d4
104			53, 231	18, 4	Anonymus	Un orible plein (Greene, Un crible plein)	c-d4
105			53, 232	21, 66	Anonymus	Va t'en mon cuer	b-c4
106			53, 233	21, 67	Anonymus	Venés a nueches	c-c4
107		5			Anonymus	Viaire gent, veuilliés moi conforter	b-g4
108		21			Anonymus	Vo gent vis et gracieus	c-d4

## Appendix 2: Ambitus and signatures.

Work number	Finale cantus	System	Tenor	Countertenor	Cantus	Triplum
29	bb3	b-b-b	b2-g3	f3-g4	d4-d5	
34	bb3	bb-bb-b	b2-b3	b2-c4	f3-f4	
55	bb3	bb-bb-b-b	bb2-c4	bb2-c4	f3-g4	f3-g4
75	c3	bb-b-b	c3-c4	c3-d4	g3-a4	
44	c4	b-b-b	b2-g3	c3-a3	f3-g4	
8	c4	b-b-b	c3-c4	c3-d4	g3-b4	
92	c4	b-b-b	c3-c4	d3-g4	g3-a4	
105	c4	bb-b-b	b2-c4	c3-d4	f3-g4	
54	c4	bb-b-b	bb2-c4	f3-a4	f3-a4	
26	c4	bb-b-b	c3-c4	f3-g4	f3-g4	
64	c4	bb-b-b	c3-c4	g3-a4	g3-a4	
96	c4	bb-bb-b	bb2-c4	bb2-d4	d3-g4	
17	c4	bb-bb-b	c3-c4	bb2-c4	f3-f4	
20	c4	bb-bb-b	c3-c4	c3-d4	f3-a4	
12	c4	bb-bb-b	c3-c4	c3-d4	f3-g4	
80	c4	bb-bb-b	c3-c4	c3-d4	g3-a4	
82	c4	bb-bb-b	c3-d4	c3-d4	f3-a4	
60	c4	b-b	c3-c4		a3-a4	
98	c4	b-b	c3-c4		g3-a4	
57	c4	b-b	c3-d4		g3-a4	
53	c4	b-b-b / bb-b-b	c3-c4	c3-c4	g3-a4	
27	c4	b-b-b	c3-a3	c3-c4	f3-g4	
2	c4	b-b-b	c3-a3	c3-c4	g3-a4	
106	c4	b-b-b	c3-a3	g#3-g4	a3-g4	
13	c4	b-b-b	c3-c4	c3-c4	g3-a4	
85	c4	b-b-b	c3-d4	a3-a4	g3-a4	
79	c4	b-b-b	c3-d4	c3-d4	a3-a4	
97	c4	b-b-b	c3-d4	c3-d4	f3-a4	
16	c4	b-b-b	c3-d4	c3-e4	g3-b4	
51	c4	b-b-b	c3-d4	c3-e4	g3-b4	
10	c4	b-b-b	c3-d4	c3-e4	g3-bb4	
21	c4	b-b-b	c3-e4	c3-d4	g3-b4	
49	c4	b-b-b-b	c3-c4	c3-d4	e3-a4	a3-c5
5	c4	b-b-b-b	c3-c4	c3-d4	g3-a4	c4-b4
43	c4	b-b-b-b	c3-c4	c3-d4	g3-a4	a3-c5
72	c4	b-b-b-b	c3-c4	c3-d4	g3-a4	g3-a4



**Appendix 2: Ambitus and signatures (continued).**

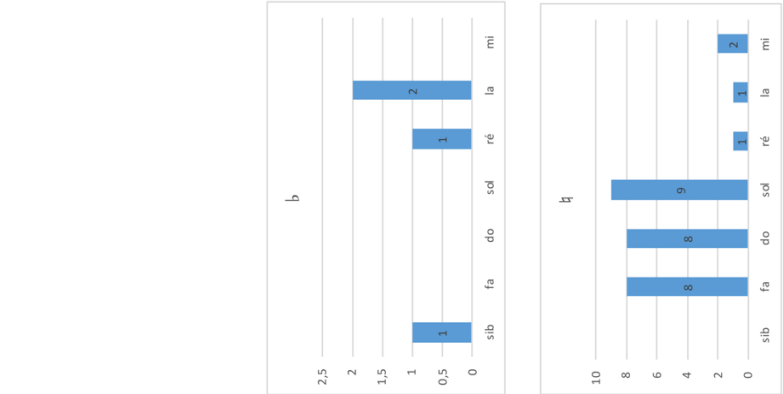
Work number	Finale cantus	System	Tenor	Countertenor	Cantus	Triplum
6	d3	h-h	d3-f4		d3-f4	
39	d3	h-h-h	d2-e3	d2-e3	a2-c4	
87	d4	b-b-h	c3-d4	c3-f4	g3-a4	
32	d4	b-h	f3-f4		c4-c5	
9	d4	h-h	c3-e4		b3-c5	
33	d4	h-h	c3-f4		c3-e4	
25	d4	h-h	d3-a3		a3-b4	
73	d4	h-h	d3-d4		a3-b4	
11	d4	h-h	d3-d4		c4-c5	
59	d4	h-h-h	c3-b3	g3-a4	g3-a4	
30	d4	h-h-h	c3-d4	c3-d4	a3-a4	
108	d4	h-h-h	c3-d4	c3-d4	b3-b4	
1	d4	h-h-h	c3-d4	c3-f4	a3-b4	
88	d4	h-h-h	c3-e3	c3-d4	a3-d5	
40	d4	h-h-h	c3-e4	d3-e4	a3-c5	
45	d4	h-h-h	c3-f4	d3-f4	b3-b4	
24	d4	h-h-h	d3-c4	c3-a3	a3-a4	
104	d4	h-h-h	d3-d4	c3-d4	a3-b4	
4	d4	h-h-h	d3-d4	d3-e4	a3-a4	
14	d4	h-h-h	d3-d4	d3-e4	a3-a4	
101	d4	h-h-h	d3-d4	d3-e4	a3-c5	
31	d4	h-h-h	d3-d4	d3-e4	g3-b4	
74	d4	h-h-h	d3-d4	d3-e4	g3-c4	
19	d4	h-h-h	d3-d4	d4-d4	a3-a4	
38	d4	h-h-h	d3-e4	d3-e4	g3-d5	
103	d4	h-h-h	d3-f4	d3-e4	a3-c5	
93	d4	h-h-h-h	c3-c4	d3-d4	a3-b4	c4-b4

## Appendix 2: Ambitus and signatures (continued).

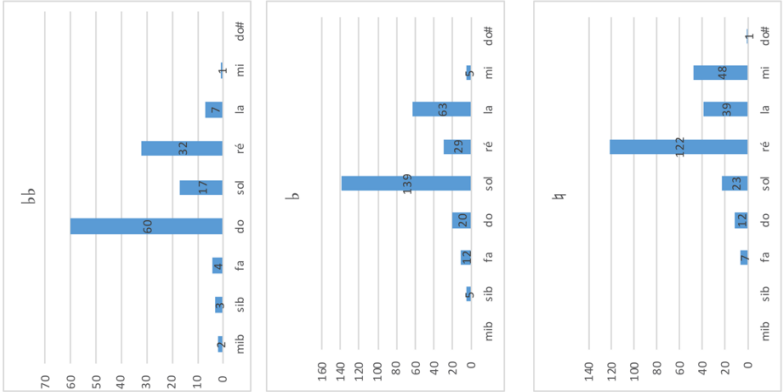
Work number	Finale cantus	System	Tenor	Countertenor	Cantus	Triplum
28	f3	g-g	c3-a3		e3-f4	
22	f3	g-g	c3-c4		e3-g4	
91	f3	g-g	c3-d4		c3-f4	
18	f3	g-g	c3-d4		d3-f4	
71	f4	g-g-g	f3-d4	f3-c4	c4-c5	
15	f4	g-g-g	f3-d4	g3-g4	c4-c5	
52	f4	g-g-g	f3-f4	f3-g4	c4-d5	
56	f4	g-g-g	f3-f4	f3-g4	c4-d5	
67	f4	g-g-g	f3-f4	f3-g4	d4-d5	
35	f4	g-g-g	f3-g4	f3-a4	c4-d5	
46	f4	g-g-g	f3-g4	f3-a4	c4-d5	
58	f4	g-g-g	f3-g4	f3-a4	c4-d5	
42	f4	g-g-g	f3-g4	f3-g4	c4-c5	
70	f4	g-g	f3-c4		d4-d5	
63	f4	g-g	f3-g4		c4-d5	
76	f4	g-g-g	f3-g4	c4-e5	c4-d5	
62	g3	g-g	d3-d4		f3-a4	
61	g3	g-g	f3-c4		e3-g4	
94	g3	g-g-g	c3-d4	d3-e4	g3-a4	
81	g4	g-g-g	f3-a4	f3-bb4	b3-e5	
47	g4	g-g-g	f3-a4	g3-a4	b3-d5	
36	g4	g-g-g	f3-f4	f3-g4	c4-d5	
69	g4	g-g-g	f3-f4	g3-g4	d4-d5	
68	g4	g-g-g	f3-g4	f3-g4	d4-d5	
107	g4	g-g-g	f3-g4	g3-a4	c4-c5	
90	g4	g-g-g	f3-g4	g3-g4	d4-d5	
50	g4	g-g-g	g3-f4	g3-g4	d4-c5	
83	g4	g-g-g	g3-g4	f3-c4	c4-e5	
48	g4	g-g-g	g3-g4	g3-g4	c4-d5	
86	g4	g-g	f3-a4		d4-e5	
3	g4	g-g	f3-c4		c4-d5	
78	g4	g-g	f3-f4		c4-c5	
41	g4	g-g	f3-g4		b3-e5	
7	g4	g-g	f3-g4		d4-e5	
95	g4	g-g	g3-d4		c4-d5	
89	g4	g-g	g3-g4		d4-e5	
84	g4	g-g-g	f3-d4	b3-c5	b3-c5	
100	g4	g-g-g	f3-f4	c4-c5	c4-c5	
102	g4	g-g-g	f3-f4	f3-g4	d4-d5	
66	g4	g-g-g	f3-g4	f3-g4	b3-e5	
37	g4	g-g-g-g	f3-e4	f3-f4	c4-d5	c4-d5
23	g4	g-g	f3-f4		d4-d5	
65	g4	g-g	g3-f4		d4-e5	
99	g4	g-g-g	c3-d4	c3-e4	g3-d5	
77	g4	g-g-g	c3-d4	d3-d4	b3-b4	

Appendix 3: Cadential incises and Tonal types.

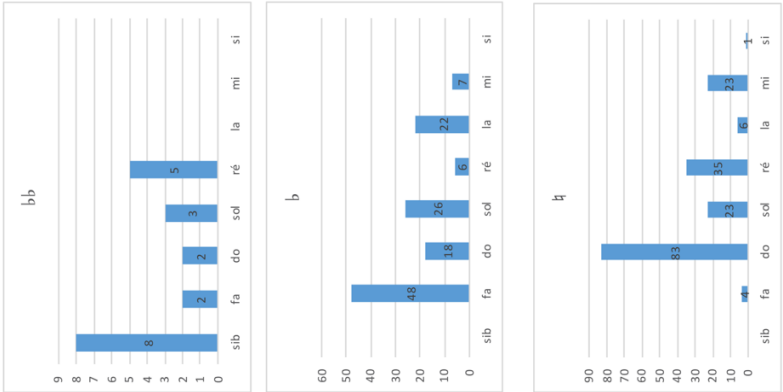
Gamma major



Alpha minor



Alpha major



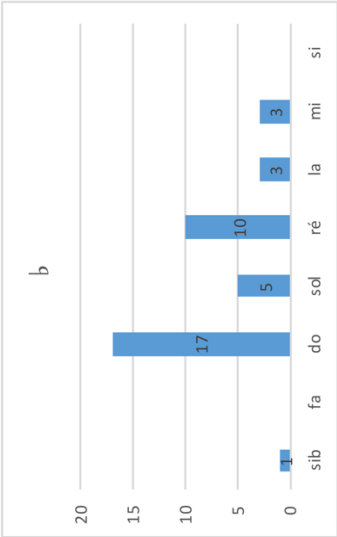
b b

b

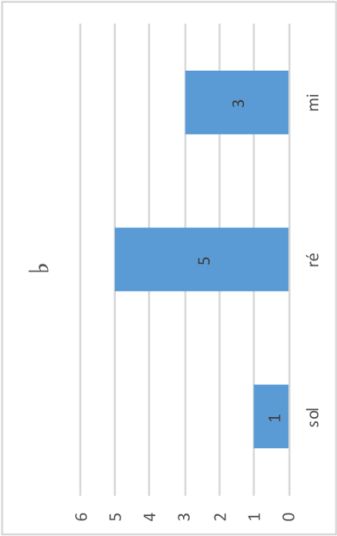
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Appendix 3: Cadential incises and Tonal types (continued).

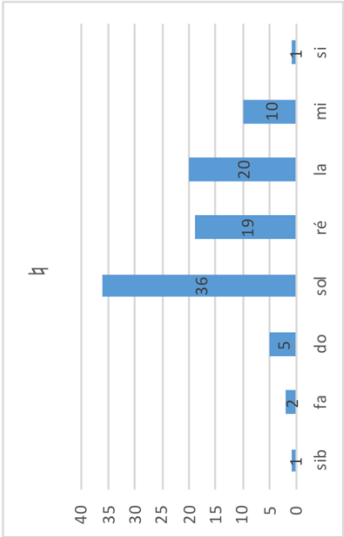
Beta major



Beta minor



b



b