THE MODES OF LIMITED TRANSPOSITIONS IN OLIVIER MESSIAEN’S MUSIC:
TRANSFORMATIONAL AND TONAL APPROACHES

by

Rebecca Simpson-Litke

B.Mus., The University of Manitoba, 2001
M.A., The University of British Columbia, 2003

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Abstract

This thesis provides a detailed examination of the theoretical structures, compositional possibilities, and musical effects of the Modes of Limited Transpositions, as discovered by Olivier Messiaen and explored throughout his career, but primarily in his early works. In the introductory chapter, I discuss Messiaen’s unique perspective on these collections, including an investigation into the composer’s synaesthetic sound-colour perception and artistic preferences. Taking Messiaen’s own writings as my point of departure, I develop a more systematic method for generating and labeling these transpositionally symmetrical collections, situating each of them within a larger family of augmented-triad-based and/or tritone-based modes.

In the main body of the thesis, I explore Messiaen’s use of these modes from three interrelated perspectives—modal, chromatic, and tonal—each requiring distinct analytical tools. In Chapter 1, entitled “A Modal Perspective,” I adapt concepts from transformational theory to create a modal transformational approach. In the analyses of this chapter, musical objects and transformations are considered not in reference to a mod-12 chromatic universe, but within purely modal contexts. (In the accompanying appendix to this chapter, I develop the concept of an abstract Tonnetz, highlighting some ways in which new objects, transformations, and spaces may accommodate a wider variety of analytical contexts.)

In Chapter 2, entitled “A Chromatic Perspective,” I describe transformational relationships between modes of different types, and the standard twelve-tone universe is used as the backdrop against which objects and transformations are heard. I create geometric models of the augmented-triad-based and tritone-based families and demonstrate their analytical usefulness.

In Chapter 3, entitled “A Tonal Perspective,” I examine ways in which Messiaen exploits the tonal resources of his modes in order to imitate traditional harmonic and melodic structures. I discuss the various ways in which focal centres are created, and how superimposed layers or juxtaposed blocks of music may be unified (or kept aurally distinct) via references to tonality.

In the final Chapter 4, then, I show how all three perspectives work together in my analysis of a complete song, in which Messiaen beautifully depicts the sentiments of the text through the creation of a rich fabric of musical relationships.
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**Introduction – Messiaen’s Modes of Limited Transpositions**

Olivier Messiaen (1908-92) was a devoutly Catholic composer who believed in a concept that he termed the “Charm of Impossibilities,” in which an insurmountable obstacle imbues an object with a strong mystical power, providing the perceiver of the object with a tangible way to contemplate the inconceivable nature of God. This concept is manifest in the musical pitch domain by Messiaen’s Modes of Limited Transpositions (henceforth MLT), the impossible nature of which is demonstrated when one attempts to transform each of these collections by all twelve transpositions to achieve twelve unique pitch-class (pc) sets.¹ It quickly becomes evident that collections of this kind can be transposed only a few times (at least two and at most six) before the original collection of pcs is repeated.

In a number of famous documents designed to illuminate his

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¹ Messiaen’s Charm of Impossibilities is manifested in the rhythmic domain by the Nonretrogradable Rhythms and the Symmetrical Permutations.

The Nonretrogradable Rhythms are palindromes and thus, are the same when read backwards as when read forwards. On the relationship between these rhythms and his MLT, Messiaen writes: “Immediately one notices the analogy of these two impossibilities and how they complement one another, the rhythms realizing in the horizontal direction (retrogradation) what the modes realize in the vertical direction (transposition) (Messiaen 1956, 13).”

On remarque tout de suite l’analogie de ces deux impossibilités et comment elles se complètent: les rythmes réalisant dans le sens horizontal (rétrogradation) ce que les modes réalisent dans le sens vertical (transposition) (Messiaen 1944, 6).

The Symmetrical Permutations were developed later in Messiaen’s career and involve the application of an algorithm to a “chromatic series of durations” in order to achieve a rhythmic permutation (also called an interversion). The repeated application of the algorithm produces new permutations but eventually leads back to the first permutation, and thus, creates a closed circuit (Wu 1998, 86, 104).

All three of these charms exhibit a sort of “theological rainbow” in which beginning and end are confused because they are identical (Messiaen 1956, 21, 63), creating the effect of suspended time and providing the listener with a way to reflect on the concept of eternity.
compositional technique and musical language, Messiaen provides detailed
examples of the characteristic ways in which he uses these modes and describes
how the sound of each unique pc form of each mode is synaesthetically linked in
his perception to a specific combination of visual colours.\(^2\) He distinguishes his
MLT from other modal systems (specifically, the Indian, Chinese, ancient Greek,
and Western plainchant traditions, as he understood them) and examines links
between his modal music and traditional tonality. The MLT have no inherently
tonic-defining intervallic landmarks (such as the tritone in a major scale) due to
their high degrees of transpositional (and usually also inversional) symmetry.
Messiaen was particularly intrigued by these features, stating on several
occasions that the MLT are “at once in the atmosphere of several tonalities,
\textit{without polytonality}, the composer being free to give predominance to one of the
tonalities or to leave the tonal impression unsettled.”\(^3\)

Because of their interesting theoretical properties, beautiful sound-colours,
and meaningful religious symbolism, the MLT were used extensively by
Messiaen throughout his lifetime; they truly permeate his compositional output
and stamp his music with a unique and characteristic sound. At times, his
experimentation with these collections is systematic, a rigorous exploration of a
particular mode’s sonic features with a great deal of harmonic and melodic
consistency. At other times, Messiaen’s music moves more freely, mixing modes

\(^2\) Greta Berman notes that this association of sound and colour is called
chromesthesia and is the most common manifestation of synaesthesia (Berman
1999, 15).

\(^3\) Messiaen 1956, 58.

Ils sont dans l’atmosphère de plusieurs tonalités à la fois, \textit{sans polytonalité}—le compositeur étant libre de donner la prédominance à l’une des tonalités, ou de laisser l’impression tonale flottante
(Messiaen 1944, 85).
of different types, introducing material that is not strictly modal, and mimicking elements of traditional tonality. One of the challenges that the analyst faces when approaching such music is in going beyond the simple labeling of collections toward a more meaningful description of how the pitch content of the music has been artfully constructed and why it “works” aesthetically.4

While there has been much musicological research devoted to Messiaen’s life and work, Allen Forte notes in his contribution to the recent book, Olivier Messiaen: Music, Art and Literature, that relatively little scholarship has tackled the theoretical dimensions of his music, aside from the composer’s own writings.5 Of the few articles that discuss Messiaen’s use of the MLT from an analytical/ theoretical perspective, a number focus on extra-musical associations and relationships. For instance, in “Mystical Symbols of Faith: Olivier Messiaen’s Charm of Impossibilities,” Jean Marie Wu concentrates her analysis of “Le baiser de l’Enfant-Jésus,” the fifteenth of Messiaen’s Vingt regards sur l’Enfant-Jésus for piano, on the religious symbolism behind the different modal colours, tonal implications, and themes found in the piece.6

In “Messiaen’s Synaesthesia: The Correspondence between Color and Sound Structure in his Music,” Jonathan Bernard attempts to define some of the

4 For instance, in his account of other theorists’ discussions of the role of the octatonic collection in the music of Stravinsky, Richard Taruskin writes that “too often the analysis merely establishes local referability to the octatonic collection, along, perhaps, with a description of various partitioning devices,” failing to address the piece’s long-range direction and coherence, and failing to account for “chromatic” pcs that do not belong to the prevailing collection of a given passage (Taruskin 1987, 266-267).
6 Wu 1998, 90-96.
factors that govern Messiaen’s sound-colour associations. He argues that
Messiaen’s colour responses are not arbitrarily in flux but consistent, and that by
examining the sonorities for which Messiaen has made colour indications in his
scores and theoretical writings, it is possible to identify the features that
determine sound-colour. By comparing the similarities and differences between
sonorities from this perspective, Bernard hopes to gain a greater understanding
of Messiaen’s harmonic language.\(^7\) While such extra-musical dimensions are
interesting and important aspects and should be addressed as part of any study
of Messiaen’s work, my focus in this thesis is primarily on the theoretical
properties and compositional use of the MLT themselves.

The systematic nature of some of Messiaen’s music, then, has led a
number of authors to employ pc-set theory as part of their analytical
methodology. In “Modes and Pitch-Class Sets in Messiaen: A Brief Discussion of
‘Première Communion de la Vierge,’” Rosemary Walker examines excerpts
where Messiaen has added pcs to an essentially modal texture, or where not all
of the pcs of the predominant mode are present. She suggests that in such
passages of modal impurity, extra or missing pcs are chosen in order to create
mod-12 set-class (sc) consistency.\(^8\) Allen Forte takes a similar approach in his
article, “Messiaen’s Chords,” where he attempts to gain an understanding of
Messiaen’s harmonic syntax through a pc-set theory account of the composer’s
extensive repertoire of unusual chords.\(^9\) In “Messiaen’s Triadic Colouration:

\(^7\) Bernard 1986, 43.
\(^8\) Walker 1989, 160-163.
Modes as Interversion,” Cheong Wai-Ling explores Messiaen’s changing attitude toward the different MLT over time by examining the series of parallel modal chords that are discussed in his writings and heard prominently throughout his repertoire. In particular, she notes how the succession of mod-12 chord qualities changes with the permutation of the order of chords in a given series, and relates this to Messiaen’s concept of interversion.\(^{10}\)

Perhaps the most significant research to date into Messiaen’s harmonic and melodic use of the MLT has been conducted by Christoph Neidhöfer, who integrates three perspectives into his analytical approach to Messiaen’s music: modal, chromatic, and tonal. In part one of his article, “A Theory of Harmony and Voice Leading for the Music of Olivier Messiaen,” Neidhöfer develops a classification system for harmonies and voice-leading patterns that is based on standard mod-12 pc-set theory, but modifies it to accommodate modal systems of cardinalities other than twelve; in part two, he shows how many of Messiaen’s modal chord progressions employ traditional contrapuntal devices (Neidhöfer continues this work in his paper, “Olivier Messiaen’s Transformations of Counterpoint,” presented at the 2008 meeting of the Society for Music Theory); and in part three, he examines polymodal and modulatory textures.\(^{11}\)

In this thesis, I seek to explore Messiaen’s treatment of pitch—specifically the theoretical structures, compositional uses, and musical effects of the MLT—from the three interrelated perspectives that Neidhöfer discusses (modal,

\(^{10}\) Cheong 2002.  
\(^{11}\) Neidhöfer 2005 and 2008.
chromatic, and tonal), each requiring distinct analytical tools.\textsuperscript{12} In Chapter 1, entitled “A Modal Perspective,” I adapt concepts from transformational theory (neo-Riemannian theory in particular) to create a modal transformational approach. In the analyses of this chapter, musical objects and transformations are considered not in reference to a mod-12 chromatic universe, but within purely modal contexts. In Chapter 2, entitled “A Chromatic Perspective,” I describe transformational relationships between modes of different types, and the standard twelve-tone universe is used as the backdrop against which objects and transformations are heard. In Chapter 3, entitled “A Tonal Perspective,” I examine ways in which Messiaen exploits the tonal resources of his modes in order to imitate traditional harmonic and melodic structures. In particular, I discuss how superimposed layers or juxtaposed blocks of music are unified (or keptaurally distinct) via references to tonality.

The fact that Messiaen’s music can be convincingly approached from such diverse theoretical perspectives (sometimes within a single passage) is, in part, what makes it so challenging to analyze. It is not always immediately clear which analytical tools should be used when examining a given passage or piece. However, it is also this simultaneous interaction of all three perspectives which in fact allows Messiaen to achieve such richly colourful musical textures.\textsuperscript{13} A single object or progression can have identity and meaning within (at least) three

\textsuperscript{12} While much of my analytical and theoretical work in this thesis (Chapter 1 in particular) was completed prior to Neidhöfer’s 2005 publication, the reader will note some overlap in our respective approaches.

\textsuperscript{13} For instance, Neidhöfer 2008, 3 suggests that it is the changing mod-12 intervals projected by parallel motion within a particular mode that produces the shimmering, “stained-glass quality” of Messiaen’s “chord-clusters.”
distinct sonic spaces, and in many instances, the listener draws upon an understanding of multiple spaces simultaneously. In the final Chapter 4, then, I show how all three perspectives work together in my analysis of a complete work.

Before proceeding to Chapter 1, a number of preliminary issues need to be addressed. It is important to examine the definition of the term “Mode of Limited Transpositions” in some detail, particularly because Messiaen’s own description is, at times, vague and incomplete. He discusses the structures, compositional uses, and sound-colours of his MLT in a number of sources, including theoretical treatises, prefaces to musical scores, interviews, and lectures. In this introduction, I will focus on the theoretical information that Messiaen presents in three main documents—the preface to La Nativité du Seigneur (1936), Technique de mon langage musical (1944, translated into English in 1956), and Traité de rythme, de couleur, et d’ornithologie (2002)\(^\text{14}\)—the most comprehensive coverage being found in the Technique. While many details are consistent from document to document (including much verbatim repetition of material), there are also some interesting differences, which will be discussed below. These theoretical sources, in combination with Messiaen’s musical works, provide clues as to the composer’s understanding of and (perhaps changing) attitude towards these collections. There is evidence that Messiaen was thinking of these modes and their generation in a number of different ways, and that these multiple perspectives may have caused him to be less-than-comprehensive in his account of them.

\(^{14}\) This seven-book compilation of Messiaen’s writings was completed and published posthumously by his second wife, Yvonne Loriod.
In his discussion of the MLT, Messiaen writes that “at the end of a certain number of chromatic transpositions which varies with each mode, they are no longer transposable because one falls again into the notes that were already heard in the previous transpositions.”\textsuperscript{15} In other words, each mode is a transpositionally symmetrical (TS) pc collection, where at least one transposition (in addition to $T_0$) leaves the entire collection completely invariant. He also writes that “based on our present chromatic system, a tempered system of twelve sounds, these modes are formed of several symmetrical groups, the last note of each group always being common with the first of the following group.”\textsuperscript{16} If, by “symmetrical groups,” Messiaen is referring to pc sets that belong to the same sc (and not necessarily to pc sets that are themselves transpositionally and/or inversionally symmetrical), this is a key observation about the nature of TS pc sets in general—they are, by definition, comprised of smaller repeating units which map onto each other under certain transpositions.\textsuperscript{17}

The second quotation above suggests a possible method by which Messiaen was generating all of his MLT—that of octave subdivision. In each of the three main sources, Messiaen follows his general theoretical description with an examination of the properties of individual modes; for example, he describes

\begin{itemize}
\item \textsuperscript{15}Messiaen 2002, 50-51. Translation is mine.
\item \textsuperscript{16}Messiaen 1956, 58.
\item \textsuperscript{17}Richard Cohn calls this property \textit{transpositional combination} (TC): “Any pitch- or pc-set has the TC-property if it may be disunited into two or more transpositionally related subsets” (Cohn 1988, 23).
\end{itemize}
Mode 2 (the familiar octatonic collection) as being “divided into four symmetrical groups of three notes each. These ‘trichords,’ taken in ascending movement, are themselves divided into two intervals: a semitone and a tone.”18 Thus, Messiaen deals with both intervals and objects in his generation of Mode 2; he first divides an intervallic span (the octave) into objects (four adjoining trichords), and then subdivides these objects back into intervals (a semitone in alternation with a whole tone), as illustrated in Example i.

**Example i – Generation of Messiaen’s Mode 2 by Octave Subdivision**

```
   (013)  (013)  (013)
01  2  1  2  1  2  1  2
C, C♯, D♭, E, F♯, G, A, B♭, C
   octave
```

I will modify Messiaen’s procedure slightly to make it more consistent and to show that such a method generates all of the possible TS scs if followed systematically and to completion. Instead of mixing both intervals and pc sets into the subdivision process as Messiaen does, my method of generation will involve two stages: first, I will subdivide the octave purely intervallically, and second, I will examine the TS scs that result from these intervallic subdivisions.

The octave may be divided into equal intervallic segments in five ways: twelve semitones (12 x pc-interval 1), six whole tones (6 x pc-interval 2), four

---

minor thirds (4 x pc-interval 3), three major thirds (3 x pc-interval 4), or two
tritones (2 x pc-interval 6). The pc-intervals 3, 4, and 6 may then be unevenly
subdivided to form eleven other intervallic patterns, as shown in Example ii.\(^{19}\)

<table>
<thead>
<tr>
<th></th>
<th>12 x</th>
<th>6 x</th>
<th>4 x</th>
<th>3 x</th>
<th>2 x</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 °</td>
<td>&lt;1&gt;</td>
<td>&lt;1&gt;</td>
<td>&lt;3&gt;</td>
<td>&lt;4&gt;</td>
<td>&lt;6&gt;</td>
</tr>
<tr>
<td>2 °</td>
<td>-</td>
<td>-</td>
<td>&lt;12&gt;</td>
<td>&lt;13&gt;</td>
<td>&lt;15&gt;, &lt;24&gt;</td>
</tr>
<tr>
<td>3 °</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>&lt;112&gt;</td>
<td>&lt;114&gt;, &lt;123&gt;, &lt;132&gt;</td>
</tr>
<tr>
<td>4 °</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>&lt;1113&gt;, &lt;1122&gt;</td>
</tr>
<tr>
<td>5 °</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>&lt;11112&gt;</td>
</tr>
</tbody>
</table>

These sixteen intervallic patterns may be said to generate all of the possible TS
scs, as shown in Example iii.\(^{20}\) This table groups the TS scs by cardinality and
provides some of the names with which these scs have been labeled historically.
The reader will note that there are sixteen possible intevallic patterns identified
in Example ii, but only fifteen possible TS scs identified in Example iii. This is
because the intervallic patterns <123> and <132> both generate pc sets
belonging to sc (013679) (pc sets generated by <123> are inversions of pc sets
generated by <132> and vice versa). (013679) is the only TS sc that does not
also feature inversionsal symmetry, which accounts for its comparatively large
number of pc forms.

\(^{19}\) Pc-intervals 2, 4, and 6 could also be evenly subdivided, but such
subdivisions do not generate new intevallic patterns. For example, dividing the
octave into six whole tones (6 x <2>), and then subdividing each whole tone into
two semitones (6 x <11>) produces the same end result as simply dividing the
octave into twelve semitones (12 x <1>) from the start.

\(^{20}\) Alternatively, it is possible to think of generating these TS scs by
cyclically repeating the intevallic patterns of Example ii until the octave span is
evenly filled up, a process that is conceptually opposite to octave subdivision but
produces the same results.
Example iii – The Fifteen Transpositionally Symmetrical Set Classes

<table>
<thead>
<tr>
<th>c</th>
<th>sc</th>
<th>labels</th>
<th>#</th>
<th>pat</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>(0123456789te)</td>
<td>Chromatic</td>
<td>1</td>
<td>&lt;1&gt;</td>
</tr>
<tr>
<td>10</td>
<td>(012346789t)</td>
<td>Mode 7</td>
<td>6</td>
<td>&lt;11112&gt;</td>
</tr>
<tr>
<td>9</td>
<td>(01245689t)</td>
<td>Mode 3, Enneadic, Enneatonic, Nonatonic, Weilzmann Collection</td>
<td>4</td>
<td>&lt;112&gt;</td>
</tr>
<tr>
<td>8</td>
<td>(01236789)</td>
<td>Mode 4</td>
<td>6</td>
<td>&lt;1113&gt;</td>
</tr>
<tr>
<td></td>
<td>(0124678t)</td>
<td>Mode 6</td>
<td>6</td>
<td>&lt;1122&gt;</td>
</tr>
<tr>
<td></td>
<td>(0134679t)</td>
<td>Mode 2, Octatonic</td>
<td>3</td>
<td>&lt;12&gt;</td>
</tr>
<tr>
<td>6</td>
<td>(012678)</td>
<td>Mode 5</td>
<td>6</td>
<td>&lt;114&gt;</td>
</tr>
<tr>
<td></td>
<td>(013679)</td>
<td>truncated Mode 2</td>
<td>12</td>
<td>&lt;123&gt; or &lt;132&gt;</td>
</tr>
<tr>
<td></td>
<td>(014589)</td>
<td>Hexatonic</td>
<td>4</td>
<td>&lt;13&gt;</td>
</tr>
<tr>
<td></td>
<td>(02468t)</td>
<td>Mode 1, Whole Tone</td>
<td>2</td>
<td>&lt;2&gt;</td>
</tr>
<tr>
<td>4</td>
<td>(0167)</td>
<td>truncated Mode 5</td>
<td>6</td>
<td>&lt;15&gt;</td>
</tr>
<tr>
<td></td>
<td>(0268)</td>
<td>French Augmented 6\textsuperscript{th}</td>
<td>6</td>
<td>&lt;24&gt;</td>
</tr>
<tr>
<td></td>
<td>(0369)</td>
<td>Fully-Diminished 7\textsuperscript{th}</td>
<td>3</td>
<td>&lt;3&gt;</td>
</tr>
<tr>
<td>3</td>
<td>(048)</td>
<td>Augmented Triad</td>
<td>4</td>
<td>&lt;4&gt;</td>
</tr>
<tr>
<td>2</td>
<td>(06)</td>
<td>Tritone</td>
<td>6</td>
<td>&lt;6&gt;</td>
</tr>
</tbody>
</table>

\(c\) = cardinality; \(sc\) = set class; \(#\) = number of unique pc forms; \(pat\) = repeated pc-interval pattern

For consistency, I have written the intervallic patterns in Examples ii and iii so that the smallest numbers are packed to the left; however for the majority of these patterns, the order of intervals is unimportant. The single exception is the pattern \(<1122>\), which when rotated as \(<1221>\), \(<2211>\), or \(<2112>\), produces the expected \(sc\) (0124678t), but when rearranged as \(<1212>\) (which may be reduced to \(<12>\)), produces \(sc\) (0134679t) instead. Thus, the general rule is that rotations of these intervallic patterns do not change the resulting \(sc\), but rearrangements of intervals within the order may.\(^{21}\)

\(^{21}\) I consider different rotations of an intervallic pattern to be equivalent (as did Messiaen) because they generate the same TS \(sc\); however, it should be noted that other theorists use these differing orders of intervallic succession to distinguish between different forms of the same collection. For instance, Pieter Van den Toorn refers to the \(<12>\) form of the octatonic collection as Model A and the \(<21>\) form as Model B (Van den Toorn 1983, 48-60).
Example iii also shows that only some of the fifteen TS scs are mentioned by Messiaen as MLT. Because of their small sizes and traditional harmonic identities, it seems logical that Messiaen would not have considered the dyad, trichord, or tetrachords of Example iii to be full-fledged modes. These scs are better suited for compositional use as chordal sonorities, rather than as collections from which to draw melodic and harmonic materials. However, it is the rather puzzling omission of the hexatonic (sc (014589)), a collection in relatively common use in late-Romantic music (as explored in recent neo-Riemannian theoretical literature), which suggests that Messiaen’s theory of the MLT is not as systematic and comprehensive as he claimed. Indeed, his statement that “it is mathematically impossible to find others of them, at least in our tempered system of twelve semitones” is incorrect.

John Schuster-Craig proposes that because Messiaen was writing about the techniques of his own composition, the hexatonic collection might have been excluded from his discussion simply because it was not a part of his compositional activity. While it is true that Messiaen does not use this mode on its own, the hexatonic collection may be heard in his music as an important subset of Mode 3—one that teases out all of the major and minor triads from within this frequently used, larger collection (as will be discussed in detail in Chapter 1). In this way, the hexatonic collection is analogous to the whole-tone

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22 As discussed below, Messiaen refers to some of these scs as *accords classés*—“classified chords” (Messiaen 1944, 90 and 1956, 61).
23 Messiaen 1956, 58.
24 Schuster-Craig 1990, 298.
collection, which teases out all of the whole tones from within Mode 3, and which
Messiaen names as his Mode 1 despite expressing a certain artistic aversion to it. He writes, "Claude Debussy, in Pelléas et Mélisande, and after him Paul
Dukas, in Ariane et Barbe-Bleue, have made such remarkable use of [Mode 1] that there is nothing more to add. Then we shall carefully avoid making use of it, unless it is concealed in a superposition of modes which renders it unrecognizable."\(^{25}\) Thus, if Messiaen included the whole-tone collection as the first in his list of modes despite his conviction that it would never intentionally appear in his music, it is unlikely that he would have deliberately omitted the hexatonic collection from his theoretical discussion on the basis of his own compositional preferences.

Schuster-Craig also suggests that the omission might have something to do with the intervallic content of the hexatonic collection as compared to the other MLT. He writes:

Six of Messiaen’s seven Modes of Limited Transposition (all but Mode 3) can be divided into pairs of tritones. Mode 3 does not divide into tritone pairs only because it contains an odd number of pitches; the tritone is still maximally present. In striking contrast, no two pitches in [the hexatonic collection] are a tritone apart.\(^{26}\)

Schuster-Craig’s observation regarding the absence of tritones in the hexatonic collection is correct and pertinent to this discussion. Indeed, the importance of the tritone in many of the MLT is emphasized by Messiaen himself. In his

\(^{25}\) Messiaen 1956, 59.
Claude Debussy (dans <<Pelléas et Mélisande>>) et après lui Paul Dukas (dans <<Ariane et Barbe-Bleue>>) en ont fait un usage si remarquable qu’il n’y a plus rien à ajouter. Nous éviterons donc soigneusement de nous en servir.—À moins qu’elle ne soit dissimulée dans une superposition de modes qui la rende méconnaissable (Messiaen 1944, 85).

\(^{26}\) Schuster-Craig 1990, 298.
theoretical description of Modes 4 to 7, Messiaen recognizes repetition and
equivalence at this interval:

These modes are transposable six times, like the interval of the
augmented fourth. They are divided into two symmetrical groups....One
cannot find others of them transposable six times, because all other
combinations dividing the octave into two symmetrical groups must:
commence the scales of Modes 4, 5, 6, and 7 upon other degrees than
the first (which changes the order of the intervals, but not the notes or the
chords of the modes....); or form arpeggios of classified chords; or form
truncated Modes 2....or form truncated Modes 5.27

However, Schuster-Craig’s statement regarding the three tritones within Mode 3
is neither accurate (the maximum number of tritones for a nine-note collection is
four, not three), nor supported by Messiaen’s description. Instead of relating this
mode to the tritone, Messiaen writes that Mode 3 “is transposable four times, as
is the chord of the augmented fifth.”28

The above statements quoted from Messiaen’s writings imply that he was
thinking of some of the modes in relation to the tritone and others in relation to
the augmented triad. Taking this into consideration, there are two more methods
by which all of the possible TS scs may be generated: 1) via the combination of
either some number of tritones or some number of augmented triads (the two
smallest TS units) in all possible configurations, or 2) via the subtraction from the

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27 Messiaen 1956, 61. Emphasis is mine.

Ces modes sont six fois transposables, comme l'intervalle de 4\textsuperscript{e} augmentée. Ils se divisent en
deux groupes symétriques....On ne peut en trouver d'autres six fois transposables, toutes les
autres combinaisons divisant l'octave en deux groupes symétriques aboutissant: soit à
commencer l'échelle des modes 4, 5, 6 et 7 sur d'autres degrés que le premier (ce qui change
l'ordre des intervalles, mais non les notes et les accords des modes....); soit à des arègèges
d'accords classés, soit à des modes 2 tronqués....soit à des modes 5 tronqués (Messiaen 1944,
90).

By “classified chords,” I believe Messiaen is referring here to the French
augmented-sixth (sc (0268)) and fully-diminished-seventh (sc (0369)) chords.

28 Messiaen 1956, 60. Emphasis is mine.

Est quatre fois transposable, comme l'accord de 5\textsuperscript{e} augmentée (Messiaen 1944, 88).
total chromatic of either some number of tritones or some number of augmented triads in all possible configurations.\textsuperscript{29} To illustrate the second of these complementary processes, one tritone and one augmented triad may be taken out of the total chromatic to create Messiaen’s seventh and third modes, respectively, as shown in Example iv.\textsuperscript{30}

\begin{center}
\textbf{Example iv}
\end{center}

a) Generating Mode 7 from the Total Chromatic via Tritone Subtraction

\[\{0,1,2,3,4,5,6,7,8,9,t,e\} \xrightarrow{\text{minus tritone \{5,e\}}} \{0,1,2,3,4,6,7,8,9,t\}\]

b) Generating Mode 3 from the Total Chromatic via Augmented-Triad Subtraction

\[\{0,1,2,3,4,5,6,7,8,9,t,e\} \xrightarrow{\text{minus augmented-triad \{3,7,e\}}} \{0,1,2,4,5,6,8,9,t\}\]

If an additional tritone and augmented triad are subtracted from Modes 7 and 3, respectively, new MLT are created. As shown in Example v, subtracting a tritone from a Mode-7 collection can result in three different types of MLT.

\textsuperscript{29} Headlam 1983, 43 discusses a similar procedure for deriving pc sets of limited transpositions.

\textsuperscript{30} I have chosen a specific tritone \{5,e\} and a specific augmented triad \{3,7,e\} as illustrations; however, the subtraction of any tritone from the total chromatic will produce a pc form of Mode 7, and the subtraction of any augmented triad from the total chromatic will produce a pc form of Mode 3.
Example v

a) Generating Mode 2 from Mode 7 via Tritone Subtraction

\[
\{0,1,2,3,4,6,7,8,9, t\} \quad \text{minus tritone } \{2,8\} \quad \rightarrow \quad \{0,1,3,4,6,7,9, t\}
\]

b) Generating Mode 4 from Mode 7 via Tritone Subtraction\textsuperscript{31}

\[
\{0,1,2,3,4,6,7,8,9, t\} \quad \text{minus tritone } \{4, t\} \quad \rightarrow \quad \{0,1,2,3,6,7,8,9\}
\]

c) Generating Mode 6 from Mode 7 via Tritone Subtraction\textsuperscript{32}

\[
\{0,1,2,3,4,6,7,8,9, t\} \quad \text{minus tritone } \{3,9\} \quad \rightarrow \quad \{0,1,2,4,6,7,8, t\}
\]

As shown in Example vi, subtracting an augmented triad from a Mode-3 collection can result in two different types of MLT.

Example vi

a) Generating Mode 1 from Mode 3 via Augmented-Triad Subtraction

\[
\{0,1,2,4,5,6,8,9, t\} \quad \text{minus augmented-triad } \{1,5,9\} \quad \rightarrow \quad \{0,2,4,6,8, t\}
\]

\textsuperscript{31} Subtracting tritone \{0,6\} produces another pc form of Mode 4, sc (01236789).

\textsuperscript{32} Subtracting tritone \{1,7\} produces another pc form of Mode 6, sc (0124678t).
Example vi (cont’d)

b) Generating the Hexatonic from Mode 3 via Augmented-Triad Subtraction\textsuperscript{33}

\[
\begin{array}{c}
\{0,1,2,4,5,6,8,9,t\} \quad \text{minus augmented-triad} \{2,6,t\} \\
\{0,1,4,5,8,9\}
\end{array}
\]

If this process of tritone or augmented-triad subtraction is continued to completion, all fifteen TS scs are generated, as indicated by the downward-pointing arrows of Example vii. (The upward-pointing arrows suggest the complementary method of combining tritones or augmented triads to create larger pc sets.) Here, the TS scs are divided into two families: those shown to the left of the dotted line are based on tritones, those shown to the right of the dotted line are based on augmented triads, and those shown straddling the dotted line belong to both families.

I have now discussed three procedures, any one of which may be used to generate all fifteen TS scs. Perhaps Messiaen omitted the augmented-triad-based hexatonic collection because he discovered these collections in different ways and did not follow any single method of generation through to completion. While he seems to be most faithful to octave subdivision, including observations of this nature in his discussion of each of the modes, I do not think that this is the way in which Messiaen first came across many of these collections. In some cases, a mode’s subdivision of the octave seems to be a secondary observation.

\textsuperscript{33} Subtracting augmented-triad \{1,4,8\} produces another pc form of the hexatonic collection, sc (014589).
made after his initial discovery of the collection.

In Technique, Messiaen mentions that he was already familiar with Modes 1 and 2 through the music of his predecessors, and for this reason, he spends little time discussing Mode 1. In contrast, Messiaen devotes a significant amount of attention to the properties of Mode 2 in all of his sources, perhaps because it had been used less commonly and was a collection of which he was particularly
fond. This first theoretical observation about this collection is that it is “transposable three times, as is the chord of the diminished seventh.” This suggests that he may have initially encountered Mode 2 as the complement of the fully-diminished-seventh chord (or as a subtraction of two tritones from the total chromatic). Similarly, Messiaen makes note of the relationship between Mode 3 and its complement before describing its generation via octave subdivision in this source. It seems plausible that he initially discovered this collection through its analogy to Mode 2—that is, as the result of subtracting the augmented triad from the total chromatic.

Modes 1 to 3 are included in all three of Messiaen’s main documents on MLT, and his description of them changes very little from source to source. I believe that upon discovering these modes, Messiaen sensed that there were more collections of this type which had not been used extensively by other composers. Modes 4 to 7 are discussed in much less detail in all of his writings,

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34 Messiaen makes some contradictory statements regarding the discovery of his MLT. In *Technique*, he writes that he became familiar with Mode 1 through the music of Debussy and Dukas, and with Mode 2 through the music of Rimsky-Korsakov, Scriabin, Ravel, and Stravinsky (Messiaen 1956, 59; 1944, 85). However, in the later *Traité*, he writes that all of the MLT except the whole-tone collection were his own inventions, apparently taking credit for Mode 2 as well (Messiaen 2002, 51).

35 Messiaen 1956, 59.

Le "mode 2" est 3 fois transposable, comme l’accord de 7e diminuée (Messiaen 1944, 85).

36 Donald Street, who traces the MLT historically through many composers’ works, notes that Modes 3 through 7 are rarely found outside of Messiaen’s music (Street 1976, 823). Interestingly, the Russian composer Alexander Tcherepnin, who was nine years Messiaen’s senior, discovered and composed with the nine-note TS collection as early as 1918, but described it as the combination of two “major-minor hexachords” (sc (014589)), or as three interlocking “major-minor tetrachords” (sc (0134) or sc (0124)), as explained in his 1962 unpublished manuscript *Basic Elements of My Musical Language*. It appears that Messiaen was unaware of Tcherepnin’s work.
but the most significant coverage is found in *Technique*, as quoted above.\textsuperscript{37} This theoretical description suggests that Messiaen discovered these remaining modes by first dividing the octave into two halves, and then systematically exploring all of the intervallic patterns that subdivide the tritone span. Indeed, his account of the tritone-based modes is complete, and at this point, he appears to have been satisfied that he had found all of the mathematically possible MLT. I suspect that he simply overlooked the fact that the tripartite division of the octave (which he observed in relation to Mode 3) could also be subdivided into different intervallic patterns, yielding Mode 1 (which he had already discovered by other means) and the hexatonic collection. He simply did not investigate the augmented-triad-based TS scs with the same theoretical rigour as he did the tritone-based TS scs.

The organization of Example vii raises another issue concerning Messiaen’s definition of the MLT—the term “truncated,” which he uses only in describing scs (0167) and (013679). Messiaen was no doubt referring to the fact that these two scs are abstract subsets of Modes 5 and 2, respectively. However, the reader will note by examining the solid lines of Example vii (which indicate the hierarchical subset-superset relationships between all of the TS scs), that (0167) and (013679) are abstract subsets of other modes as well, and that in

\textsuperscript{37}In his early writing on this subject (the preface to *La Nativité*), Messiaen includes only Modes 4 and 6 (labeling them generically, “two fourth modes”) with his discussion of Modes 1 to 3. Similarly in his most recent writing (the *Traité*), he chooses to discuss the sound-colours of only his favourite modes (Modes 2, 3, 4, and 6), omitting Modes 1, 5, 7, and the truncated modes from the discussion altogether. In a footnote, Yvonne Loriod explains that Mode 5 was cut out after *Technique* because it is a subset of Mode 4, and Mode 7 is omitted because its harmonies are rarely used by Messiaen (Messiaen 2002, 107).
fact, all but two of Messiaen’s modes are abstract subsets of at least one other
mode—that is, all but Modes 3 and 7 could be considered to be truncated.\textsuperscript{38}

It seems clear that Messiaen considered the TS scs of cardinalities greater
than six to be full-fledged modes, and the TS scs of cardinalities less than six not
to be modes at all (with the exception of sc (0167)).\textsuperscript{39} As for the six-note TS scs,
one might expect them to be labeled in a consistent way—either all as full-
fledged modes or all as truncated modes, depending on whether a cardinality of
six is large enough to constitute an independent scale. However, Messiaen was
inconsistent in his labeling of these collections. Of the six-note modes that he
acknowledged, scs (012678) and (02468t) are full-fledged, while sc (013679) is
truncated, and his comments about them suggest that he was taking factors
other than cardinality into consideration as well.

For example, he writes that Mode 5 (sc (012678)), “being a truncated
Mode 4, has the right of quotation here only because it engenders the melodic
formula…and the chord in fourths.”\textsuperscript{40} Thus, Messiaen seems aware of his own
inconsistencies regarding truncation, and scs (012678) and (02468t) were likely
categorized as full-fledged modes because they were sufficiently aurally distinct
and musically important so as to be heard as entities independent of the TS
supersets to which they belonged. It appears that sc (013679) was not important

\textsuperscript{38} Street 1976, 819 makes similar observations.
\textsuperscript{39} Like the other four-note scs in Example iii, this sc is too small to be
considered a full-fledged mode. However, sc (0167) does not have the traditional
harmonic associations that the other small scs have (i.e. it is not a “classified
chord”), which makes it more convincing as a truncated mode.
\textsuperscript{40} Messiaen 1956, 62.
Ce mode 5, étant un mode 4 tronqué, n’a droit de cité ici que parce qu’il engendre la formule
mélodique…et <<l’accord en quartes>> (Messiaen 1944, 91).
or unique enough to stand on its own, and that Messiaen heard it in relation to Mode 2 in particular (rather than to Modes 4, 6, or 7 of which it is also a subset).

In this thesis, I consider all TS scs of cardinality six or greater to be MLT. As shown in Example viii, I maintain Messiaen’s numbering for Modes 1 to 7, but include the hexatonic collection (sc (014589)) as Mode 8 (to create a more complete picture of modal relations) and re-label truncated Mode 2 (sc (013679)) as Mode 9 (to avoid confusing and imprecise terminology).

Example viii – Renumbering the Modes of Limited Transpositions

While Messiaen does not explicitly address numbering in his writings, several of his statements indirectly suggest that his conventions were based, at least partially, on the transpositions of the modes—the fewer unique transpositions that are possible, the smaller the mode number. For instance, he writes in Traité:

The Modes of Limited Transpositions are based on the multiples [sic—divisors] of 12: 2 times 6, 3 times 4, 4 times 3, 6 times 2. In these multiplications, the multiplier indicates the number of transpositions.
possible for each mode. Consequently, the first mode has two
transpositions and six groups, the second mode has three transpositions
and four groups, the third mode has four transpositions and three groups,
the following modes....have six transpositions and two groups.41

This quote explains the numbering of Modes 1 to 3, but not Modes 4 to 7 (all
transposable six times), and Messiaen does not make any further comments
clarifying his decisions. Since he does not indicate whether his numbering of
Modes 4 to 7 was based on any particular criteria or was arbitrarily decided, it
seems reasonable to place sc (013679) at the end as Mode 9 because it has the
largest number of unique pc forms (twelve). However, sc (014589), being
transposable only four times, should really be placed before Mode 4. By labeling
it Mode 8, I am violating the basic principle upon which Messiaen numbered his
modes in order to avoid disrupting his original numbering of Modes 4 through 7.42

In Example ix, then, I have listed all of the distinct pc forms for each of
these nine modes and have maintained the pc orderings and spellings that
Messiaen provides in his writings. The reader will note that in some cases, the

41 Messiaen 2002, 50. Translation is mine.
Les Modes à transpositions limitées sont basés sur les multiples de 12: 2 fois 6, 3 fois 4, 4 fois 3,
6 fois 2. Dans ces multiplications: le multiplicateur indique le nombre de transpositions possibles
de chaque Mode. En conséquence: le 1er Mode aura 2 transpositions et 6 groupes, le 2e Mode 3
transpositions et 4 groupes, le 3e Mode 4 transpositions et 3 groupes, les Modes suivants....6
transpositions et 2 groupes.

While Messiaen understands the first factor in these multiplications as
indicating the number of transpositions of the mode (and the second factor as
indicating the number of units or "groups" into which the octave is divided), the
first factor could also indicate the length (in semitones) of the repeating intervallic
unit (or "group") that generates the collection.

42 Schuster-Craig similarly calls the hexatonic collection an eighth MLT but
numbers it Mode 1b because of its structural similarities to Mode 1. His label
also violates Messiaen’s numbering principle, but it raises another option.
Numbering sc (014589) as Mode 3b puts it in the right place and at the same
time, avoids the displacement of the following MLT. However, I feel that this
collection is musically significant enough to deserve its own number, and that
such a label would place unnecessary emphasis on its relationship to Mode 3.
**Example ix – The Transpositionally Symmetrical Modes**

<table>
<thead>
<tr>
<th>Mode 1 (W)</th>
<th>Mode 6 (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: {C, D, E, F#, G#, B}</td>
<td>1: {C, D, E, F, F#, G#, A#, B}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode 2 (O)</th>
<th>Mode 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: {C, D#, E#, E, F#, G, A, B}</td>
<td>1: {C, D#, D, E#, E, F#, G, G#, A, B#, B}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode 3 (N)</th>
<th>Mode 8 (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: {C, D, E#, E, F#, G, A#, B}</td>
<td>1: {C, C#, E, F, A#, A}</td>
</tr>
<tr>
<td>4: {E#, E, F, A#, A, B#, B, D}</td>
<td>4: {D#, E, G, G#, B#, C}</td>
</tr>
<tr>
<td>5: {E, F, F#, A, A#, B, C, D#}</td>
<td></td>
</tr>
<tr>
<td>6: {F, G#, G, B#, B, C, D#, E}</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode 4 (C)</th>
<th>Mode 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>2: {C#, D, E#, F, G, A#, A, C}</td>
<td>2: {C#, E, F#, G, B#, C}</td>
</tr>
<tr>
<td>4: {E#, E, G#, A, B#, B, D}</td>
<td>4: {E#, F#, G#, A, C, D}</td>
</tr>
<tr>
<td>5: {E, F, F#, A, B#, B, C, D#}</td>
<td>5: {E, G, A, B#, C#, D#}</td>
</tr>
<tr>
<td>6: {F, G#, B#, B, C, D#, E}</td>
<td>6: {F, G#, B, B, D, E}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode 5</th>
<th>Mode 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2: {C#, D, F, G, A#, C}</td>
<td>2: {C#, E, F#, G, B#, C}</td>
</tr>
<tr>
<td>4: {E#, E, G#, A, B#, D}</td>
<td>4: {E#, F#, G#, A, C, D}</td>
</tr>
<tr>
<td>5: {E, F, A, B#, B, D#}</td>
<td>5: {E, G, A, B#, C#, D#}</td>
</tr>
<tr>
<td>7: {C, D, F, F#, G#, B}</td>
<td>7: {C, D, F, F#, G#, B}</td>
</tr>
<tr>
<td>8: {C#, D#, F#, G, A, C}</td>
<td>8: {C#, D#, F#, G, A, C}</td>
</tr>
<tr>
<td>9: {D, E, G, A#, B#, C#}</td>
<td>9: {D, E, G, A#, B#, C#}</td>
</tr>
<tr>
<td>10: {E#, F, G#, A, B, D}</td>
<td>10: {E#, F, G#, A, B, D}</td>
</tr>
<tr>
<td>11: {E, F#, A, B#, C, D#}</td>
<td>11: {E, F#, A, B#, C, D#}</td>
</tr>
</tbody>
</table>
intervallic patterns of these modal presentations are rotations of those shown in Examples ii and iii; however Messiaen writes that although he starts from pc C in each mode for convenience of work, one can also begin on other notes.\textsuperscript{43} It is clear from this and the following statement that, while he often notates these modes in a particular scalar ordering in his theoretical discussions, Messiaen does not always use or conceive of them as ordered sets:

The Modes of Limited Transpositions have neither tonic, nor dominant. They do not have a beginning, they do not have an ending. They are not a place, like a major tonality. They are not an order, like a series. They are \textit{colours}.\textsuperscript{44}

Throughout this thesis, I use the terms \textit{mode} and \textit{collection} interchangeably, in conjunction with curly brackets, \{\}, to refer to the unordered pc sets that form the musical substrata from which Messiaen draws his melodic and harmonic musical materials. Where ordering is important in reflecting a particular registral presentation or conceptual hierarchy of pcs in a specific musical context, I use the term \textit{scale} and angled brackets, \(<\>.

In labeling the MLT in his writings and scores, Messiaen uses one number to indicate mode type, and a second number (shown as a superscript) to indicate

\begin{footnotes}
\footnote{\textsuperscript{43}Messiaen 2002, 107. Je suis parti d'un do naturel pour chaque mode pour la commodité du travail, mais on peut partir sur d'autres notes.}
\footnote{\textsuperscript{44}\textit{i}bid., 51. Translation is mine. Les Modes à transpositions limitées n'ont ni tonique, ni dominante. Ils n'ont pas d'initiale, ils n'ont pas de finale. Ils ne sont pas un lieu, comme la tonalité majeure. Ils ne sont pas un ordre, comme la série. Ils sont des \textit{couleurs}.}
I believe that what Messiaen means here is that his modes do not have particular orderings that are suggested by their intervallic structure, as would perhaps a major scale. However, as I discuss in Chapter 3, this does not prevent him from presenting these collections as ordered sets, nor does it preclude the use of other musical parameters to emphasize a particular pc in order to create the effect of a tonic.
the transposition or pc form of the mode. For example, the first transposition of Mode 1 \{C, D, E, F\#, G\#, B\} is labeled by Messiaen as Mode 1\(^1\); the second transposition of the same mode \{C\#, D\#, F, G, A, B\} is labeled as Mode 1\(^2\); the first transposition of Mode 2 \{C, C\#, D\#, E, F\#, G, A, B\} is labeled as Mode 2\(^1\), and so on. At times throughout this thesis, I will use Messiaen’s labeling system; however, at other times, it will be helpful to avoid the use of these superscripts. In these cases, I will label collections by a letter (indicating mode type) followed by a number (indicating pc form).

The letter names I have given some of the MLT are shown in rounded brackets to the right of the mode number in Example ix. For example, the first transposition of Mode 1 will alternatively be labeled W1; the second transposition of Mode 1 will be labeled W2; the first transposition of Mode 2 will be labeled O1, and so on. My lettering choices for Modes 1, 2, and 8 are fairly obvious—“W” for whole tone, “O” for octatonic, and “H” for hexatonic, respectively. “N” stands for enneatonic or enneadic, which are common names for Mode 3; “C” stands for chromatic, in recognition of the chromatic tetrachords of Mode 4; and “F” refers to the Phrygian character of Mode 6 when presented in a specific scalar ordering.

Particularly in his early works from the 1930s and 40s, Messiaen finds his modes to be such rich sources of melody and harmony that long passages often remain in a single mode (or combination of modes), and so it will be mainly this repertoire from which I will draw my musical examples in this thesis. While Messiaen employs all of his modes at one time or another in his musical output, he does not use all of them equally. As the final topic of discussion in this
introduction, I will now examine Messiaen’s modal preferences and posit some possible reasons for them.

It is clear that Messiaen’s synaesthesia plays a large role in his compositional choices. On a number of occasions, he recalls his first viewing of the stained-glass windows in Paris’s *Sainte Chapelle* at the age of ten, and how this experience of “dazzlement” remained with him for the rest of his life, shaping his musical use of sound-colour.\(^45\) In his *Traité*, Messiaen provides a detailed discussion of his perception of sound and its relationship to colour, including descriptions of the colours produced by each unique pc form of Modes 2, 3, 4, and 6.\(^46\) He writes:

> When I hear or when I read music (hear it internally), I see colour complexes in my head that walk and move with the sound complexes….If it stays in the same place, a complex of sounds set in the medium always generates the same colours. If one transposes it to the high octave, the same colours are degraded towards white (that is to say, clearer), if one transposes it to the low octave, the same colours are reduced by black (that is to say, darker). If one transposes the same complex of sounds by a semitone, a tone, a third, a fourth, etc., the corresponding colours change completely.\(^47\)

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\(^{45}\) Wu 1998, 88.

\(^{46}\) Bernard suggests that perhaps these are the only modes which had colour associations for Messiaen, but to the best of my knowledge, there is no indication that this is the reason for these omissions. Bernard also suggests that, since Messiaen described the total chromatic as grey or grey-black, and since Mode 7 was only two notes short of the total chromatic, this collection may have had too many notes to evoke vivid colours (Bernard 1986, 45-46).

\(^{47}\) Messiaen 2002, 7. Translation is mine.

Lorsque j’entends ou lorsque je lis de la musique (en l’entendant intérieurement), je vois dans ma tête des complexes de couleurs qui marchent et bougent avec les complexes de sons….S’il reste à la même place, un complexe de sons situé dans le médium engendre toujours les mêmes couleurs. Si on le transporte à l’octave aiguë, les mêmes couleurs seront dégradées vers le blanc (c’est-à-dire plus claires), si on le transpose à l’octave grave, les mêmes couleurs seront rabattues par le noir (c’est-à-dire plus sombres). Si on transpose le même complexe de sons au demi-ton, au ton, à la tierce, à la quarte, etc., les couleurs correspondantes changent complètement.
In addition to register and transposition, other musical factors that affect Messiaen’s perception of sound-colour include duration, dynamic, attack, and orchestration or timbre.\footnote{Messiaen 2002, 97 and 104.}

While he acknowledges that other people do not usually share his perception of music and colour, Messiaen insists that he is experiencing real phenomena; he provides two exercises designed to help others understand such sound-colour associations, the first of which is particularly relevant to the present investigation into Messiaen’s modal preferences. In this exercise, Messiaen asks the participant to strike a low C2 very strongly on the piano and to listen to the harmonics that are produced. Theoretically, he writes, a person could hear the following pitches in this C2 sound: \(<C3, G3, C4, E4, G4, B\#4, C5, D5, E5, F\#5, G5, G\#5, B\#5, B5, C6>\). Messiaen states that he, like most people, perceives the octave, fifth, and third (the C-major triad) very clearly and strongly, and the dominant seventh (B\#) and the major ninth (D) less strongly. However, unlike most people, he can also hear an almost imperceptible F\# and (non-tempered) G\# or A\#.\footnote{In his second exercise, Messiaen asks the participant to place a coloured sheet of paper against a white sheet of paper. He notes that if one stares long enough at the line between the two papers, the coloured paper will appear more intensely coloured (for example, red will look more red) and the white paper will become a pale shade of the complementary colour (for example, a light green). Messiaen considers the experiences of harmonic sound and complementary colours to be very similar—in each case, the phenomenon may be perceived only after an extended period of fixed concentration (Ibid., 102-103).} He writes:
The hearing of the F♯ explains my love of the augmented fourth and my use of the second mode of limited transpositions. The hearing of the almost G♯ explains my preference for the third mode of limited transpositions.\(^{50}\)

This statement informs the reader that Modes 2 and 3 were Messiaen’s favourite MLT, but it does not really explain his preference, as he suggests, since other modes also include augmented fourths and fifths. (This information does, however, further justify the emphasis that was placed on the tritone and the augmented triad in generating these modes above.) Mode 2 is indeed used most frequently in Messiaen’s music, and he often mixes it with the key of F♯ major (as discussed in detail in Chapters 3 and 4), which for him was “a sparkling of all possible colours.”\(^{51}\)

An additional connection between Mode 3 and the harmonic series is made clear when Messiaen states that it contains all of the notes of the chord of resonance; this chord (and thus, Mode 3) contains all of the pcs in the harmonic series mentioned above (stacked from low to high <C, E, G, B♭, D, F♯, G♯, B>) and Messiaen arranges it spatially to evoke the colours of stained glass.\(^{52}\) It seems likely that this unification of the natural harmonic series and the property of limited transpositions was particularly appealing to Messiaen and caused him to declare that Mode 3 is the most beautiful of all of the modes.\(^{53}\)

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\(^{50}\) Messiaen 2002, 102. Translation is mine.

\(^{51}\) Wu 1998, 91.

\(^{52}\) Messiaen 1956, 50; 1944, 68.

\(^{53}\) Messiaen 2002, 106.
Messiaen speaks very little about an order of preference for the remaining modes. As mentioned above, his aversion to Mode 1 seems to come from a desire to distance himself from the influence of previous French composers (Debussy and Dukas) who had used the collection extensively (the use of Mode 2 by other composers did not seem to bother him, perhaps because they were mostly Russian). Regarding Modes 4 through 7, he expresses a general disinterest “for the very reason of their too great number of transpositions,” and does not make any specific statements about preferences among them.\(^{54}\)

However, he uses Modes 5 and 7 much less frequently in his music than he does Mode 6 and to a lesser extent, Mode 4, and he describes them theoretically only in *Technique* (Modes 5 and 7 are excluded from *La Nativité* and mentioned only in a footnote in *Traité*). Thus, it seems clear that Modes 2 and 3 were his favourite modes, followed by Mode 6 and Mode 4, while Modes 1, 5, and 7 were his least favourite modes.

Walker suggests that the distinctive qualities and therefore, special status of these four modes derive partly from the fact that there are no inclusion relations among them; that is, none of these favourite modes is a subset of any other favourite mode, which helps to keep their sound-colours aurally differentiated for the perceiver.\(^{55}\) Cheong, however, suggests that Messiaen’s attitudes towards the modes were not fixed throughout his compositional career, and that his use of them changed over time. She writes:

\(^{54}\) Messiaen 1956, 58.

Plus quatre autres modes, six fois transposables, et présentant moins d’intérêt, en raison même de leur trop grand nombre de transpositions (Messiaen 1944, 85).

\(^{55}\) Walker 1989, 162.
Modes 2 and 3 and, to a lesser extent, Mode 6 are integrated into the *Préludes* [1928-9], while Mode 5 assumes an early presence in the form of specific melodic formulae. But there is no prominent use of Mode 4 until *La nativité* [1935]. Indeed, Modes 2 and 3 are used in the majority of his early works, but only two out of all twenty-odd published works leading up to *Visions* [1943] use Mode 4. Thus, the fact that Messiaen closely knits Mode 4 into *Visions* and all of its immediate successors—*Liturgies* [1943-4], *Vingt regards* [1944], *Harawi* [1945], and *Turangalîla* [1946-8]—strikes us as a marked change. Messiaen’s initial focus on a handful of modes had in time been replaced by a more comprehensive approach (even if Modes 1 and 7 are still largely left out).\(^{56}\)

In addition to Messiaen’s own comments about his modes, it is helpful to refer to concepts from the scale-theory literature in order to gain an additional perspective on the properties and resources of these TS collections, and to understand why some might be more compositionally attractive than others. In his article, “On Coherence and Sameness, and the Evaluation of Scale Candidacy Claims,” Norman Carey writes:

> Scales form the substratum of musical works. In order for the works themselves to manifest characteristics distinct from one another, it is an advantage for the substratum to be rather bland. A substructure that calls too much attention to itself marks everything with its own stamp, diminishing the range of individual compositional character.\(^{57}\)

Carey explores the complexity of various types of pc sets in terms of three main parameters: cardinality, the existence of generators, and generic intervals. In general, the more complex these factors are, the less likely it is that a given set will function as a scale (or collection/mode, as I have defined above). However, he also notes that a certain degree of complexity may be advantageous in some respects. The main purpose of Carey’s work in this article, then, is to determine

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\(^{56}\) Cheong 2002, 57.  
\(^{57}\) Carey 2002, 41.
how much complexity a pc set can tolerate and still be useful as a scale (collection/mode).

In the discussion of his first parameter—cardinality—Carey notes that the general limit in the cognition and memory of categories (such as scales) is 7±2, as demonstrated by George Miller.\(^\text{58}\) The diatonic collection and Messiaen’s four favourite modes fall within this optimal cognitive range, as do the six-note modes. His ten-note Mode 7, however, is one pc too big, which may help to explain Messiaen’s reluctance to use it. In a musical context, it may be difficult for the listener to distinguish a pc form of Mode 7 from the total chromatic, since it is missing only one tritone and its intervalllic pattern features a high degree of chromaticism. For this reason, I will leave it out of the remaining discussion.

Carey’s second parameter—the existence of generators—does not apply well to the MLT because most of these collections cannot be generated by the repetition of a single interval (in the way that pc-intervals 5 or 7 may be said to generate the entire diatonic collection).\(^\text{59}\) Carey notes that the more intervals there are that independently generate a collection and the more dissonant the generator(s), the greater the collection’s complexity; however, he does not discuss the possibility of generating collections via the cycling of a two-or-more-interval repeated pattern, as occurs in many of the TS scs (refer back to Example ii).

\(^{58}\) Miller 1956.

\(^{59}\) This also means that Carey and Clampitt’s concept of a \textit{well-formed scale} (a collection generated by consecutive “fifths” in which symmetry is preserved by the scalar ordering) does not apply to the MLT either (Carey/Clampitt 1989).
While this second criterion does not help to shed light on Messiaen’s preferences, it does bring up a related and relevant topic of discussion—the bisection of the octave by a “dominant” interval. As a number of authors have pointed out, one of the features that makes the diatonic collection particularly special is the fact that the interval which generates it cyclically also (approximately) bisects its octave expanse from tonic to tonic. Many of the MLT contain similar bisecting intervals (both approximate and exact) and, while these intervals cannot be used to generate the TS collection, their presence is useful in mimicking the sound of traditional tonality (this discussion will be continued in Chapter 3).

Carey’s third parameter—generic intervals—is particularly pertinent to the present discussion. Of special interest is the relationship between generic intervals (measured in scale steps) and specific intervals (measured in chromatic semitones) within a given collection. Carey proposes “that a pitch-class set may function as a scale when its generic intervals efficiently organize and encode its specific intervals. Put simply, a scale is that kind of pitch-class set in which it makes sense to think about intervals generically.”

In an earlier article entitled, “Coordination of Interval Sizes in Seven-tone Collections,” Jay Rahn discusses three types of situations, or “heteromorphisms,” that can arise when comparing specific and generic intervals (Carey then adopts this terminology as well). The first situation, in which two pairs of ordered pcs

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have a single generic size but different specific sizes, is termed a “difference;” the second situation, in which two pairs of ordered pcs have the same specific sizes but differing generic sizes, is termed an “ambiguity;” and the third situation, in which two pairs (x and y) of ordered pcs exist such that x is greater than y in terms of chromatic semitones and y is greater than x in terms of scale steps, is termed a “contradiction” or “opposition.”

Example x lists the generic and specific interval sizes for all of the MLT with cardinalities of 7±2.

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**Example x – Comparison of Genus and Species for TS Collections of Cardinalities 7±2**

<table>
<thead>
<tr>
<th>Mode 1</th>
<th>Mode 5</th>
<th>Mode 8</th>
<th>Mode 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>genus</td>
<td>species</td>
<td>genus</td>
<td>species</td>
</tr>
<tr>
<td>&lt;1&gt;</td>
<td>{2}</td>
<td>&lt;1&gt;</td>
<td>{1,4}</td>
</tr>
<tr>
<td>&lt;2&gt;</td>
<td>{4}</td>
<td>&lt;2&gt;</td>
<td>{2,5}</td>
</tr>
<tr>
<td>&lt;3&gt;</td>
<td>{6}</td>
<td>&lt;3&gt;</td>
<td>{6}</td>
</tr>
<tr>
<td>&lt;4&gt;</td>
<td>{8}</td>
<td>&lt;4&gt;</td>
<td>{7,6}</td>
</tr>
<tr>
<td>&lt;5&gt;</td>
<td>{t}</td>
<td>&lt;5&gt;</td>
<td>{8,e}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode 2</th>
<th>Mode 4</th>
<th>Mode 6</th>
<th>Mode 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>genus</td>
<td>species</td>
<td>genus</td>
<td>species</td>
</tr>
<tr>
<td>&lt;1&gt;</td>
<td>{1,2}</td>
<td>&lt;1&gt;</td>
<td>{1,3}</td>
</tr>
<tr>
<td>&lt;2&gt;</td>
<td>{3}</td>
<td>&lt;2&gt;</td>
<td>{2,4}</td>
</tr>
<tr>
<td>&lt;3&gt;</td>
<td>{4,5}</td>
<td>&lt;3&gt;</td>
<td>{3,5}</td>
</tr>
<tr>
<td>&lt;4&gt;</td>
<td>{6}</td>
<td>&lt;4&gt;</td>
<td>{6}</td>
</tr>
<tr>
<td>&lt;5&gt;</td>
<td>{7,8}</td>
<td>&lt;5&gt;</td>
<td>{7,9}</td>
</tr>
<tr>
<td>&lt;6&gt;</td>
<td>{9}</td>
<td>&lt;6&gt;</td>
<td>{8,t}</td>
</tr>
<tr>
<td>&lt;7&gt;</td>
<td>{t,e}</td>
<td>&lt;7&gt;</td>
<td>{9,e}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;8&gt;</td>
<td>{t,e}</td>
</tr>
</tbody>
</table>

---

Where differences occur, more than one species (specific interval size) is listed opposite a particular genus (generic interval size). Where ambiguities occur, the species numbers involved are written in italics, and where contradictions occur, the species numbers involved are written in bold. Example xi provides a tally of the number of heteromorphisms for each of these MLT, and also includes data for the diatonic collection in the dashed column for comparison.

Example xi – A Comparison of Heteromorphisms for TS Collections of Cardinality 7±2

<table>
<thead>
<tr>
<th>Mode</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
<th>9</th>
<th>(Dia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Ambiguity</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Contradiction</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

A collection with a low number of heteromorphisms will be relatively aurally coherent (in the sense that the listener will know how the specific intervals relate to the generic intervals and vice versa), but may lack musical variety. Mode 1, for example, contains no heteromorphisms of any kind, and its one-to-one correspondence between generic and specific intervals ensures a high degree of aural consistency; however, this uniformity also limits the harmonic and melodic resources of the collection—only a small number of unique subsets may be drawn from this collection and it is impossible to hierarchize pcs based on their intervallic positions within the collection. Mode 4, on the other hand, contains a relatively high number of heteromorphisms, including four contradictions. Many types of subsets may be drawn from this collection, but its structure is somewhat aurally confusing. For instance, it may be difficult for the
listener to distinguish stepwise motion from arpeggiation, as melodic intervals may be the same size (in the case of ambiguities) or larger (in the case of contradictions) than harmonic intervals.\textsuperscript{63} Like the diatonic collection, Messiaen’s favourite modes fall in between these two extremes.

While comparing specific and generic interval sizes, it is helpful to briefly introduce the concept of \textit{maximal evenness}.\textsuperscript{64} For any given cardinality, there is one maximally even sc whereby the interval(s) in the species of each genus are as similar in size as possible (either a single integer or two consecutive integers). This property ensures that the set contains no contradictions (which are particularly detrimental to the aural coherency of a collection) and that its pcs are as evenly distributed in the octave span as possible. Example xii shows the maximally even scs for cardinalities of 7±2.

---

**Example xii — The Maximally Even Set Classes for Cardinalities 7±2**

<table>
<thead>
<tr>
<th>Cardinality</th>
<th>Set Class</th>
<th>Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>(02479)</td>
<td>Pentatonic</td>
</tr>
<tr>
<td>6</td>
<td>(013568t)</td>
<td>Diatonic</td>
</tr>
<tr>
<td>7</td>
<td>(02468t)</td>
<td>Whole Tone, Mode 1</td>
</tr>
<tr>
<td>8</td>
<td>(0134679t)</td>
<td>Octatonic, Mode 2</td>
</tr>
<tr>
<td>9</td>
<td>(01245689t)</td>
<td>Enneadic, Mode 3</td>
</tr>
</tbody>
</table>

The reader will note that Messiaen’s favoured Modes 2 and 3 are the maximally even sets for cardinalities eight and nine, respectively. Due to its

\textsuperscript{63} In Mode 4, for example, some steps \((<1> = \{1,3\})\) are bigger than some “thirds” \((<2> = \{2,4\})\), and are the same size as some “fourths” \((<3> = \{3,5\})\).

\textsuperscript{64} See Clough/Douthett 1991.
maximal evenness, Mode 2 contains fewer heteromorphisms than the other eight-note Modes 4 and 6 and its intervallic pattern is shorter. The short intervallic patterns and lack of contradictions in both Modes 2 and 3 ensure a certain degree of aural coherence, while a few differences (and in the case of Mode 3, ambiguities) ensure a reasonable amount of intervallic variety with which the composer can work.

Western listeners acculturated to the equal-tempered scale usually consider the semitone to be the smallest possible intervallic unit and tend to measure all other intervallic spans in reference to it regardless of the modal environment that is presented. Thus, it may be difficult for large specific intervals to be perceived as “steps,” even if they are scalar adjacencies within a given collection. As a result, collections whose generic steps are small in specific size (semitones or whole tones) seem to have an advantage in functioning as substrata. Perhaps not surprisingly, Messiaen’s favourite Modes 2, 3, and 6 include only semitones and whole tones as scale steps, while the remaining modes in Example x include a mixture of semitones and larger intervals. The interesting tension that may be heard between the generic and the specific aspects of this modal music will be fleshed out in Chapters 1 and 2.

Much of the scale-theory literature has focused on the unique properties of the diatonic collection and has attempted to explain why this collection has enjoyed such privileged status as the preferred substratum for the majority of Western art music. The criteria that have been devised to evaluate the efficacy of other pc sets as scales are predicated on the features of the diatonic collection.
as an ideal model. As shown above, some of the MLT (especially Messiaen’s favourite modes) share important characteristics with the diatonic collection, which make these collections suitable for use as musical substrata. However, there is (at least) one diatonic property that, by definition, cannot be applied to TS scs such as the MLT—that of being a deep scale.

As defined by Carlton Gamer, a pc set is a deep scale if each of its interval classes (ics) occurs with unique multiplicity (the ic vector of the diatonic collection, for example, is [254361]).\(^65\) This is significant because if an ic (n) occurs \(m\) times in a particular set, there will be \(m\) pcs held in common between the original pc set and its \(T_n\) transposition (except when \(n = 6\), in which case \((m \times 2)\) pcs will be held in common between the original set and its \(T_6\) transposition). Transpositions of a given deep scale may therefore be hierarchized based on the number of common tones they share with the original pc set.

Example xiiiia illustrates this principle by showing the number of pcs held in common between a diatonic pc set and each of its eleven transpositions. While the hierarchization here is not perfect due to the exception in the rule above (the \(T_6\) transposition has the same number of common tones as the \(T_1\) and \(T_6\) transpositions), the reader will notice a distinct difference between this situation and the one depicted in Example xiiiib.\(^66\) This second example shows the number of pcs held in common between a pc form of Mode 2 and each of its eleven transpositions. Of course, the transpositional symmetry of Mode 2

\(^{65}\) Gamer 1967, 39-45.

\(^{66}\) Incidentally, the “Guidonian Hexachord” (sc (024579), ic vector [143250]) is an example of a deep scale with a perfect hierarchization of transpositions because it contains no tritones.
Example xiii – A Comparison of Common Tones between a Pc Set and its Transpositions

a) Diatonic

Original pc set: \{C, D, E, F, G, A, B\}  
Interval-Class Vector [254361]

\[
\begin{align*}
T_1 &= \{C\sharp, D\sharp, E\flat, F\sharp, G\sharp, A\sharp, B\sharp\} & (2 \text{ CT}) \\
T_2 &= \{D, E, F\sharp, G, A, B, C\sharp\} & (5 \text{ CT}) \\
T_3 &= \{E\flat, G, A\flat, B\flat, C, D\} & (4 \text{ CT}) \\
T_4 &= \{E, F\flat, G\flat, A, B, C\flat, D\flat\} & (3 \text{ CT}) \\
T_5 &= \{F, G, A, B\flat, C, D, E\} & (6 \text{ CT}) \\
T_6 &= \{F\flat, G\flat, A\flat, B, C\flat, D\flat, E\flat, F\flat\} & (2 \text{ CT}) \\
T_7 &= \{G, A, B, C, D, E, F\} & (6 \text{ CT}) \\
T_8 &= \{A, B, C\flat, D, E\flat, F, G\} & (3 \text{ CT}) \\
T_9 &= \{B\flat, C, D, E\flat, F, G, A\} & (5 \text{ CT}) \\
T_{10} &= \{B, C\flat, D\flat, E, F\flat, G\flat, A\flat\} & (2 \text{ CT})
\end{align*}
\]

b) Mode 2

Original pc set: \{C, D\flat, E\flat, E, F\sharp, G, A, B\}  
Interval-Class Vector [448444]

\[
\begin{align*}
T_1 &= \{C\flat, D, E, F, G, G\flat, A\flat, B\} & (4 \text{ CT}) \\
T_2 &= \{D, E\flat, F, F\sharp, G\flat, A, B, C\} & (4 \text{ CT}) \\
T_3 &= \{E\flat, E, F\sharp, G, A, B\flat, C, D\flat\} & (8 \text{ CT}) \\
T_4 &= \{E, F, G, G\flat, A\flat, B, C\flat, D\} & (4 \text{ CT}) \\
T_5 &= \{F, F\flat, G\flat, A, B, C, D, E\flat\} & (4 \text{ CT}) \\
T_6 &= \{F\flat, G, A, B\flat, C, D\flat, E\flat, F\flat\} & (8 \text{ CT}) \\
T_7 &= \{G, G\flat, A\flat, B, C\flat, D, E, F\} & (4 \text{ CT}) \\
T_8 &= \{G\flat, A, B, C, D, E\flat, F, F\flat\} & (4 \text{ CT}) \\
T_9 &= \{A, B\flat, C, D\flat, E\flat, E, F\flat, G\} & (8 \text{ CT}) \\
T_{10} &= \{A\flat, B, C\flat, D, E, F, G, G\flat\} & (4 \text{ CT}) \\
T_{11} &= \{B, C, D, E\flat, F, F\flat, G\flat, A\} & (4 \text{ CT})
\end{align*}
\]

prevents any real hierarchization of pc forms based on common tones (there are
only two relations here—a transposition is either identical to the original or it
shares four common tones), and in this way, the MLT are fundamentally different
from the diatonic collection.
Thus, in contrast to many Western composers who may have valued the
diatonic collection for its hierarchical structure and depth of transposition,
Messiaen valued the MLT specifically for their ambiguities and transpositional
limitations (perhaps the fewer the pc forms, the clearer the colour). At times in
his composition, however, Messiaen draws on the expanded repertoire of colours
that diatonic collections provide and evokes a sense of extended tonality. In
order to mix his modes with diatonic collections as seamlessly as possible, he
often exploits the traditional harmonic sonorities that are present in some of the
MLT and thus, a final criterion by which Messiaen may have chosen his favourite
MLT involves an assessment of the extent to which tonal resources may be
found within each of the modes. Indeed, Modes 2, 3, and 6 are rich with
traditional harmonic subsets such as major and minor triads, various types of
seventh chords, and so on. These intriguing relationships between symmetrical
modal structures and asymmetrical tonal structures will be examined in detail in
Chapter 3.
Chapter 1 – A Modal Perspective

In this chapter, I adapt standard concepts from transformational theory (objects and transformations) to the unique contexts of Messiaen’s Modes of Limited Transpositions (MLT). Because these MLT are subsets of the total chromatic, there is an inherent tension between these two types of spaces, which were described as generic versus specific in the introduction. When encountering Messiaen’s music, the listener or performer is often aware of both of these spaces simultaneously, and so, while the primary focus of this chapter is on modal objects and transformations, it may be helpful from time to time to refer to the mod-12 or tonal identities of these objects and transformations as well; in such cases, the conceptual space to which I am referring will be clearly indicated.

I will begin by examining Messiaen’s use of the augmented-triad-based (ATB) modes from this modal perspective, focusing on how transformations of a particular modal trichord reveal interesting properties of and relationships between the modes of this family. I will then discuss the identity of this same modal trichord within the modes of the tritone-based (TB) family and the ways in which it may be used to create unity in musical passages where different modes are superimposed and/or juxtaposed.

As shown in Example vii of the introductory chapter, the largest of the ATB modes is Mode 3, or the enneadic collection. This nine-note collection is particularly rich and useful, partly because of its size and ability to form traditional-sounding subsets (that is, major and minor triads, dominant-seventh chords, and so on), partly because of its special transformational and voice-
leading structure, and partly because of the interesting relationships that it has with both of the other ATB modes—Modes 1 (whole tone) and 8 (hexatonic). As noted in the introduction and shown in Example 1.1, generic steps in Mode 3 have two specific sizes, the repeated scalar pattern being semitone, semitone, whole tone <112> (or some rotation of this pattern). The collection is transpositionally invariant at \( T_4 \) and \( T_8 \) and inversionally invariant; hence, there are only four unique transpositions, labeled N1 to N4.

---

**Example 1.1** – Messiaen’s 3\(^{rd} \) Mode of Limited Transpositions (Enneadic Collection)

<table>
<thead>
<tr>
<th></th>
<th>B(^\flat)</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E(^\flat)</th>
<th>E</th>
<th>F(^#)</th>
<th>G</th>
<th>A(^\flat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>B(^\flat)</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E(^\flat)</td>
<td>E</td>
<td>F(^#)</td>
<td>G</td>
<td>A(^\flat)</td>
</tr>
<tr>
<td>N2</td>
<td>B</td>
<td>C</td>
<td>D(^\flat)</td>
<td>E(^\flat)</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>A(^\flat)</td>
<td>A</td>
</tr>
<tr>
<td>N3</td>
<td>C</td>
<td>C(^#)</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>F(^#)</td>
<td>G(^#)</td>
<td>A</td>
<td>B(^\flat)</td>
</tr>
<tr>
<td>N4</td>
<td>C(^#)</td>
<td>D</td>
<td>E(^\flat)</td>
<td>F</td>
<td>F(^#)</td>
<td>G</td>
<td>A</td>
<td>A(^#)</td>
<td>B</td>
</tr>
</tbody>
</table>

\( \uparrow \) = semitone

\( \underline{\text{---------}} \) = whole tone

\( T_0(N1) = T_4(N1) = T_8(N1) = N1 \)
\( T_1(N1) = T_5(N1) = T_9(N1) = N2 \)
\( T_2(N1) = T_6(N1) = T_{10}(N1) = N3 \)
\( T_3(N1) = T_7(N1) = T_{11}(N1) = N4 \)
\( I_2(N1) = I_6(N1) = I_{10}(N1) = N1 \)
\( I_3(N1) = I_7(N1) = I_{11}(N1) = N2 \)
\( I_4(N1) = I_8(N1) = I_{10}(N1) = N3 \)
\( I_5(N1) = I_9(N1) = I_{11}(N1) = N4 \)

Some of the interesting properties of this mode are illustrated in the opening section of Messiaen’s “Alléluia sereins d’une âme qui désire le ciel,” the second méditation from *L’Ascension* for organ (1933-34), which begins with an eleven-measure melodic line expressing N2, as shown in Example 1.2. After this opening solo, a short imitative section follows, during which various enneadic collections overlap each other. However, the deviation from N2 is only temporary. Beginning with the anacrusis to m. 24, the opening melodic line
returns exactly, this time accompanied by a repeated trichord series that also expresses N2. Example 1.3 shows the first three measures of this reprise.

Example 1.2 – “Alléluia sereins d’une âme qui désire le ciel” – mm. 1-11

Example 1.3 – “Alléluia sereins d’une âme qui désire le ciel” – mm. 24-26

Near the end of her 2002 article, Cheong Wai-Ling discusses chord series such as this one in relation to Messiaen’s synaesthesia. She writes:

If a mode is represented by just a few notes, or, alternatively, if all the notes of a mode are involved but they are distributed over an extended period of time, can the mode still retain its identity and create the same colour effect? Does it cease to evoke colours?...For the identity of a mode to be unambiguously perceived, it seems vital that most, if not all, of its notes be played rather closely together....The formulation of parallel chord series....offers a unique way to engage a mode—at once fully,
exclusively and in an orderly fashion, within a relatively short span of time.\textsuperscript{67}

Thus, Messiaen seems to use parallel chord series as a quick and efficient way to get the sound-colour of a mode into the listener’s ear, both melodically and harmonically.

The chord series in “Alléluias” is twelve triplet eighth notes in duration and stated three times without variation (the first two statements are bracketed in Example 1.3), each time beginning with an \{A\#, D\#, F\} chord. The series is then transposed down four semitones, beginning with an \{E, A, D\#\} chord on the downbeat of m. 28 (not shown in Example 1.3). At this pitch level, the chord series is also heard three times before dropping down another four semitones to begin with a \{C, F, A\} chord on the second beat of m. 32.

If each trichord in the series is labeled according to standard set-class (sc) labeling (that is, in reference to the total chromatic), there are two types: some are major triads of sc (037) and some are whole-tone-sounding chords of sc (026). However, since Messiaen does not go outside of N2 at all during this section (the voice leading between consecutive chords in the series is parallel and almost entirely stepwise within N2), it makes sense to consider these chords not in reference to the total chromatic but within a specifically enneadic modal context. Following work by Anne Le Forestier, Matthew Santa, and Christoph Neidhöfer, the pitch classes (pcs) of N2 may be numbered with consecutive integers from 0 to 8 within a mod-9 universe, instead of with nine integers

\textsuperscript{67} Cheong 2002, 76.
selected from within a mod-12 universe, as with standard labeling.\textsuperscript{68} The mod-9 labels shown at the top of Example 1.1 remove the distinction between the two mod-12 step sizes in the collection—that is, the mod-12 pc-interval 2s from A to B, D\( \flat \) to E\( \flat \), and F to G are mod-9 pc-interval 1s, as are the mod-12 pc-interval 1s from B to C, C to D\( \flat \), and so on.

Sets of modal (in this case, enneadic (mod-9)) pcs may be classified, like their mod-12 counterparts, by considering equivalence under transposition and/or inversion. As with mod-12 transpositions, modal transpositions move all of the pitches of a set up or down by the same number of modal steps. Modal transposition indices may be calculated by subtracting the assigned value of the origin pc from that of the destination pc. For example, if A\( \flat \) = 7 and D\( \flat \) = 2 (within N2, as labeled in Example 1.1), A\( \flat \) maps onto D\( \flat \) under enneadic T\textsubscript{4} (2 – 7 = 4 (mod-9)). As with mod-12 inversions, modal inversions flip all of the pitches of a set about an axis (a pitch x modal steps above the axis will map onto a pitch x modal steps below the axis, and vice versa). Modal inversion indices may be calculated by adding the assigned values of two pcs together. For example, if A\( \flat \) = 7 and D\( \flat \) = 2 (within N2, as labeled in Example 1.1), A\( \flat \) maps onto D\( \flat \) under enneadic I\textsubscript{0}, and vice versa (7 + 2 = 2 + 7 = 0 (mod-9)).

\textsuperscript{68} Le Forestier 1984 provides a number of musical exercises designed to help students familiarize themselves aurally and conceptually with Messiaen’s music. In her analysis of \textit{L’Ascension}, from which all of her ear-training exercises are derived, Le Forestier numbers the mod-12 pcs of Mode 3 with scale degrees from 1 to 9. In an introduction to this document, Messiaen himself endorses this method, stating that after working through Le Forestier’s studies, students will think of his music in the way that he himself thinks of it.

Santa 1999, 202 and Neidhöfer 2005, 4 refer to numbered positions within a given modular system as \textit{step classes}.
Henceforth, a subscript X (where X is the letter abbreviation for a particular mode, as given in Example ix of the introductory chapter) will be included as a prefix to all modal sc and transformation labels to distinguish them from standard mod-12 labels. In the case of the enneadic collection, the letter prefix is “N.” Thus, the first chord in the series, \( \{A\flat, D\sharp, F\} \), belongs to the \( _N T_n \) class \( _N(035) \), which includes sets that are equivalent under transposition only. (Within N2, F is three enneadic steps up from D\# and A\flat is five enneadic steps up from D\#.) This chord also belongs to the larger \( _N T_n \text{I} \) class \( _N(025) \), which includes sets that are equivalent under both transposition and inversion. (The same set of pcs within N2 can be read down from A\flat instead of up from D\#: F is two enneadic steps down from A\flat, and D\# is five enneadic steps down from A\flat.) When I refer to modal scs in this thesis, I will mean \( _X T_n \text{I} \) classes within mode X.

By doing so, I am asserting an inversive equivalence that I have not yet motivated analytically, but that will prove useful later on. In instances where it is important to distinguish between \( _X T_n \) classes, I will use the terms prime and inverted. For example, those members of \( _N T_n \text{I} \) class \( _N(025) \) that belong to \( _N T_n \) class \( _N(025) \) will be termed the prime forms of the sc and those that belong to \( _N T_n \) class \( _N(035) \) will be termed the inverted forms.

Because of the parallel voice leading within N2 of this passage, every chord in the series belongs to the same mod-9 sc \( _N(025) \). However, despite this equivalence, it is helpful to be able to distinguish between the two mod-12 types of chords in the enneadic sc. Chords of mod-12 sc (037) will be termed the \( M \)-type chords of mod-9 sc \( _N(025) \) (“M” for major or minor), and chords of mod-12 sc
(026) will be termed the *W*-type chords of mod-9 sc\(^N\) (025) (“W” for whole tone) throughout this chapter.

A mod-9 transformational description of this passage may be used to show how the structure of the individual chords influences the design of the entire chord series. Since each of the chords belongs to the same enneadic sc, each chord may also be represented by the same transformational graph. Example 1.4 shows one way to do so, using the first two chords as representative examples.

---

**Example 1.4 – “Alléluias” – m. 24 – Individual Chord Networks**

The objects are pcs within N2 (mod-9), labeled with corresponding mod-12 pc names.

The operations are transpositions within N2 (mod-9) – labeled \(N_{T_x}\).

This analysis emphasizes the enneadic transpositional relationships between the notes in each chord, heard up from the lowest note. (The \(N_{T_1}\) arrow between the two networks means that the contents of each node in the right network are \(N_{T_1}\) of the contents of each corresponding node in the left network.)

An examination of the relationships from chord to chord in the passage shows that the voice leading is mainly up or down by enneadic step \((N_{T_1} \text{ or } N_{T_{-1}})\), leaping only once by \(N_{T_2}\). However, another level of structure is evident when one listens to the overall shape of the chord series, paying particular attention to
the chords that articulate its boundaries. Example 1.5 shows the transformational network that may be generated when the enneadic transpositional relationships between the first, last, highest, and lowest chords of the series are considered.

---

**Example 1.5** – “Alléluias” – Large-scale Structure of the Chord Series (Boundaries)

![Diagram of chord relationships](image)

The objects are pc-forms of $N(025)$. The operations are transpositions within $N2 \ (\mod 9)$.

The first thing to notice about this network in relation to those in Example 1.4 is that they all contain the same $NT_3, NT_4,$ and $NT_7$ transformations. If the arrangement of nodes, arrows, and transposition labels of the network in Example 1.4 is compared with the left side of Example 1.5 (that is, omitting the node labeled “last chord” and the arrows coming from it), they are identical. This is significant because it shows how the larger-scale relationships between the first, highest, and lowest boundary chords may be derived from the internal structure of all of the chords in the passage.

Example 1.5 also shows that the same enneadic transpositions which structure the *first*, highest, and lowest chords also structure the *last*, highest, and lowest chords. Thinking of these transformations as intervals, the relation can be expressed even more specifically. The distance from the highest to the first
chord is the same as the distance from the last to the lowest chord (seven enneadic steps). Equivalently, the distance from the lowest to the first chord is the same as the distance from the last to the highest chord (three enneadic steps). This means that in the system of enneadic trichords, the last chord is the inversion of the first chord about the axis defined by the registrally extreme chords. While such inversive relationships are interesting to note and are relationships to which I will return, it is the transpositional relationships, expressed both within the structure of the individual chords and in the structure of the chord series as a whole, that are most audible and that seem to be determining both the horizontal and vertical dimensions of the passage.

These clear relations in the chord series suggest the possibility of transformational structure in the melodic line as well (refer back to Example 1.2). The melody may be heard as dividing into two phrases, the first phrase spanning three measures and cadencing on the F in m. 3, and the second spanning three measures beginning on the downbeat of m. 4, with a five-measure extension that repeats the end of the second phrase twice in increasingly augmented rhythm. While the strong F centre of this melody contributes to the way I hear phrase and sub-phrase divisions, it would be difficult and perhaps unsatisfying to attempt a traditional tonal analysis of this melody, particularly within the context of the nontonal chord series that accompanies its return. My transformational analysis of the melody, then, begins with the observation that, as in the chord series, sc

\( n(025) \) is quite prominent. Example 1.6a shows a number of manifestations (some more audible than others) of this sc in the first phrase, and Example 1.6b
lists all of the possible forms of the sc in the N2 collection for reference.

Example 1.6

a) "Alléluia" – First Melodic Phrase – Some Forms of $\mathbb{N}(025)$

b) All Forms of Set-Class $\mathbb{N}(025)$ in the N2 Collection

<table>
<thead>
<tr>
<th>Prime</th>
<th>Inverted</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Db-F</td>
<td>025 F- Eb-B</td>
</tr>
<tr>
<td>C-Eb-G</td>
<td>136 G-E-C</td>
</tr>
<tr>
<td>Db-Eb-A</td>
<td>247 A-F-Db</td>
</tr>
<tr>
<td>Eb-F-A</td>
<td>358 A-G-Eb</td>
</tr>
<tr>
<td>E-G-B</td>
<td>460 B-A Eb</td>
</tr>
<tr>
<td>F-Ab-C</td>
<td>571 C-A-F</td>
</tr>
<tr>
<td>G-A-Db</td>
<td>682 Db-B-G</td>
</tr>
<tr>
<td>Ab-B-Eb</td>
<td>703 Eb-C-Ab</td>
</tr>
<tr>
<td>A-C-E</td>
<td>814 E-Db-A</td>
</tr>
</tbody>
</table>

Unlike in the chord series, both inverted and prime forms of sc $\mathbb{N}(025)$ may be heard here, which suggests that enneadic inversion relationships are interesting
to consider.

At the beginning of this first phrase, Messiaen lays out two clear, temporally compact $N_{025}$ trichords, balancing the upward $<F, A\flat, C>$ arpeggiation with the downward $<E, B, A\flat>$ arpeggiation. These two M-type trichords share one pc ($A\flat$), are related by enneadic inversion, and together, present five of the nine pcs of N2. Before any other pcs appear, Messiaen repeats the $B\flat$ of the $<E, B, A\flat>$ chord. He then repeats the $C, F, C$ of the $<F, A\flat, C>$ chord, bridging the melodic line’s first and second flourishes. These repetitions subtly isolate the dyads $\{B, A\flat\}$ and $\{F, C\}$ from the remaining pc in their respective trichords. I hear these isolations as preparations for new pcs that are generated transformationally. Example 1.7 gives the details.

The next pc to be introduced, $E\flat$, may be generated by an enneadic contextual inversion that holds invariant the isolated $\{B, A\flat\}$ dyad of the original $<E, B, A\flat>$ trichord, while mapping $E$ onto the new pc $E\flat$ (see Example 1.7a). Example 1.7b shows how the following pc, $A\flat\flat$, is generated in a similar manner via an enneadic contextual inversion that holds invariant the isolated $\{F, C\}$ dyad of the original $<F, A\flat, C>$ trichord, while mapping the $A\flat$ onto $A\flat\flat$. If the opening two trichords are considered to be referential in developing the rest of the phrase, the next pc to be added, $D\flat$, may be generated by an enneadic contextual inversion that holds invariant the $\{F, A\flat\}$ dyad of the $<F, A\flat, C>$ trichord, while mapping $C$ onto $D\flat$ (see Example 1.7c). Similarly, $G$ may be generated by an
Example 1.7 – “Alléluias” – Melodic Transformations – mm. 1-2, 24-25, 58-59

a) Generating the E\# pc:

[b]nL\n{E, B, A\#} = {B, A\#, E}\nListen for E to E\# voice leading\n(E-major to A\#-minor triads)

b) Generating the A pc:

[b]nP\n{F, A\#, C} = {F, C, A}\nListen for A\# to A voice leading\n(F-minor to F-major triads)

c) Generating the D\# pc:

[b]nL\n{F, A\#, C} = {F, A\#, D\#}\nListen for C to D\# voice leading\n(F-minor to D\#-major triads)

d) Generating the G pc:

[b]nP\n{E, B, A\#} = {E, B, G}\nListen for A\# to G voice leading\n(E-major to E-minor triads)
enneadic contextual inversion that holds invariant the \{E, B, A_b\} dyad of the \langle E, B, A_b\rangle trichord, while mapping A_b onto G (see Example 1.7d). Thus, the last four pcs of N2 are added by way of two types of enneadic contextual inversions, one which preserves the \_{NT_7}\text{-related dyad and one which preserves the \_{NT_4}\text{-related dyad of the opening referential trichords.}

Each of the transformations in Example 1.7 calls attention to stepwise connections between the factors of two different trichords, and so could be said to engage the “voice leading” of the polyphonic melody. The voice-leading connections E to E_b, A_b to A, C to D_b, and A_b to G, shown with grey arrows, are the aural “signatures” (to use David Lewin’s term) of the enneadic contextual inversions working in the passage.\textsuperscript{69} These signatures are the same as those of two of the standard neo-Riemannian operations (mod-12), so Example 1.7 labels the enneadic inversions accordingly. \_{NP} stands for parallel and when applied to one of the M-type \_{N(025)} trichords in an enneadic collection, it maps that triad onto its parallel triad (F minor onto F major, for example), preserving the mod-12 interval-class (ic) 5 (mod-9 ic 4) dyad in the triad. Similarly, \_{NL} stands for leading-tone exchange and when applied to one of the M-type \_{N(025)} trichords in an enneadic collection, it maps that triad onto the triad that has the same mod-12 ic 3 (mod-9 ic 2) dyad (E major becomes A_b minor, for example).\textsuperscript{70}

\textsuperscript{69} Lewin 1993, 32.
\textsuperscript{70} By discussing the major or minor qualities of the \_{N(025)} trichords, I am mixing observations from different conceptual spaces. The chord qualities are irrelevant from this mod-9 transformational perspective; however, I feel that they are an essential part of the way in which these sonorities are heard.
The similarity of these enneadic contextual inversions to the standard neo-
Riemannian inversions suggests that the relationships of this passage might be
shown more compactly on a Tonnetz—a transformational space through which
the melody and harmony of this music may be said to move. Example 1.7 also
shows that both of these contextual inversions exhibit (the enneadic
manifestation of) a principle that has long been recognized as a defining feature
of the Western classical music tradition—parsimonious voice leading. That is,
one object is transformed into another object via the smoothest voice leading
possible; two voices do not move and the moving voice moves only by
(enneadic) step. Richard Cohn has mathematically defined a generic Tonnetz
for modeling parsimonious trichords, a portion of which is shown in Example
1.8a. While the Tonnetz has traditionally been used by neo-Riemannians as a
two-dimensional graphic instrument for modeling triadic progressions in mod-12
space, Cohn takes the idea further, applying his parsimonious Tonnetz structure
to mod-18 and -24 microtonal contexts. A mod-9 parsimonious Tonnetz, then,
may be derived from Cohn’s model when x = 2, as shown in Example 1.8b.

The pcs of N2 may be mapped onto the numbers of Example 1.8b to
reflect the “Alléluias” analysis when 0 = F, as shown in Example 1.8c. All

__________________________

71 Arnold Schoenberg 1978, 39 (quoting Anton Bruckner) discusses this
principle as “the law of the shortest way.”
72 Cohn 1997, 12-14. Cohn proves that parsimonious trichords have a
prime form of {0, x, 2x+1} and are comprised of intervals <x, x+1, x+2>. He
shows that the mod-12 trichord (037) is unique amongst the mod-12 trichords in
its ability to map onto itself via parsimonious voice leading, and defines a generic
parsimonious Tonnetz for modeling such relations; however, the structure he
presents (in his Figure 8, my Example 8a) is not the only possible spatial
arrangement for such a Tonnetz. See Appendix A for further discussion.
73 Ibid., 37-42.
Example 1.8

a) 
\[
\begin{array}{ccc}
x+1 & 2x+1 & 3x+1 \\
0 & x & 2x \\
2x+2 & 3x+2 & x-1 \\
\end{array}
\]

Mathematical Model of a Parsimonious Tonnetz
(From Cohn 1997, 14)

d) 
Transpositional Relationships between \( N(025) \) Trichords from 1.8c

e) 
Transformational Networks for the “Alléluias” Melody

The objects are forms of \( sc_{N(025)} \) – refer to Example 1.6b for complete list.
The operations are transpositions and inversions within \( N2 \) (mod-9).
horizontal pc transpositions are the same ($N_T_7$ moving from east to west), all vertical pc transpositions are the same ($N_T_3$ moving from south to north), all diagonal pc transpositions are the same ($N_T_4$ moving from northeast to southwest), and all right triangles with northeast-to-southwest hypotenuses are M-type $N(025)$ trichords. The $N_P$ and $N_L$ inversions, shown with solid arrows, are represented as flips around the $N_T_4$ diagonals and $N_T_7$ rows respectively, and the four pcs A, E♭, D♭, and G result from these flips, expanding the two referential trichords (the shaded triangles) outward and creating new $N(025)$ trichords in the process.\(^7\) Interestingly, as shown in Example 1.8d, these new trichords may be related by the same $N_T_3$, $N_T_4$, and $N_T_7$ transpositions that were found in the chord series. Example 1.8e shows the two larger triangles (that is, the two diagonally cut halves of the square shown in Examples 1.8c and 1.8d) as transformational networks.\(^5\)

The reader will notice by examining the solid arrows of Example 1.8c that a third contextual inversion may be defined in the enneadic context. A flip around the $N_T_3$ columns of the Tonnetz is labeled $N_R$ because of its close

\(^7\) See Appendix A for a more detailed discussion regarding the nature of these flips.

\(^5\) Because of the dualist nature of neo-Riemannian transformations (they transform prime and inverted forms in equal-but-opposite ways), the center node of the left graph in Example 1.8e must be filled with an inverted-form trichord in order for the enneadic transposition labels to be correct. Similarly, the center node of the right graph must be filled with a prime-form trichord. Julian Hook calls these “non-path-consistent graphs” (Hook 2007, 3-4, 25-28).

In order to be able to insert either form of this trichord into any node in the graph, the transpositions of Example 1.8e could be replaced with contextual transpositions that would be defined to transpose prime and inverted forms in equal-but-opposite ways. The group of enneadic contextual transpositions and inversions would be analogous to the group of Schritt and Wechsels defined by Henry Klumpenhouwer (after Hugo Riemann) in Klumpenhouwer 1994, §15-29.
relationship to the standard neo-Riemannian R operation. As with R, \( nR \) stands for relative and when applied to one of the M-type \( n(025) \) trichords, it maps that triad onto its relative triad (F minor onto A\# major, for example), preserving the mod-12 ic 4 (mod-9 ic 3) dyad.\(^7^6\) While \( nP \) and \( nL \) preserve trichord type (an M-type \( n(025) \) trichord is transformed into another M-type, a W-type into another W-type), \( nR \) has the ability to change trichord type (an M-type transforms into a W-type or another M-type, a W-type always becomes an M-type).

The Tonnetz of Example 1.8c may be expanded as shown in the top right quadrant of Example 1.9. The transpositional relationships between horizontal, vertical, and diagonal neighbour pcs in Example 1.9 are the same as those in Example 1.8c (\( nT_7, nT_3, \) and \( nT_4 \), respectively). However, whereas the right triangles with northeast-to-southwest hypotenuses in Example 1.8c included only M-type \( n(025) \) trichords, the top right quadrant of Example 1.9 includes all possible \( n(025) \) trichords in the N2 collection, both M- and W-types. This quadrant shows one of four possible mappings of nine of the twelve pcs (where each set of nine pcs forms an enneadic collection) onto the abstract mod-9 Tonnetz structure shown in Example 1.8b, and is what I am terming (in this

\(^7^6\) The relationship between the mod-12 P, L, and R operations and the mod-9 \( nP, nL, \) and \( nR \) operations is clear when they are applied to the M-type forms of \( n(025) \) because they sound exactly the same. However, it should not be forgotten that these mod-9 contextual inversions can also be applied to the W-type forms of this enneadic sc, which sound different from a mod-12 perspective but are equivalent within the enneadic mode. For example, the four pcs that are unique to the middle of this melodic phrase (E\#, A, D\#, and G) combine with each other in stating two \( nL \)-related forms of the W-type of sc \( n(025) \), \( <E, A, G> \) and \( <A, D, G> \). Thus, the middle of the phrase involves the same mod-9 objects and transformations as the beginning and end while providing a mod-12 change in character with tritone and whole-tone sounds not heard at the beginning or end of the phrase.
Example 1.9 – Four Parsimonious Enneadic Tonnetze

<table>
<thead>
<tr>
<th>N1</th>
<th>N2</th>
</tr>
</thead>
<tbody>
<tr>
<td>B      D     E      G      A♯     C      D♯     F♯     G♯     B</td>
<td>B      D♭    E      G      A      C      D♯     F♯     G♯     B♭</td>
</tr>
<tr>
<td>G      A♯     C      D♯     F♯     G♯     B      D      E      G</td>
<td>G      A      C      E♭     F      A♭     B      D♭    E      G</td>
</tr>
<tr>
<td>E♭     F♯     G♯     B      D      E      G      A♯     C      E♭</td>
<td>E♭     F      A♭     B      D♭    E      G      A      C      E♭</td>
</tr>
<tr>
<td>B      D      E      G      A♯     C      D♯     F♯     G♯     B</td>
<td>B      D♭    E      G      A      C      D♯     F♯     G♯     B♭</td>
</tr>
<tr>
<td>B      D      F      G      A♯     C♯     E♭     F♯     A      B♭</td>
<td>B♭     C♯     E      F♯     A      C      D      F      A♭    B♭</td>
</tr>
<tr>
<td>G      A♯     C♯     D♯     F♯     A      B      D      F      G</td>
<td>G      A      C      D      F      G♯     B♭     C♯     E      F♯</td>
</tr>
<tr>
<td>E♭     F♯     A      B      D      F      G      A♯     C♯     E♭</td>
<td>E♭     D    F      G♭     B♭     C♯     E      F♯     A      C      D</td>
</tr>
<tr>
<td>B      D      F      G      A♯     C♯     E♭     F♯     A      B</td>
<td>B♭     C♯     E      F♯     A      C      D      F      A♭    B♭</td>
</tr>
</tbody>
</table>
chapter) the complete $N2$ Tonnetz.\textsuperscript{77} The other three mappings (that is, the $N1$, $N3$, and $N4$ Tonnetze) are shown in the remaining quadrants of Example 1.9.

As with other modular Tonnetze, the pcs of the right- and left-most $N_T_3$ columns of each of the four quadrants in Example 1.9 are identical, as are the pcs of the top and bottom $N_T_7$ rows of each quadrant. This allows each enneadic Tonnetz to be wrapped into a three-dimensional torus. As well, each Tonnetz shares two of its three unique $N_T_3$ columns with each of the other Tonnetze. (I will return to the relationships between these four Tonnetze below.)

There are interesting points to make regarding this enneadic Tonnetz. First, the enneadic collection is one of very few relatively familiar collections that has a parsimonious trichord and, thus, can be arranged into a parsimonious Tonnetz.\textsuperscript{78} Second, unlike the traditional mod-12 chromatic Tonnetz and the mod-18 and -24 Tonnetze defined by Cohn, this enneadic Tonnetz has an aurally uneven structure, due to the fact that its generic intervals often come in more than one specific size (that is, differences exist within this collection). While each mod-12 interval along the $N_T_3$ columns corresponds to ic 4, the mod-12 intervals along the $N_T_7$ rows follow the pattern ic 3, ic 3, ic 2, and the mod-12 intervals

\textsuperscript{77} The Tonnetz shown in Example 1.8b is one of ten possible abstract mod-9 Tonnetz structures, each with four possible enneadic realizations. I will discuss these alternative Tonnetze in Appendix A, at which point I will give this particular Tonnetz a more descriptive name.

\textsuperscript{78} In order for a collection to be capable of forming a parsimonious Tonnetz, its cardinality must be a multiple of three (as shown in Cohn 1997, 21-22). The six-note modes (both ATB and TB) can also be arranged in this way (when x from Example 1.8a = 1), but the results are less practical because of the small size of these collections. In particular, it often becomes difficult to determine the functions of pcs, as voice-leading intervals may be the same size (ambiguities) or larger (contradictions) than harmonic intervals.
along the $N_{T4}$ diagonals follow the pattern ic 5, ic 5, ic 6. This variation also accounts for the fact that two-thirds of the forms of $sc_{N(025)}$ are M-type (those trichords which contain mod-12 ics 3 and 5) and one-third is W-type (those trichords which contain mod-12 ics 2 and 6).

The analytic usefulness of this enneadic *Tonnetz* can be observed by examining some passages from Messiaen’s “La Bouscarle,” the ninth piece in *Catalogue d’oiseaux* for piano (1956-58). The first time the listener hears the enneadic collection is in the depiction of the *Martin-pêcheur*, shown in Example 1.10.

---

**Example 1.10** – “La Bouscarle” – m. 10

![Example 1.10 - “La Bouscarle” - m. 10](image)

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In this passage, Messiaen makes the scalar pattern of the N3 mode very audible—$N(025)$ trichords in the right hand and $N(024)$ trichords in the left hand ascend in parallel enneadic stepwise motion through a complete octave. In volume 7 of his *Traité de rythme, de couleur, et d’ornithologie*, Messiaen presents each of the four enneadic collections in just this way (parallel $N(025)$ trichords on an upper staff, parallel $N(024)$ trichords on a lower staff) and
describes the dominant colouration of N3 as blue and green.\textsuperscript{79}

The main statement of the enneadic collection occurs later in the piece as the *thème de la rivière*. Messiaen analyzes this passage in his *Traité*, providing collectional labels for mm. 46 to 51 of the piece, as shown in Example 1.11.\textsuperscript{80} I have added question marks in this example to show that Messiaen’s collectional labeling is somewhat unclear and incomplete for this passage. In general, each label seems to apply to all of the chords after it until the next label appears, as indicated by my dotted boxes. However, this rule does not work for the question-marked chords of the third and fourth systems. What Messiaen’s labels do seem to indicate fairly clearly is a segmentation of the passage into successive, non-overlapping blocks of material that are articulated by collectional change. (The statements of the *Merle noir* are non-modal interjections into the *thème de la rivière*.)

While it is possible to hear the passage in this way, I believe it is useful to consider another segmentation of the passage, shown in Example 1.12.\textsuperscript{81} This collectional labeling suggests that, rather than being segmented into sections which involve frequent changes of collection, the *thème de la rivière* is carried horizontally by a consistent N3 collection in the right hand. This reveals a stronger correlation between the river and the *Martin-pêcheur* since they are both

\textsuperscript{79} Messiaen 2002, 123.

\textsuperscript{80} *Ibid.*, 240.

\textsuperscript{81} While I often use comments made by Messiaen to support my analytical arguments in this thesis, my main goal is to describe how I perceive the music as a listener (what Jean-Jacques Nattiez 1990 (after work by Jean Molino) calls the *esthetic* level of analysis). This is an example of a passage where my own interpretation contradicts evidence that suggests how the work was created by the composer himself (what Nattiez/Molino call the *poietic* level of analysis).
Example 1.11 – "La Bouscarle" – mm. 46-51 (Messiaen’s collectional labels)

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Example 1.12 – “La Bouscarle” – mm. 46-51 (my collectional labels)
the blue-green colour of N3. While the left hand shares the right hand’s N3 collection for the most part, it also provides additional colours in the water by borrowing chords from the other enneadic collections.

Some interesting transformational observations may be made using this new segmentation. Throughout the passage, the chords of the right hand are either \(n(025)\) trichords or are dyads that might reasonably be heard as incomplete \(n(025)\) trichords, while the chords of the left hand are mainly \(n(024)\) trichords that shadow the contours of the right hand. Three chord progressions are separated by the non-enneadic statements of the *Merle noir*, the \(\{F\#, A, C\#, E\}\) dotted-whole-note sonority of mm. 47, 49, and 51 is the goal of each progression, strongly durationally accented and more consonant than the sonorities that precede it each time. Example 1.13 plots this tetrachord on the N3 *Tonnetz*, suggesting that it may be understood as two M-type \(n(025)\) trichords (\(\{F\#, A, C\#\}\) and \(\{A, C\#, E\}\)) that are related by an \(nR\) flip which maps \(F\#\) onto \(E\) and vice versa.

---

Example 1.13 – “La Bouscarle” – downbeats of mm. 47, 49, and 51 on the N3 *Tonnetz*
The transformational structure of this chord influences other aspects of the
*thème de la rivière*. In the first progression of right-hand chords (mm. 46 to 47),
a clear $nL$ inversion maps the $\{D, F\#\}$ chord onto the $\{C\#, F\#, A\}$ chord via
parsimonious voice leading—the $F\#$ and $A$ are held in common, and the $D4$
moves down by enneadic step to $C\#4$. The second progression of chords (mm.
48 to 49) is slightly more elaborate, but is a very similar gesture in rhythm and
contour. The $\{C, E\}$ dyad is decorated by upper neighbours, then is echoed an
octave higher (as was the $\{D, F\#, A\}$ chord in m. 46), before moving to the $\{C\#, E\}$
dyad. With the $E4$ held in common between the two dyads, the $C4$ moves up by
enneadic step, a reversal of the voice-leading motion of the first progression with
the same goal—$C\#4$. Example 1.14 shows these two progressions on the $N3$
*Tonnetz*.

Example 1.14 – “La Bouscarle” – Right Hand, mm. 46-49 on the N3 Tonnetz

![Diagram of chord progression](image)

The dotted lines in this example suggest that an implied $A$ would complete
two $N(025)$ trichords in the second progression—$\{A, C, E\}$ would map onto $\{A, C\#$,
E} via an \( NP \) inversion. In fact, the left hand supplies this A in m. 49, completing the \{A, C\#, E\} chord. Thus, while this second chord progression mimics the first in some ways (similar rhythm and contour, similar parsimonious voice leading), it also provides some contrast (the voice-leading motion is in the opposite direction, a move by \( NP \) is implied rather than a move by \( NL \), and the supporting \( N(024) \) chords of the left hand provide a different enneadic colour).

The third progression of chords is much longer than the previous two, but refers back to the first progression in the following ways. First, the left hand returns to the N3 collection heard in the first progression for the majority of its chords, especially at the beginning. Second, considering Messiaen's beaming and slurring of chords in the third progression, all but the first of the right hand's groupings begin with \{D, F\#, A\} chords (or a \{D, F\} dyad that may be regarded as incomplete) which refer back to the first sonority of this passage. This third progression, then, may be considered to be a continuation of the first progression.

The relation of these two progressions and the linking function of the second progression are depicted in Example 1.15, which plots the series of right-hand chords on the N3 Tonnetz from the \{D, F\#, A\} chord that begins the first progression to the \{F\#, B\>, C\#\} chord that begins the third progression. The accentuated chords of the first and third progressions confine themselves to one column-pair of the Tonnetz, moving upward along this path, first with an \( NL \) flip (mm. 46 to 47), then with an \( NP \) flip (m. 47 to m. 50, skipping mm. 48 to 49). Thereafter, all of the right-hand triads and dyads that are stressed in the third
Example 1.15 – “La Bouscarle” – Right Hand, mm. 46-downbeat of 50 on the N3 Tonnetz

progression (by their placement at the beginning of slurred or beamed groupings and by percussive accents) are found in this column-pair. The second progression both interrupts and anticipates the \(NP\) flip between the first and third progressions with its own \(NP\) flip, but in another column-pair of the Tonnetz.

Comparing Example 1.13 with Examples 1.14 and 1.15, the \(\{F\# , A , C\# , E\}\) chord that cadences every progression can now be understood as synthesizing elements from these two column-pairs of the N3 Tonnetz—an object containing elements of both column-pairs is used to block further motion along either one. Thus, while these two column-pairs are equally represented in the cadential sonority to which each of the progressions eventually resolves (which freezes their voice-leading urges in order to provide stability), they also provide a local directionality (each of the three progressions moves along one column-pair) and a mutual contrast (the second progression moves along a different column-pair than the first and third progressions) that is played out in the overall ABA’ harmonic structure of the passage.
There are many more things that could and should be discussed in a complete analysis of this passage from “La Bouscarle” (particularly the left hand’s progression of $N(024)$ chords, its movement through various enneadic collections, and its relationship to the right hand); however, at this time, I would like to pursue a theoretical avenue that this partial analysis opens up—the relationships between the three column-pairs of this enneadic Tonnetz. These relationships are highlighted most clearly by following Cohn’s work on maximally smooth cycles and hexatonic systems, which explores the way in which cycles of major and minor triads, connected by their parsimonious voice leading, may be generated when chains of two alternating neo-Riemannian operations are applied.\(^{82}\) Specifically, Cohn shows that chains of $<PL>$ operations, when applied to major and minor triads in a mod-12 context, generate closed cycles that do not exhaust the entire set of twenty-four consonant triads. Instead, these cycles divide the consonant triads into four six-triad groups which Cohn terms the four hexatonic systems.

Cohn’s ideas may easily be applied to this enneadic context. Example 1.16 shows the three types of cycles that result from pairing the three enneadic neo-Riemannian operations and applying them in alternation on the N3 Tonnetz. As in previous examples, right triangles with northeast-to-southwest hypotenuses indicate $N(025)$ trichords, some M-types, others W-types. Both the $<NPNR>$ chain and the $<NRL>$ chain generate only one unique cycle that exhausts all of the eighteen possible $N(025)$ trichords of the N3 collection. The $<PRL>$ chain (a

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\(^{82}\) See Cohn 1996 to 2000.
Example 1.16 – Chains of Alternating Neo-Riemannian Operations on the N3 Tonnetz

\[
\begin{align*}
D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A \\
B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F \\
F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \\
D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A \\
B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F \\
F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \\
D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A \\
B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F \\
F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \quad E & \quad F & \quad A & \quad C & \quad D & \quad F & \quad G & \quad B & \quad C & \\
\end{align*}
\]
portion of which was found in the “La Bouscarle” analysis above) is more interesting because it does not cycle through all of the trichords in the collection. Instead, three unique cycles emerge, dividing the eighteen \( \mathbb{N}(025) \) trichords of \( \mathbb{N}3 \) into systems containing six trichords each. Unlike \( \langle \mathbb{N}P_NR \rangle \) and \( \langle \mathbb{N}R_NL \rangle \) chains, \( \langle \mathbb{N}P_NL \rangle \) chains preserve M- or W-type (since only \( \mathbb{N}R \) can change trichord type).

From a mod-12 perspective, two different MLT are teased out from within the enneadic collection by these mod-9-equivalent \( \langle \mathbb{N}P_NL \rangle \) chains: \( \langle \mathbb{N}P_NL \rangle 1 \) and \( \langle \mathbb{N}P_NL \rangle 2 \) form two different hexatonic collections (Mode 8), and \( \langle \mathbb{N}P_NL \rangle 3 \) forms a whole-tone collection (Mode 1).\(^\text{83}\) The two hexatonic collections account for all of the M-type forms of sc \( \mathbb{N}(025) \) in a given enneadic collection, while the whole-tone collection accounts for all of the W-type forms. Example 1.17 is a different representation of this same phenomenon, labeling the results of these \( \langle \mathbb{N}P_NL \rangle \) cycles “Hyper-Hexatonic Analogue Subsystems (mod-9)” (after Cohn 1997, 39) and showing that the two hexatonic collections and the one whole-tone collection result from different pairings of the three augmented triads of the enneadic collection.

\(^{83}\) In the introductory chapter of this thesis, I quote Messiaen as stating that the only time he allows the whole-tone collection in his music is when it is carefully concealed in a superposition of modes which renders it unrecognizable. However, I find it difficult not to hear the whole-tone collection within the enneadic collection, particularly when one-third of the chords in the \( \mathbb{N}(025) \) sc have such a characteristic whole-tone sound. The \( \langle \mathbb{N}P_NL \rangle \) cycles uncover the (barely) concealed whole-tone and hexatonic sub-collections embedded in the enneadic collection.
Example 1.17

\(<_{nP_{nL}} 1\) Cycles Resulting in Hyper-Hexatonic Analogue Subsystems (mod-9) – N3

\(<_{nP_{nL}} 2\>

\(<_{nP_{nL}} 3\>

H1 = \{C, C#, E, F, G#, A\}
H2 = \{C#, D, F, F#, A, B\}
W1 = \{C, D, E, F#, G#, B\}
N3 = \{C, C#, D, E, F, F#, G#, A, B\}
Some analytical applications of these theoretical observations may now be examined. Example 1.18 shows a passage expressing the N1 mode from “Amen du Désir,” the fourth movement of *Visions de l’Amen* for two pianos (1943).\(^\text{84}\)

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Example 1.18 – “Amen du Désir” – mm. 178-180

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\(^{84}\) See Messiaen 2002, 236 for his discussion of this passage.
In mm. 178-9 of this passage, piano one repeats a series of nine descending $N(025)$ trichords. In m. 180, the right hand of piano one continues these descending $N(025)$ trichords, beginning on the seventh chord of the series. (As in “La Bouscarle,” the left hand of piano one accompanies the right hand with parallel $N(024)$ trichords during this measure.) Example 1.19 plots this series of nine descending $N(025)$ trichords on the N1 Tonnetz.

Example 1.19 – “Amen du Désir” – Chord Series on the N1 Tonnetz

Only inverted forms of sc $N(025)$ are present in this passage (i.e. no prime forms) and thus, no inversion relationships exist among the trichords. Instead,
transpositions of these trichords down by enneadic step cycle repeatedly through
the three column-pairs of the N1 Tonnetz, moving from the H3 sub-collection, to
the W1 sub-collection, to the H4 sub-collection, and back to H3. Together, the
three trichords plotted in each column-pair of Example 1.19 provide all six pcs of
the hexatonic or whole-tone sub-collection to which they belong. The right hand
of piano two also conforms to this pattern of descending $\mathfrak{N}(025)$ trichords, but at
one-third the rate of piano one and beginning on chord three (thus, H4) of the
series. In m. 180, the \{C, E, G\} chord that continues down by enneadic step from
the last chord of the previous measure should proceed directly to the \{B, E\# , F\#\}
chord that is heard on the fourth eighth note of the measure. Instead, two higher
chords are inserted which interrupt the descending pattern temporarily.

Because Messiaen presents this chord series in a triple meter with triplet
subdivisions, chords from a particular sub-collection are also associated by
metric placement. In piano one, for example, the trichords of the H3 sub-
collection recur each triplet sixteenth note. Although the beaming visually
suggests a 3/4 meter, repetitions of the series every nine chords emphasize the
first and fourth eighth notes of each measure, supporting a 6/8 meter instead.
This 6/8 meter is also supported in the piano-two right hand by the recurrence of
H4 chords on the first and fourth eighth notes of each measure, coinciding
rhythmically with the 6/8 meter of piano one, but clashing harmonically against its
H3 sub-collection. (In other words, the strong beats of the 6/8 meter are uniquely
characterized by a combination of H3 and H4 chords.) The series repetition in
the piano-two right hand results in an analogous (but much slower) grouping to
that of piano one, suggesting a possible 9/8 meter (across the first bar line) that is quickly interrupted by the inserted chords of m. 180.

Despite these metric and harmonic tensions, the different layers of the passage are coordinated at certain points. There are three instances when piano one and the right hand of piano two arrive at the same sonority. Example 1.20 shows the movement of these two layers through the N1 Tonnetz for the first three eighth notes of m. 178, the first coincidence of the passage occurring on the second eighth note of the measure with an \{E_{b}, G, B_{b}\} chord.

Example 1.20 – “Amen du Désir” – First Chord Series Coincidence on the N1 Tonnetz

These two layers coincide again with the same \{E_{b}, G, B_{b}\} chord on the fifth eighth note of m. 179, and then with a \{B, E_{b}, F_{#}\} chord on the fourth eighth note of m. 180. Thus, the first two coincidences (the doubled \{E_{b}, G, B_{b}\} chords) occur each time one eighth note after the dotted-quarter pulse established by piano
two’s repeated nine-chord harmonic pattern, accentuating these weak eighth notes and creating a feeling of syncopation in these measures. If Messiaen had continued the descending motion of the right hand of piano two as expected (that is, continuing down from the \{C, E, G\} chord), the next coincidence would have occurred with a shared \{G, B, D\} chord on the fifth eighth note of m. 180—again, just after the dotted-quarter pulse. However, because Messiaen interpolates two chords into the pattern in m. 180, the two layers coincide instead with a \{B, E\#, F\#\} chord on the strong fourth eighth note of m. 180—no longer slightly late, but right on the beat.

The left hand of piano two also plays a coordinating role in this passage. While its repeated quarter-note chords support a rising eighth-note motive that clearly articulates a 3/4 meter (going against the dotted-quarter beats of the upper layers), the piano-two left hand helps to reconcile the sub-collectional clashing that occurs between piano one and the right hand of piano two by containing elements from both hexatonic sub-collections. Its repeated G bass notes reinforce the root of the H3 G-major triads that begin each repetition of piano one’s nine-chord series, while its repeated \{A\#, C, E\#\} chords belong to the H4 sub-collection of the piano-two right hand, as can be seen by referring back to the N1 Tonnetz. Thus, by showing visually both how the different layers move individually and how they are coordinated contrapuntally in this musical excerpt, the enneadic Tonnetz has proven to be a useful analytical tool.

Series of parallel chords (often moving by step, often expressing an enneadic mode, and often involving the \(\mathbb{N}(025)\) sc) are common in Messiaen’s
music, especially in his keyboard repertoire. The reader will find many examples of such progressions simply by browsing through Messiaen’s *Technique* or *Traité*, and hexatonic and whole-tone relationships (highlighted by this enneadic *Tonnetz*) reveal interesting aspects of this music. For example, the sub-collections parse the nine sixteenth-note chords of the *Martin-pêcheur* passage (refer back to Example 1.10) into groups of three, a more regular pattern than the 4+5 grouping that Messiaen’s beaming suggests. (As in all such cases, the succession of chord types {M, M, W} functions as an obvious signal for the underlying progression of these hexatonic and whole-tone sub-collections.)

In contrast, the sub-collections parse the chord series from “Alléluias” into a pattern that is slightly less regular than its beaming suggests, as shown in Example 1.21.

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**Example 1.21 – “Alléluias” – Sub-collectional Parsing of the Chord Series**

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85 Cheong 2002 discusses, from a mod-12 perspective, various parallel chord series found in Messiaen’s writings and music. Her appendix 3 provides a list of works featuring what Cheong terms the Mode 3 “parallel hexad series,” which I describe as $\mathcal{N}(025)$ trichords superimposed over $\mathcal{N}(024)$ trichords. I prefer this characterization because of the consistent way in which the hexachords are divided between the staves and the fact that Messiaen often uses the upper $\mathcal{N}(025)$ trichord series on its own (see Cheong’s appendix 6).
The H4 sub-collection (shown with dash-dot lines) is consistently implied on the last eighth note of each triplet. The H1 sub-collection (shown with dashed lines) and W2 sub-collection (shown with solid lines) are implied on the first and second eighth notes of each triplet respectively, with the exception of the second triplet, for which they switch positions.

These hexatonic and whole-tone sub-collections are also important in the coordination of different enneadic collections. It was noted in connection with Example 1.9 above that each enneadic Tonnetz shares two of its three \( N T_3 \) columns with each of the other enneadic Tonnetze. This means that any two of these Tonnetze will have either one identical \( <N P_N L> \) column-pair (the same six pcs and \( N(025) \) trichords—a common hexatonic sub-collection), or one \( <N P_N L> \) column-pair which is identical in pc content but does not involve the same \( N(025) \) trichords (a common whole-tone sub-collection).\(^{86}\)

Example 1.22 provides an expanded version of Example 1.17, showing the relationships between the four enneadic collections, the four hexatonic collections, and the two whole-tone collections. On the tetrahedron in the center of Example 1.22, each vertex corresponds to one of the four augmented triads; each edge combines two augmented triads and so corresponds to either one of the two whole-tone collections or one of the four hexatonic collections; and each face combines three augmented triads and so corresponds to one of the four

\(^{86}\) A pc set that is common to two enneadic collections does not necessarily belong to the same enneadic sc in both collections. The N1 collection, for example, shares six of its pcs (the W1 sub-collection) with the N3 collection, and contains the same forms of mod-12 sc (026). However, the (026) trichords which comprise the W-type forms of the \( N(025) \) sc in N1, belong to the \( N(014) \) sc in N3, and vice versa.
Example 1.22

$<nP_nL>$ Cycles Resulting in Hyper-Hexatonic Analogue Subsystems (mod-9) – All Enneadic Collections

H1 = \{C, C#, E, F, G#, A\}
H2 = \{C#, D, F, F#, A, B\}
H3 = \{D, E#, F#, G, G#, B\}
H4 = \{E#, E, G, G#, B, C\}
W1 = \{C, D, E, F#, G#, B\}
W2 = \{C#, E#, F, G, A, B\}
N1 = \{B#, B, C, D, E, E#, F, G, G#, A\}
N2 = \{B, C, C#, E#, E, F, G, G#, A\}
N3 = \{C, C#, D, E, F, F#, G, A, B\}
N4 = \{C#, D, E#, F, F#, G, A, B, B\}
ennead collection.

Although there are only two unique whole-tone collections, each whole-tone collection arises from two distinct \(<\!P_{n}\!>\) cycles, depending on which ennead collection is involved. For example, consider the W1 collection which is listed at the top right of the figure and which corresponds to the front right edge of the tetrahedron. While it is part of both N1 and N3, as indicated by its location at the intersection of the N1 and N3 faces, it is generated in each case by \(<\!P_{n}\!>\) cycles of different chords. The \(\(025\)\) chords shown on the outer, boldface cycle belong to the N3 collection, while those on the inner cycle belong to N1. Similarly, the outer bold W2 cycle at the bottom right of the figure is unique to the N2 collection, while the inner cycle is unique to N4. Thus, there are four unique hexatonic cycles and four (not two!) unique whole-tone cycles.

The collectional relationships shown in Example 1.22 are particularly useful for modulating from one ennead collection to another because a shared whole-tone or hexatonic sub-collection can serve as an effective pivot between the two collections. For instance, the “Dieu est immuable” passages from the fifth piece of Messiaen’s *Méditations sur le Mystère de la Sainte Trinité* for organ (1969) modulate from one ennead collection to another.\(^87\) The first such passage is shown in Example 1.23; Example 1.24 provides a voice-leading sketch of the right-hand chord progression, with harmonic-function labels (T (tonic), S (subdominant), D (dominant)) assigned to sonorities according to their quasi-tonal behavior as discussed below. I have changed the register of some

\(^{87}\) See Messiaen 2002, 239 for his discussion of this passage.
Example 1.23 – Méditations sur le Mystère de la Sainte Trinité, “Dieu est immuable”

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Example 1.24 – “Dieu est immuable” – Right-hand Voice Leading and Harmonic Functions

notes (shown with filled-in note heads) to show more clearly the roots and incremental voice leading of the passage. Common-tone relationships are indicated by dashed slurs, semitone motion is indicated by pointed slurs, and
whole-tone motion is indicated by rounded slurs.

The opening two measures present the E♭-major triad as a tonic-function sonority—the music keeps returning to it, the left hand doubles the right-hand E♭-major chords, and an E♭ pedal is held throughout these measures. The first departure from the E♭-major triad—a right-hand A♭-major triad with shadowing left-hand N(024) trichord on the third eighth note—functions as a subdominant neighbour chord that quickly returns to E♭ major. The second departure ascends to the dominant-function W-type N(025) trichord at the end of the first measure through a passing subdominant-function E-major sonority (spelled with an A♭). The E-major chord serves as an effective substitute for the traditional A♭-major subdominant heard earlier because it includes an A♭ (perhaps Messiaen spelled this E-major triad with an A♭ (rather than a G♯) because he heard the A♭ (rather than the E) as the root of this chord, emphasizing its fifth relationship with E♭), it belongs to the same H4 sub-collection, and it has the same overall voice-leading distance to the E♭-major tonic (3 total semitone moves). The whole-tone sonority at the end of the first measure serves as an effective dominant chord because of the descending-fifth root motion (B♭ to E♭) and the semitone and whole-tone voice-leading motion to the third and fifth of the tonic chord, respectively. Note, however, that there is no leading tone in this dominant-function chord; instead, the semitone motion from F♯ to G puts particular

88 On the use of summation in describing the total voice-leading distance between triadic pairs consult Cohn 1996, 25.
emphasis on the third of the E♭-major chord.

Example 1.25a plots these right-hand $n(025)$ trichords on the N1 Tonnetz.

Example 1.25

a) “Dieu est immuable” – mm. 1-2 on the N1 Tonnetz

Example 1.25b)

b) “Dieu est immuable” – mm. 3-4 on the N2 Tonnetz
This representation assigns tonic function to the entire H3 sub-collection, dominant function to the W1 sub-collection, and subdominant function to the H4 sub-collection, for the first two measures of this passage.\footnote{This idea of assigning different harmonic functions to different TS collections will be examined in greater detail in Chapter 3.} As mentioned above, the neighbour and passing chords of the first two measures both belong to the H4 subdominant sub-collection and are making their way down this column-pair of the N1 \textit{Tonnetz}. The C-major triad, shown as a dashed triangle, is the next logical step in the completion of this pattern and it is, in fact, what is heard on the downbeat of the third measure.

Beginning with this C-major chord, the last four chords of the first two measures are transposed down a minor third, expressing a new N2 collection, as shown in Example 1.25b. This transposition and the movement of the bass pedal down to C signals an abrupt change in harmonic function. Given the established pattern in E\textsuperscript{♭} major, the listener might have expected this chord to function as a subdominant, as represented by the S? in Example 1.24; however, the motivic repetition causes it to sound immediately like a new tonic instead. In retrospect, the voice-leading emphasis on the G of the E\textsuperscript{♭}-major tonic in the second measure hints very subtly at the dominant of this C-major tonic chord, as represented by the D? in Example 1.24.

While the tonal modulation from E\textsuperscript{♭} major to C major is rather sudden, the listener becomes aware of the change of collection from N1 to N2 more gradually—that is, because the C-major triad belongs to both collections, this
chord can function as a pivot between N1 and N2. Indeed, the reader will note by referring back to Example 1.22 that N1 and N2 are related via the entire H4 sub-collection. By using trichords from this sub-collection in subtle, elaborative, subdominant roles in the first two measures of this passage, Messiaen is able to make the transition to the new collection smooth but clearly audible. The pivotal C-major triad on the downbeat of the third measure both completes the H4 pattern established within the N1 collection and serves as the tonic sonority within the new N2 collection.

The other “Dieu est immuable” passage of this piece occurs a short time later, and is an exact transposition of Example 1.23 up a minor third. The passage moves from an F♯-major tonic within an N4 collection back to the original E♯-major tonic within an N1 collection through a shared H3 sub-collection. Example 1.26a shows the tonics and transpositional relationships of these two passages as a cyclic pattern. Example 1.26b shows the collectional relationships of the two passages; the reader will see here that the hexatonic sub-collections which relate the two parts within each passage also relate analogous parts of the passages. That is, the H4 sub-collection which acts as the pivot in the collectional modulation from part one to part two of passage 1 also associates part two of passage 1 with part two of passage 2. Similarly, the H3 sub-collection which acts as the pivot in the collectional modulation from part one to part two of passage 2 also associates part one of passage 1 with part one of passage 2. The W2 relationship that links the end of the first passage to the beginning of the second passage is well concealed by intervening musical material.
Example 1.26 – “Dieu est immuable” passages

a) Tonics and Transpositional Relationships

b) Collectional Relationships

To summarize the discussion thus far, both the internal structure of Mode 3 and the way in which Messiaen uses this mode compositionally have prompted the definition and exploration of an interesting transformational space—an enneadic parsimonious Tonnetz. In turn, this Tonnetz has helped to reveal certain melodic, harmonic, rhythmic, and metric features of these musical passages that otherwise might not have been noticed. Example 1.22 shows that the three ATB modes form an interconnected, closed subsystem within the larger system of all MLT, neatly parsing the twelve pcs of the total chromatic into harmonic sections (or layers) which may be juxtaposed (or superimposed) in musical passages. While the TB modes are not capable of forming such
parsimonious Tonnetze, it is still worthwhile to explore transformations of objects within these modes as well.\(^{90}\) In particular, it is interesting to consider how the mod-12 identity of a modal sc changes when placed in different modal contexts.

In a book of aural-skills exercises designed to help students internalize Messiaen's musical language, Anne Le Forestier discusses two procedures for melodic transformation, as reproduced in Example 1.27.

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**Example 1.27 – Procedures for Melodic Transformation (Le Forestier 1984)**

a) **Transposition**
(ex. thème du mode 3\(^{\text{e}}\) au mode 3\(^{\text{e}}\))

b) **Translation** (transformation d’une mélodie par décalage du point de départ, l’échelle restant identique).
— indiquer les degrés du mode...
— transcrire les notes du thème en degrés:
— décaler ces degrés de -1 :
— décaler ces degrés de +1 :

... et trouver la ligne mélodique résultant de ce décalage...

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(As noted above, Messiaen endorsed these exercises, stating in his introduction to Le Forestier’s work that after using this method, students will think of his music

\(^{90}\) Appendix A examines other types of Tonnetz which the TB modes are capable of forming.
in the way that he himself thinks of it.)\textsuperscript{91} In Example 1.27a, Le Forestier shows that a melodic segment (taken from the opening of “Alléluias” from \textit{L’Ascension}) may be transformed from one pc form of a mode to another pc form of the same mode by transposition (a melody in Mode 3\textsuperscript{2} becomes a melody in Mode 3\textsuperscript{3} when transposed by T\textsubscript{1} in this example).

In Example 1.27b, she shows how a melody may be transformed by shifting the scale degrees of a mode so that its mod-12 intervallic pattern changes. Her original scalar ordering of Mode 3\textsuperscript{2}, for example, begins and ends on D\textsuperscript{♭} with a repeated intervallic pattern of <211>, while her -I ordering of 3\textsuperscript{2} begins and ends on C, which results in a rotation of the intervallic pattern to <121>; her +II ordering begins and ends on E and has the same intervallic pattern as -I. Le Forestier’s \textit{thème} example shows that when a melodic line is translated from one scalar ordering to another, its mod-12 identity may change. The -I melodic translation, for example, maintains the same succession of modal intervals as the original theme: <-1, -2, -1, +3, +1, -4, -1, -1, +2>; however, its succession of mod-12 intervals <-1, -3, -1, +4, +1, -5, -1, -2, +3> is radically different from that of the original <-2, -2, -2, +4, +2, -6, -1, -1, +2>.

Le Forestier is working with different rotations of a single mode, but it is easy to see how a melodic pattern or harmonic object in one mode might be translated into a completely different mode using the same principles.\textsuperscript{92} The

\textsuperscript{91} Le Forestier 1984, preface.
\textsuperscript{92} Chapter 2 explores in detail the challenges faced when trying to map one entire mode onto another. In particular, issues such as how to determine the point(s) of pc synchronization between the two modes and how to deal with modes of differing cardinalities and families are addressed.
opening of “Action de grâces,” the first piece in Messiaen’s *Poèmes pour Mi* (1936), a song cycle for soprano and piano, provides a good illustration. Example 1.28 shows the first three measures of the song.

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Example 1.28 – “Action de grâces” – mm. 1-3

As bracketed on the score, there are three different modes presented in this short excerpt. The piece opens with a pair of superimposed chord series in rhythmic canon at the quarter note; the right hand of the piano presents a form of Mode 3 (N2), while the left hand presents a form of Mode 2 (O1). The two hands then come together in a converging figure that presents a form of Mode 6 (F1) and thus, prepares the entrance of the first vocal verse in the same mode.

Despite such modal diversity, Messiaen has created a great deal of harmonic and melodic consistency in this passage. Example 1.29 shows the first trichord of each of the three modal layers (N2, O1, and the left hand of F1) within its unique scalar context. This example shows that all three of these trichords, when arranged in their most compact form within their respective modes, belong to the modal sc x(025); or in other words, Messiaen has translated the modal
Example 1.29 – Representative Trichords from the Three Modal Layers of “Action de grâces”

\[ \begin{array}{c|c|c|c|c|c|c|c} \hline & \text{N2:} & \langle D_b, E_b, E, F, G, A_b, A, B, C \rangle & \text{(mod-9)} \\ \hline & \text{O1:} & \langle A, B_b, C, C#, D#, E, F#, G \rangle & \text{(mod-8)} \\ \hline & \text{F1:} & \langle E, F, F#, G#, A#, B, C, D \rangle & \text{(mod-8)} \\ \hline \end{array} \]

The arrows of Example 1.29 show the size of the ordered intervals (measured in modal scale steps) between the adjacent factors of each trichord. Those intervals that are represented in the \( \chi(025) \) sc label remain consistent in the translation from mode to mode; that is, the interval from pc 0 to pc 2 is two modal steps and the interval from pc 2 to pc 5 is three modal steps in all three modal contexts, as shown with the solid arrows. However, the size of the remaining interval from pc 5 to pc 0, shown with a dashed arrow in each trichord, varies depending on the cardinality of the mode; in N2, the mod-9 interval between these pcs is four modal steps, while in O1 and F1, the mod-8 interval

\[ \chi(025) \] into three different modal contexts in this passage.\(^{93}\)

\(^{93}\) My approach to translation here is similar to Santa’s MODTRANS \( (x, y, z) \) operation, which maps each modal pc (Santa uses the term step class) of a musical entity in modular system \( x \) onto a corresponding modal pc (step class) in modular system \( y \) from a point of synchronization \( z \) (Santa 1999, 202).
between these pcs is only three modal steps. (I will examine this situation in more detail in my complete analysis of this piece in Chapter 4.)

For this and other reasons, Christoph Neidhöfer prefers to classify Messiaen’s modal chords according to their interval normal form (INF), which lists the modal intervals between all adjacent chord factors. The $\chi(025)$ trichords shown in the mod-8 contexts of Example 1.29 have INFs of $<233>$, while the mod-9 $\kappa(025)$ trichord has an INF of $<324>$ (the sum of the intervals listed in an INF equals the cardinality of the mode). Using an INF rather than a sc label provides a more complete picture of the intervallic structure of a chord within a particular modal context. However for my purposes, using the INF to identify structural similarities between objects in different modes is limiting, since two chords may only have the same INF if they are found within modal environments of the same cardinality. For this reason, I will tend to classify chords according to modal scs, which can be translated into any context.

The trichords of each hand move (almost entirely) in parallel motion within their respective modes and thus, the entire passage is composed of modal $\chi(025)$ trichords. $\chi(025)$ is a particularly special modal sc because it teases out all of the major and minor triads that Messiaen’s favourite Modes 2, 3, 4, and 6 are

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94 Neidhöfer 2005, 5-6.
95 A single departure from this parallel voice leading is found in the O1 chord series. In the movement from the fourth/ninth chord \{C$, F$, B$\} to the fifth/tenth chord \{G, C, D$\} in this series, the two lowest voices move by up four steps within the O1 scale, while the highest voice moves up by only three steps. Thus, the \{G, C, D$\} chord, has a slightly different structure than the rest of the chords in the series; interestingly however, it still belongs to the same $\kappa(025)$ sc. I will discuss the significance of this variation in my complete analysis of this piece in Chapter 4.
capable of forming (plus a few other mod-12 scs, depending on the mode).

Example 1.30 shows the spectra of mod-12 scs that are associated with the modal $\chi(025)$ trichord when placed in each of these modal contexts.\footnote{Neidhöfer defines the spectrum of a step class sc (i.e. modal sc) in a particular mode as the set of mod-12 scs produced when the INF runs through the entire mode. He notes that “in the diatonic context, the spectrum of a step class set class corresponds to what Clough/Myerson 1985 identify as the ‘species’ (set of mod-12 set classes) that belong to a particular ‘genus’ (diatonic set class)” (Neidhöfer 2005, 9).}

---

**Example 1.30 – The Mod-12 Identity of the $\chi(025)$ Modal Trichord within Modes 2, 3, 4, and 6**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Modal Trichord</th>
<th>Mod-12 Sc(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>$\circ(025)$</td>
<td>(037)</td>
</tr>
<tr>
<td>3</td>
<td>$\pi(025)$</td>
<td>(037), (026)</td>
</tr>
<tr>
<td>4</td>
<td>$\gamma(025)$</td>
<td>(037), (027)</td>
</tr>
<tr>
<td>6</td>
<td>$\varnothing(025)$</td>
<td>(037), (027), (048)</td>
</tr>
</tbody>
</table>

Thus, a unique pattern of mod-12 trichords is created within each modal layer of this passage—the O1 left-hand chord series includes only major and minor triads, the N2 right-hand series includes major triads and the occasional (026) chord, and the F1 converging figure includes a chord exchange of major and minor triads between the two hands with passing (027) chords in the middle. I will save my discussion of the transformational structure of the N2 and O1 chord series for my complete analysis of “Action de grâces” in Chapter 4 because a convincing explanation of these relationships requires a synthesis of all three perspectives (modal, chromatic, and tonal). For now, I will continue the present modal analysis by examining the relationship between the F1 converging figure.
of Example 1.28 and the subsequent figures that are presented later on in the piece.

Example 1.31 compiles all such figures found in "Action de grâces."

Example 1.31 – Converging Figures in "Action de grâces"

a) mm. 2, 6, 12, 19

F1: \{C, D, E, F, F♯, G♯, A♯, B\}

\[
\begin{align*}
D &\rightarrow C &\rightarrow B \\
B &\rightarrow A♯ &\rightarrow G♯ \\
F♯ &\rightarrow F &\rightarrow E \\
G♯ &\rightarrow A♯ &\rightarrow B \\
E &\rightarrow F &\rightarrow F♯ \\
B &\rightarrow C &\rightarrow D
\end{align*}
\]

b) mm. 6, 12, 19

N2: \{D♭, E♭, E, F, G, A♭, A, B, C\}

\[
\begin{align*}
G &\rightarrow G &\rightarrow F \\
E &\rightarrow D♭ &\rightarrow D♭ \\
B &\rightarrow A &\rightarrow A♭ \\
C &\rightarrow C♭ &\rightarrow E♭ \\
A♭ &\rightarrow A &\rightarrow C♭ \\
E♭ &\rightarrow E &\rightarrow F
\end{align*}
\]

c) mm. 17, 20, 22

N3: \{D, E, F, F♯, G♯, A♭, C, C♯\}

\[
\begin{align*}
F &\rightarrow E &\rightarrow D \\
C♭ &\rightarrow C &\rightarrow B♭ \\
G &\rightarrow F♯ &\rightarrow F \\
A &\rightarrow B♭ &\rightarrow C \\
F &\rightarrow F♯ &\rightarrow G \\
C &\rightarrow C♯ &\rightarrow D
\end{align*}
\]

d) mm. 24, 26

F3: \{D, E, F♯, G, A♭, B♭, C, D♭\}

\[
\begin{align*}
D &\rightarrow D♭ &\rightarrow C \\
B♭ &\rightarrow A♭ &\rightarrow G \\
E &\rightarrow E♭ &\rightarrow D \\
E &\rightarrow F♯ &\rightarrow G \\
C &\rightarrow D♭ &\rightarrow E \\
G &\rightarrow A♭ &\rightarrow B♭
\end{align*}
\]

* The natural sign on this E in the score is redundant (it follows another E♭ in the same measure) but appears to be correct, as it is found in both mm. 24 and 26. Perhaps the editor included it to clarify that the flat sign applies to the D and not to the E in this chord.
Example 1.31 (cont’d)

To the left of each score excerpt, I show the measure numbers in which the figure occurs and list the mode that is expressed. To the right of each excerpt, I provide a modal voice-leading analysis of the figure, showing the right-hand pcs in bold print and the left-hand pcs in normal print. Example 1.31a illustrates that the right hand of the F1 converging figure plays three $F(025)$ trichords which descend by parallel modal step (-1), while the left hand plays three $F(025)$ trichords which ascend by parallel modal step (+1).\footnote{Neidhöfer 2008 finds similar contrapuntal patterns in a number of harmonic progressions scattered throughout Messiaen’s repertoire.}

In the score of Example 1.31b, the familiarity of the voice-leading pattern is not immediately evident because of the way that Messiaen has divided the pitches between the two hands. However, the voice-leading analysis to the right of the score shows that this figure is, in fact, a translation of the F1 figure into the N2 mode; it contains two streams of parallel $n(025)$ trichords—one descending and the other ascending. The third figure (Example 1.31c) is a $T_9$ transposition of the second figure (the right-hand trichords move up in pitch space while the left-hand trichords move down, with a doubling of the top voice of each trichord an octave lower), which results in a change of mode from N2 to N3.
The last two figures (Examples 1.31d and e) express different pc forms of the F mode; however, they are not exact transpositions of the first F1 figure. Each of these final figures violates the original voice-leading model in two places. In Example 1.31d, the E in the first right-hand chord should be an F♯ and the E in the last left-hand chord should be a D; in Example 1.31e, the C and F of the first left-hand chord should be D♯ and F♯, respectively, in order to conform to the voice-leading pattern established in Example 1.31a. As will be discussed further in Chapter 4, Messiaen may have had tonal reasons for making these alterations. The unusual Es of Example 1.31d provide a doubling of the third of the C dominant-ninth chord that is articulated between the two hands on the first and last chords of the figure (Messiaen also adds an extra C to the final left-hand trichord, doubling the root of the C⁹ chord). This chord may be heard as tonicizing the F-major triads that are found in the last and, as a result of Messiaen’s alterations, also the first chords of the final figure.

Thus, the modal χ(025) trichord has particularly special properties in relation to Messiaen’s favourite MLT and may be found frequently in his music in a number of different modal contexts; however, this trichord is, of course, not the only modal object with which Messiaen works. To illustrate, I will briefly examine Neidhöfer’s analysis of the opening of “Amen du Désir” from Visions de l’Amen, as reproduced in Example 1.32. Neidhöfer’s mode labels (in boxes) show that Messiaen is juxtaposing blocks of modal material, switching to a different pc form of Modes 2, 4, or 6 in every measure, with the exception of m. 9 which changes mode twice.
Example 1.32 – “Amen du Désir” – mm.1-10
Example 1.32 (cont’d)

As Neidhöfer’s INF labels (shown with angled brackets < >) and the modal sc labels I have added illustrate, the harmonies in the right hand of piano two are extremely consistent, despite the changes in modal context. With the exception of m. 8, all of these chords belong to the modal sc $\chi(025)$ (Modes 2, 4, and 6 are all eight-note modes so the INF $<233>$ also remains the same). The left hand of piano two is also very consistent, providing an alternation of the modal scs $\chi(0135)$ (INF $<2213>$) and $\chi(0136)$ (INF $<2123>$) throughout the passage. The modal sc labels in m. 8 show that these right-hand chords, which deviate from the $\chi(025)$ sc found in all of the other measures, belong to the same $\chi(0135)$ sc as those of the left hand. However, as the differing INFs illustrate, the right-hand chords are inversionally related to all of the left-hand $\chi(0135)$ chords in the passage.

The discussion of this passage will continue in Chapter 2 from a mod-12 perspective.
Chapter 2 – A Chromatic Perspective

The analytical and theoretical discussion of Chapter 1 focused primarily on small-scale transformational relationships between trichords within a single modal space (with some suggestions for further expansion of this work presented in Appendix A). Over the course of the chapter, though, the modal investigation eventually led to an exploration of the identity of objects and transformations in different modal environments. In order to consider the larger-scale relationships between juxtaposed and superimposed Modes of Limited Transpositions (MLT) of different types, the total chromatic must ultimately be the universe in which these individual modal environments are understood.

The first task in Chapter 2, then, will be to continue the investigation of modal relationships by examining how mod-12 pc sets may be used to highlight aural differences or similarities between different modes. The second task will be to discuss how one MLT may be transformed into another by manipulating two mod-12 abstract subsets in particular—the tritone and the augmented triad. While the mod-12 chromatic universe will serve as the background structure against which all transformations are heard in this chapter, it will be helpful at times to refer to the modal or tonal identities of objects and transformations as well. As in Chapter 1, I will clearly indicate the conceptual space to which I am referring.

Example 2.1 provides a tally of the number of pitch classes (pcs) held in common between the unique pc forms of Messiaen’s favourite and most-used Modes 2, 3, 4, and 6. Those modal forms with the most pcs in common have the
### Example 2.1 – Number of Pitch Classes between Forms of Modes 2, 3, 4, and 6

<table>
<thead>
<tr>
<th></th>
<th>Mode 2</th>
<th>Mode 3</th>
<th>Mode 4</th>
<th>Mode 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
<td>6 6 4</td>
</tr>
<tr>
<td>2</td>
<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
<td>6 6 4</td>
</tr>
<tr>
<td>3</td>
<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
<td>6 6 4</td>
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<tr>
<td></td>
<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
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<td></td>
<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
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<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
<td>6 6 4</td>
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<tr>
<td></td>
<td>8 4 4</td>
<td>6 6 6</td>
<td>6 4 4</td>
<td>6 6 4</td>
</tr>
</tbody>
</table>

Potential to sound most similar, while those with the least pcs in common have the potential to sound most dissimilar, but the musical context also greatly influences the perception of modal relations. For instance, a composer may use other musical parameters (rhythm, meter, accent, dynamic, register, timbre, etc.) to emphasize subsets that are unique to each mode in order to aurally differentiate them, or may emphasize subsets that are common to both modes in order to unify them.

Christoph Neidhöfer proposes that “in polymodal textures, Messiaen characteristically emphasizes the distinctive features of each mode by limiting the use of chords that belong to more than one of the superimposed modes…. (The
same principle generally obtains for Messiaen’s juxtaposed modes). As an illustration, Neidhöfer cites the opening of “Amen du Désir” from *Visions de l’Amen* which changes mode with almost every measure, as discussed from a modal perspective in Chapter 1 (refer back to Example 1.32). He notes that, except for the left hand of m. 8, none of the chords of the second piano is available within the modes of the preceding or following measures. Thus, the juxtaposed modal chunks are kept aurally distinct by Messiaen’s use of pc sets that are unique to each particular mode.

While Neidhöfer’s point regarding Messiaen’s mod-12 differentiation of modes is accurate for some passages, there are also many counterexamples in this repertoire. At times, different MLT that are juxtaposed or superimposed clearly share specific pcs that are grouped into traditional and easily retained chords or melodic fragments; at other times, the pcs highlighted in one MLT belong to the same mod-12 set class (sc) as pcs highlighted in other MLT. Both situations provide a given passage with greater harmonic and/or melodic consistency. For instance, Example 2.2 shows the first section of “La Vierge et

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99 Neidhöfer shows that the different modes in this passage are coordinated by the use of only a few modal scs (as discussed in Chapter 1), by the ostinati of the first piano (which provide pivot notes linking the successive modes), and by the fact that piano two’s left-hand chords all belong to a G-major diatonic collection.
100 Richard Parks notes similar situations in his analysis of music by Debussy. Parks defines four genera which (in most cases) consist of a referential collection (“cynosural set”—for example, whole tone) plus all of its subsets and supersets. He writes, “Debussy often uses sets shared among two or more genera to conjure up ambiguous associations (or to resolve them) and to effect transitions or forge connections between contrasting passages” (Parks 1989, 76).
l’Enfant” from La Nativité du Seigneur for organ (1935), which alternates quickly between pc forms of Mode 2 (shown with dotted boxes) and Mode 3 (shown with dash-dot boxes).

Example 2.2 – “La Vierge et l’Enfant” – mm. 1-15

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Here, Messiaen uses both chords and melodic fragments that are common to adjacent collections in order to facilitate smooth transitions between the juxtaposed modes of this passage. For example, the piece opens with a \{B\#, C, E\} mod-12 (026) chord in the left hand belonging to \textsc{sc}_0(014) within the Mode-$2^1$ context. The material in mm. 1 to 2 is transposed almost exactly down three semitones in mm. 5 to 6.\textsuperscript{101} Because Mode 2 is invariant under this transposition, the same Mode $2^1$ continues until m. 8, where there is a change of collection to Mode $3^1$.

The left-hand chord \{G, B\#, C, E\} on the downbeat of m. 8 belongs both to Modes $2^1$ and $3^1$; its \{B\#, C, E\} subset literally recalls the first chord of the piece, and abstractly recalls all of the (026) chords of the first two systems, as circled on the score. However, this pc set now belongs to a different modal \textsc{sc}_N(025) within Mode $3^1$. This situation contrasts with the modal translations that were observed in Chapter 1—instead of keeping the modal \textsc{sc} constant between juxtaposed or superimposed modes while the mod-12 identity is allowed to change, here the mod-12 (026) \textsc{sc} is kept constant while its modal \textsc{sc} identity changes with the modal context.

In mm. 8 to 12, the collections change more frequently with every measure (and twice in m. 11). As bracketed on the score, a two-mode model is established in mm. 8 and 9 and transposed sequentially down two semitones in m. 10 and the first half of m. 11. Messiaen’s choice of this $T_{-2}$ transposition helps

\textsuperscript{101} The only deviations from the overall $T_{-3}$ transposition are the $D\flat 6$s in the grace-note figures of mm. 5 to 6, which are $T_{-2}$ of the $E\flat 6$s in mm. 1 to 2.
to articulate the boundaries between these sequential units because it ensures that new pc forms of both Modes 2 and 3 will be heard in the next statement (neither of these modes is left invariant by this transposition). Within each sequential unit, however, Messiaen unifies the two modes through the use of chords and melodic fragments that are shared by both modes in the unit. The right-hand melodic figures heard in m. 9 and the first half of m. 11 belong both to the mode expressed by the left-hand chords of those measures and to the mode expressed in the previous measure (as indicated by the backward-pointing dash-dot arrows).\(^\text{102}\) Similarly, the left-hand chords heard at the end of mm. 8 and 10 belong both to the mode expressed in the current measure and to the mode expressed in the following measure (as indicated by the forward-pointing dotted arrows).\(^\text{103}\)

A truncated third sequential statement is heard in the second half of m. 11, which transposes the first half of this measure down another two semitones. The \(<C, E\flat, G\flat>\) figure in m. 12, a repetition of the melodic figure in the second half of m. 11 at the same pitch level, belongs both to the current Mode \(2^1\) and to the previous Mode \(2^3\) (as indicated by the backward-pointing dotted arrow), and thus, provides a smooth transition between the sequence of mm. 8 to 11 and the

\(^{102}\) That is, the \(<E, G, B\flat, F\sharp>\) figure in m. 9 belongs both to this measure’s Mode \(2^1\) and to the previous measure’s Mode \(3^1\); the \(<D, F, A\flat, E>\) figure in the first half of m. 11 belongs both to the current Mode \(2^2\) and to the previous Mode \(3^3\).

\(^{103}\) That is, the \(<G, B\flat, C, E>\) chord in m. 8 belongs both to this measure’s Mode \(3^1\) and to the following measure’s Mode \(2^1\); the \(<F, G\sharp, B\flat, D>\) chord in m. 10 belongs both to this measure’s Mode \(3^3\) and to the following measure’s Mode \(2^2\).
cadential material of mm. 12 to 15. One final mod-12 feature that unifies the passage is the arpeggiation of (0236) chords (or sometimes just an (036) subset) that saturates the entire melodic line in both Mode-2 and Mode-3 contexts.\(^{104}\)

Thus, Messiaen’s exploitation of common mod-12 pc sets blurs the aural boundaries between many of the juxtaposed collections in this passage, unifying them from a chromatic perspective. The few instances where the chords that are heard on the boundaries of collectional change are not shared between the two adjacent modes (mm. 9 to 10, the middle of m. 11, and mm. 13 to 14) are not commonplace (as Neidhöfer suggests) but striking within this passage, and are used to further articulate the sequential motivic patterning.

Messiaen’s “Le collier,” the eighth song in his *Poèmes pour Mi* for soprano and piano (1936), provides an example of his use of common mod-12 subsets to link superimposed modal layers. The first ten measures of the piece are given in Example 2.3. Messiaen includes the letters A, B, and C in the score to show changes in the arrangement of modes.\(^{105}\) At A, the right hand plays chords in Mode 3\(^{1}\) (shown with solid boxes), while the left hand plays chords in Mode 2\(^{2}\) (shown with dashed boxes). At B, the hands exchange modes, and at C, they return to their opening arrangement. Despite the changes in mode, Messiaen maintains the contour and rhythmic patterns established by each hand in the A segment throughout the B and C segments as well. The first phrase of the vocal

\(^{104}\) Messiaen borrows this “beloved melodic contour” (i.e. the ordered succession of mod-12 intervals <+4, -1, +3, -6>) from the opening of Modest Moussorgsky’s *Boris Godounov*, labeling it his first melodic cadence formula (Messiaen 1956, 31-32; 1944, 30-31).

\(^{105}\) See Messiaen 2002, 262-263 for his discussion of this passage.
Example 2.3 – “Le collier” – mm. 1-10

line follows the top notes of the piano’s right hand; however, its pcs belong to both of the piano’s collections, making it modally ambiguous. The second vocal phrase also follows the top notes of the piano’s right hand, but its Fs now place it definitively in Mode $2^2$.

The reader will notice that the modal boxes enclosing each hand of the piano frequently jut up or down on the score to include chords from the other hand’s modal stream. This indicates that these chords belong to both modes and are used to link the material of the two hands. In particular, the \{B, E, G\}
chord belongs to both Modes 2\(^2\) and 3\(^1\), which allows it to be maintained as a left-hand pedal throughout the entire passage, despite the modal rearrangements that occur between the two hands. Similarly, the right hand’s \{D, E, A\(b\}\) chord in m. 4 and \{B, E, G\} chord in m. 8 belong also to the mode of the left hand.\(^{106}\) In this passage, Messiaen emphasizes sonorities that belong to both modes, and as a result, the two hands are closely linked to each other and to the vocal line.

Now that I have shown some ways in which MLT may be linked to each other via common subsets, I will turn to an exploration of how one MLT may be transformed into another MLT.\(^{107}\) The introductory chapter highlighted the importance of the two smallest transpositionally symmetrical (TS) mod-12 scs—the tritone (sc (06)) and the augmented triad (sc (048))—in generating the MLT and dividing them into two families. The modal exploration of the augmented-triad-based (ATB) family in Chapter 1 came to a theoretical climax with the creation of the tetrahedron of Example 1.22, which showed the relationships between all of the ATB modes. I will now consider this structure from a slightly different transformational perspective.

Example 2.4a reproduces the ATB tetrahedron but omits the PL cycles attached to it. In the context of an ATB mode, pcs related by interval-class (ic) 4 are positionally equivalent, and to this extent, may also be considered to be functionally equivalent (that is, their potential voice-leading patterns are the

\(^{106}\) As with the \{B\(b\), C, E\} chord of “La Vierge et l’Enfant,” the \{D, E, A\(b\}\) mod-12 (026) chord belongs to different modal scs within the two modes of this passage—in Mode 2\(^2\), it belongs to sc \(0(014)\) and in Mode 3\(^1\), it belongs to sc \(N(025)\).

\(^{107}\) The reader will note that, in this chapter, I am not always using the term transformation in the strictest mathematical sense.
Example 2.4 – Modeling Relationships between the Augmented-Triad-Based Modes

a) Modal Representation

b) Chromatic Representation

0 = \{C, E, G^\#\} \quad 1 = \{C^\#, F, A\} \quad 2 = \{D, F^\#, B^\flat\} \quad 3 = \{E^\flat, G, B\}

same. This provides a substantive reason for thinking of these pcs as conjoined (a single vertex on the tetrahedron), but it does not imply that they may not have separate identities in specific musical contexts. The vertices of the tetrahedron are numbered from 0 to 3 and correspond to the four augmented triads as indicated at the bottom of Example 2.4.

By showing all augmented triads as equidistant on the tetrahedron, each pc form of Mode 3 is represented by a face, and each six-note TS mode is represented by an edge, regardless of whether it is a pc form of Mode 1 or of Mode 8. This makes sense, as I have demonstrated in Chapter 1, when these two types of six-note ATB collections are considered within the context of a larger Mode-3 space. For example, Mode 3^3 contains three unique six-note TS subsets (Modes 8^1, 8^2, and 1^1) belonging to two different mod-12 scs, (014589) and (02468t). However, all three of these subsets belong to the mod-9 sc \( N(013467) \), as shown in Example 2.5. Thus, the representation of pc forms of Modes 1 and 8 as analogous configurations on the tetrahedron reflects their equivalence within.
Example 2.5 – Using the Modal Tetrahedron to Compare Pc Forms of Modes 1, 3, and 8

\[
3^3 = \begin{array}{cccccccc}
0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\
C & C\# & D & E & F & F\# & G & A & B\#
\end{array}
\]

\[
8^1 = \begin{array}{cccc}
C & C\# & E & F \\
G & A
\end{array}
\]

\[
8^2 = \begin{array}{cccc}
C\# & D & F & F\# \\
A & B\#
\end{array}
\]

\[
1^1 = \begin{array}{cccc}
C & D & E & F\# \\
G & B\#
\end{array}
\]

mod-9 space.

Many musical examples where it makes sense to hear modally have been examined in Chapter 1, but the work of the present chapter is concerned with the mod-12 identities of and relations between pc sets. Example 2.4b, then, shows how the mod-12 diversity of each ATB collection may be represented by rearranging the augmented triads into a two-dimensional diamond instead of a three-dimensional tetrahedron. Here, the augmented triads are no longer shown as equidistant, and each of the three types of ATB modes now has a unique geometric representation—forms of Mode 3 are triangles, forms of Mode 8 are edges, and forms of Mode 1 are diagonals. To illustrate, Example 2.6 redraws the relationships between the modes of Example 2.5 using this diamond.

These tetrahedron and diamond representations visually suggest a fairly simple way in which one mode may be converted into another—by transforming one augmented triad into another which shares the same edge or diagonal, while maintaining the remaining augmented triad(s). In his Ph.D. dissertation, “Single-Voice Transformations: A Model for Parsimonious Voice Leading,” Brandon
Example 2.6 – Using the Chromatic Square to Compare Pc Forms of Modes 1, 3, and 8

\[
3^3 = \begin{bmatrix}
0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\
C & C^\# & D & E & F & F^\# & G^\# & A & B^\#
\end{bmatrix}
\]

\[
8^1 = \begin{bmatrix}
C & C^\# & E & F & G^\#
\end{bmatrix}
\]

\[
8^2 = \begin{bmatrix}
C^\# & D & F & F^\# & A & B^\#
\end{bmatrix}
\]

\[
1^1 = \begin{bmatrix}
C & D & E & F^\# & G^\# & B^\#
\end{bmatrix}
\]

Derfler defines single-voice transformations that act on individual pcs within a set (rather than on the entire set itself), in order to describe relationships between sets belonging to different scs. Derfler’s idea can be modified to reflect the situation here by referring to ATB collections not as sets of numbered pcs, but as sets of numbered augmented triads (such sets will be preceded by the subscript “A” and the augmented triads will be numbered as shown at the bottom of Example 2.4—for instance, Mode 8^1 will be listed as _A{0, 1}, Mode 8^2 will be listed as _A{1, 2}, and so on), and by allowing transformations to act on individual augmented triads within a collection—one augmented triad is transposed while any remaining augmented triads in the collection are left invariant.

Of the twelve transpositions, only four produce unique pc sets when applied to an augmented triad, and thus, four transposition classes may be defined; T_x produces the same overall results as T_x+4 and T_x+8, and these transpositions may be represented collectively as T_x(mod-4). Example 2.7 shows the three mod-12 transpositions that belong to each mod-4 transposition class.

---

Example 2.7 – The Mod-4 Transposition Classes

<table>
<thead>
<tr>
<th>Mod-4 Transposition Class</th>
<th>Mod-12 Transpositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_0(mod-4)</td>
<td>T_0, T_4, T_8</td>
</tr>
<tr>
<td>T_1(mod-4)</td>
<td>T_1, T_5, T_9</td>
</tr>
<tr>
<td>T_2(mod-4)</td>
<td>T_2, T_6, T_t</td>
</tr>
<tr>
<td>T_3(mod-4)</td>
<td>T_3, T_7, T_e</td>
</tr>
</tbody>
</table>

Each of these transposition classes is reversible: T_{1(mod-4)} and T_{3(mod-4)} are inverses, as are T_{2(mod-4)} and T_{4(mod-4)}, while T_{0(mod-4)} is its own inverse.\(^\text{109}\)

To illustrate, consider the conversion of Mode 3\(^1\) (the augmented-triad content of which may be listed as \(A\{0, 2, 3\}\)) into Mode 3\(^2\) (the augmented-triad content of which may be listed as \(A\{0, 1, 3\}\)), as depicted on the diamond in Example 2.8:

Example 2.8 – Converting Mode 3\(^1\) into Mode 3\(^2\) via an Augmented-Triad Transposition

\(^\text{109}\) John Roeder 2009 defines the same mod-4 transformational system using augmented triads in his analysis of Bartók’s *Scherzo for Suite*, op.14, mm. 1 to 32. His S transformation is equivalent to my T_{1(mod-4)}, his S^{-1} transformation is equivalent to my T_{3(mod-4)}, and his X transformation is equivalent to my T_{2(mod-4)}. Roeder also represents these transformations visually, using computer animations to illustrate his analyses.
Example 2.8 shows that this change in collection may be described as resulting from the transposition of a single augmented triad. That is, augmented-triads 0 and 3 remain invariant, while augmented-triad 2 maps onto augmented-triad 1 via any transposition that can be reduced abstractly to $T_{3(\text{mod}-4)}$. To change Mode $3^2$ back into Mode $3^1$, augmented-triad 1 maps back onto augmented-triad 2 via any transposition that can be reduced abstractly to $T_{1(\text{mod}-4)}$. To determine how the individual pcs of one augmented triad map onto the pcs of the other and thus, the literal transposition, the voice-leading realization in an actual musical context will need to be considered.

Example 2.9 reproduces (with some new annotations) the “Dieu est immuable” passage from Messiaen’s *Méditations sur le Mystère de la Sainte Trinité* (1969) that was originally presented as Example 1.23 in Chapter 1. In my original analysis, I noted that the second system of the passage is a transposition of the end of the first system by $T_3$, moving all of the pcs of Mode $3^1$ down three semitones to create the pcs of the new Mode $3^2$. However, another transformational interpretation for this modal change can now be posited—one which privileges common-tone retention—as modeled abstractly in Example 2.8.

In the transition between these two forms of Mode 3, it is helpful to compare the last two chords of the first system with the first two chords of the second system. The two collections share augmented-triads 0 and 3—that is, all of the pcs of Mode $8^4$. Thus, the $\{B^\flat, E^\flat, G\}$ chord at the end of the first system is slightly collectionally ambiguous, containing only one pc ($B^\flat$) that belongs to Mode $3^1$ and not to Mode $3^2$, while the inner voices of the chord that precedes it
Example 2.9 – *Méditations sur le Mystère de la Sainte Trinité*, “Dieu est immuable”

provide the complete augmented-triad 2 that is unique to Mode 3\(^1\), as circled on the score. Similarly, while the \{G, C, E\} chord at the beginning of the second system is collectionally ambiguous (belonging to both forms of Mode 3), the chord that follows it clearly establishes the new collection, including its unique augmented-triad 1 in the inner voices, as circled on the score. Omitting the transitional E\(\flat\)- and C-major triads, the inner voices of the collectionally unambiguous chords move consistently by T\(_{5}\) (which is a realization of the abstract T\(_{3(\text{mod}-4)}\) class), mapping the pitches D\(_4\), F\(_4\), and B\(\#\_4\) onto the pitches A\(_3\), D\(\#\_4\), and F\(_4\), respectively.
These individual augmented-triad transpositions may be used to relate not only different pc forms of Mode 3, but also different pc forms of the six-note ATB modes, which may belong to different mod-12 scs (i.e. Mode 1 versus Mode 8). For instance, Mode 8\(^1\) shown in Example 2.6 may be converted into Mode 1\(^1\) when augmented-triad 0 is held invariant, and augmented-triad 1 maps onto augmented-triad 2 via \(T_{1_{(mod-4)}}\). However, two collections of the same mod-12 sc cannot always be related by a single augmented-triad transposition. For example, the relationship between Modes 1\(^1\) and 1\(^2\), the two diagonals on the diamond, must be described as two augmented-triad transpositions, as must the relationship between Modes 8\(^1\) and 8\(^3\), and between Modes 8\(^2\) and 8\(^4\).

To change one ATB into another of differing cardinality, two augmented triads may *fuse* into one, or one augmented triad may *split* into two. To illustrate, the three (non-trivial) abstract ways in which the augmented triads of Mode 3\(^4\) may be mapped onto another augmented triad via transposition, and the collections that result from these transpositions, are shown in Example 2.10.

---

**Example 2.10 – The Augmented-Triad Transpositions of Mode 3\(^4\) = \(\text{ATB}\{1, 2, 3\}\)**

<table>
<thead>
<tr>
<th>Transposition</th>
<th>Augmented Triad</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T_{1_{(mod-4)}})</td>
<td>(8^3)</td>
</tr>
<tr>
<td>(T_{2_{(mod-4)}})</td>
<td>(8^3)</td>
</tr>
<tr>
<td>(T_{3_{(mod-4)}})</td>
<td>(3^1)</td>
</tr>
</tbody>
</table>

The grey cells of this table show that certain transpositions map a given
augmented triad onto an existing augmented triad in the collection, fusing the two triads and resulting in a smaller six-note collection. In the first column of this table, \( T_{1(\text{mod}-4)} \) maps augmented-triad 1 onto the already-present augmented-triad 2, while \( T_{2(\text{mod}-4)} \) maps augmented-triad 1 onto the already-present augmented-triad 3; both of these fuses result in the smaller Mode \( 8^3 \). Similarly, Mode \( 1^2 \) collection results when augmented-triad 2 fuses with augmented-triads 1 or 3 (as shown in column 2 of the table), and Mode \( 8^2 \) results when augmented-triad 3 fuses with augmented-triads 1 or 2 (as shown in column 3 of the table). To reverse the fusing process, one augmented triad must split into two in some way.

Before moving on to an analytical example, I will define these splits and fuses more precisely as two-step processes. Following work by Derfler, each ATB mode may be considered to be an \( m \)-tuple (where \( m \) is the number of augmented triads in the collection) with each order position \( (i) \) representing an augmented-triad “voice.”\(^{110}\)

Let the SPLIT\( _i \) be a transformation on \( m \)-tuples which increases the size of an \( m \)-tuple by creating a duplicate of the content of the \( i^{\text{th}} \) order position in the \((i+1)^{\text{th}} \) order position, shifting all subsequent order positions by +1 and creating an \((m+1)\)-tuple.\(^{111}\)

Following Derfler, I will use the term \textit{split} (lowercase) to mean the composite operation of a SPLIT\( _i \) transformation, followed by a (non-trivial) transposition of one (or both) of the \((m+1)\)-tuple order positions with duplicate content. For example, Mode \( 1^2 \) may be transformed into Mode \( 3^4 \) via a split operation as shown in Example 2.11a.


\(^{111}\) Ibid., 84.
Example 2.11

Mode $1^2 = A<1, 3>$

Mode $3^4 = A<1, 2, 3>$

a) Converting Mode $1^2$ into Mode $3^4$

via a *split* Transformation

\[
\begin{array}{c}
\text{split} \\
1 \xrightarrow{\text{SPLIT}_1} 1 \\
1 \xrightarrow{T_1 (\text{mod-4})} 2 \\
3 \xrightarrow{} 3 \\
\end{array}
\]

b) Converting Mode $3^4$ into Mode $1^2$

via a *fuse* Transformation

\[
\begin{array}{c}
\text{fuse} \\
1 \xrightarrow{T_3 (\text{mod-4})} 1 \\
2 \xrightarrow{} 1 \\
3 \xrightarrow{} 3 \\
\end{array}
\]

0 = \{C, E, G\} \hspace{1cm} 1 = \{C^\#_1, F, A\} \hspace{1cm} 2 = \{D, F^\#, B^\#\} \hspace{1cm} 3 = \{E^\#, G, B\}

Example 2.11b shows the inverse operation that will transform Mode $3^4$ back into Mode $1^2$.

Let FUSE$_i$ be a transformation on m-tuples which decreases the size of an m-tuple by eliminating duplicate pc-content in the $[i-1]^{th}$ order position, shifting all subsequent order positions by -1 and creating an $(m-1)$-tuple.\footnote{Derfler 2007, 85. Derfler says $(i+1)$ here, but judging from his examples, I believe he means to say $(i-1)$ as I have stated above.}

In this definition, m must be constrained to be greater than 1. I will use the term *fuse* (lowercase) to mean the composite operation of a FUSE$_i$ transformation and a preceding augmented-triad transposition that produces duplicate content between an m-tuple order position and an adjacent position.

The analytical usefulness of these theoretical ideas can be illustrated through an examination of the mode forms found in “Les eaux de la grâce,” the
second organ piece from *Les Corps Glorieux* (1939), shown in Example 2.12.\(^{113}\)

---

Example 2.12 – “Les eaux de la grâce” (mm. 1-4 and 9-14)

\[\text{A}\]

---

*** mm. 5 to 6 are similar to mm. 1 to 2 ***

---

\(^{113}\) Messiaen 1956, 70 (1944, 104-105) cites passages from this piece in his discussion of polymodal modulation.
Example 2.12 (cont’d)

*** mm. 15 to 18 are similar to mm. 9 to 14 ***

A’  *** mm. 19 to 28 are similar to mm. 1 to 8 ***

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The piece opens with a tritone-based (TB) Mode $2^2$ in the right hand, an ATB/TB Mode $1^2$ in the organ pedal, and a repetitive melodic line in the left hand that is not strictly modal, but that emphasizes sc (0268), a subset of Mode 1. The form
and mode labels on the abridged score above show a progression over the
course of the piece through a number of polymodalities, and suggest an overall
ABA’ ternary structure. That is, the motivically similar outer sections (mm. 1 to 8
and 19 to 27) frame the piece with the same polymodality (right-hand Mode $2^2$
over pedal Mode $1^2$), while the inner section (mm. 9 to 18) provides contrast both
motivically and polymodally (right-hand forms of Mode 3 over pedal forms of
Mode 2).

The piece cycles through the three pc forms of Mode 2, beginning and
ending with Mode $2^2$. I will devote a significant amount of time to the TB modes
shortly, but for now, I would like to finish my discussion of the ATB modes by
concentrating on the collectional relationships depicted in Example 2.13.

Example 2.13 – “Les eaux de la grâce” – Modal Conversions via Augmented-Triad
Splits, Transpositions, and Fuses

\[
\begin{array}{cccccccc}
& & & & & & & \\
& & & & & & & \\
& & & & & & & \\
& & & & & & & \\
& & & & & & & \\
& & & & & & & \\
\end{array}
\]

This example shows that the move from Mode $1^2$ in the A section to Mode $3^1$ at
the beginning of the B section is fairly dramatic—augmented-triad 1 splits, mapping simultaneously onto augmented-triads 0 and 2, while augmented-triad 3 is held invariant. At the beginning of the B section, Messiaen transposes the entire right-hand Mode 3¹ in mm. 9 to 11 down by one semitone to create Mode 3⁴ in mm. 12 to 14. However, if the listener focuses on the common tones maintained between these two collections (rather than on their obvious T₁ relationship), s/he will notice that Modes 3¹ and 3⁴ differ by only one augmented triad—augmented-triad 0 maps onto augmented-triad 1, while augmented-triads 2 and 3 remain invariant. The B section, then, is characterized by an alternation between augmented-triads 0 and 1 and thus, between Modes 3¹ and 3⁴.

By m. 16, the music has settled on Mode 3⁴, which shares augmented-triads 1 and 3 with the following Mode 1² of the A’ section (or in other words, Mode 1² is a subset of Mode 3⁴). In transforming Mode 3⁴ into Mode 1², augmented-triad 2 simply disappears by fusing with augmented-triad 1. Thus, the ATB modal transformations form a quasi-palindromic structure characterized by a sudden expansion (where augmented-triad 1 splits into augmented-triads 0 and 2 at the same time), followed by a more gradual contraction (where augmented-triad 0 returns to augmented-triad 1 before augmented-triad 2 does). Augmented-triad 3, a common subset of all three collections, provides a constant pedal throughout the piece.

The relationships between the ATB modes of this piece can also be described in another way, one which incorporates the material heard in the left hand into the analysis and focuses specifically on the important role of Mode 1
throughout the piece. In the A sections, Mode $1^2$ is heard in the pedal, while the left hand arpeggiates two different (0268) chords. The pc set \{E, G\sharp, D, A\sharp\} is a subset of Mode $1^1$ (indicated with dotted boxes in Example 2.12), while the pc set \{C\flat, F, B, G\} is a subset of Mode $1^2$ (indicated with dashed boxes). These two tetrachords are heard frequently throughout the A section, culminating in a rapid alternation in m. 8 just before the B section.

In the B section, the left hand continues to play material that is not strictly modal, although it often includes moments of semitone, whole-tone alternation, again mimicking the pedal collection which switches to Mode 2 for this section. The alternation between Modes $1^1$ and $1^2$, however, is carried on here in the alternation between Modes $3^1$ and $3^4$ (Mode $1^1$ is a subset of Mode $3^1$ as indicated by the dotted brackets in Example 2.12, while Mode $1^2$ is a subset of Mode $3^4$ as indicated by the dashed brackets). Thus, the A sections present alternating subsets of whole-tone collections in the left hand, while the B section presents alternating whole-tone collections as subsets in the right hand.

I will now turn to a theoretical exploration of the TB modes from this perspective. The octahedron and hexagon of Examples 2.14a and 2.14b, respectively, are analogous to the tetrahedron and diamond of Examples 2.4a and 2.4b, respectively. Each of the vertices on the octahedron and hexagon corresponds to a numbered tritone, as indicated at the bottom of the example. As with the augmented-triad-related pcs in the context of ATB modes, tritone-related pcs in the context of TB modes are positionally, and to this extent, functionally equivalent. For this reason, they may be considered to be conjoined
Example 2.14 – Modeling Relationships between the Tritone-Based Modes

(a single vertex on the octahedron or hexagon), but this does not imply that they are indistinguishable within specific musical contexts.

As with the ATB modes on the tetrahedron, all TB modes of the same cardinality are represented with the same geometric configuration on the octahedron despite the fact that they may belong to different mod-12 scs. Pc forms of the eight-note Modes 4 and 6, for example, belong to mod-12 scs (01236789) and (0124678t), respectively, but both are represented by a tetrahedron—one quarter of the octahedron. The pc forms of the remaining eight-note Mode 2, which belongs to mod-12 sc (0134679t), are differentiated from forms of Modes 4 and 6 in this representation (shown as interior parallelograms), but this is the result of the arbitrary way in which I have assigned tritones to the vertices of the octahedron. All three eight-note modes
are actually geometrically identical (or could be if the tritones were arranged differently) on this octahedron. Similarly, any six-note TB mode is represented by a triangle, regardless of its mod-12 sc, and the ten-note Mode 7 is represented by a five-sided triangular prism (half of the octahedron).

While I will not be using the octahedron analytically in this thesis (I will leave this as an area for future research), I will briefly discuss the musical meaning of these geometric equivalences. As noted with the six-note modes of the ATB tetrahedron, TB modes of the same cardinality may be considered equivalent when they occur within the modal context (as subsets of) the next largest TB mode. For example, the ten-note Mode-$7^2$ collection contains five unique eight-note TS pc sets (Modes $2^1$, $4^2$, $4^3$, $6^3$, and $6^5$) belonging to three different mod-12 scs. When these eight-note modes are considered within a mod-10 modal context, they all belong to the same modal sc (01235678). Thus, representing them as analogous configurations on the octahedron reflects their equivalence within this mod-10 TS space. Similarly, any six-note TS subset of an eight-note TB mode will have the mod-8 sc (012456), regardless of its mod-12 sc.

Example 2.14b shows how the mod-12 diversity of each TB collection may be represented by rearranging the tritones into a two-dimensional hexagon, instead of a three-dimensional octahedron. Here, the tritones are no longer equidistant—edges (shown with solid lines), geometric chords that are not diameters (shown with dash-dot lines), and diameters (shown with dotted lines) all signify different relations between tritones—and each of the TB modes now
has a unique geometric configuration, reflecting its mod-12 identity, as shown in Example 2.15.

Example 2.15 – Mod-12 Geometric Representations of the Tritone-Based Modes

a) Mode 1 (3 chords)  b) Mode 5 (2 edges, 1 chord)  c) Mode 9 (1 edge, 1 chord, 1 diameter)

As with the ATB tetrahedron and diamond, the TB octahedron and hexagon visually suggest a simple way of converting one TB mode into another by fusing, splitting, or transposing a tritone, while keeping the remaining tritones
in the mode invariant. TB collections will be represented by sets of numbered tritones (such sets will be preceded by the subscript “T” and the tritones will be numbered as shown at the bottom of Example 2.14) listed as an m-tuple (where m is the number of tritones in the collection) with each order position (i) representing a tritone “voice.” Transformations will be allowed to act on individual tritones within a collection, and splits and fuses are as defined above.

There are six abstract types of transpositions possible for the TB modes (instead of four, as with the ATB modes)—$T_y$ produces the same overall results as $T_{y+6}$, and these transpositions may be represented collectively as $T_{y(mod-6)}$. The reader can verify that $T_{1(mod-6)}$ and $T_{5(mod-6)}$ are inverses, as are $T_{2(mod-6)}$ and $T_{4(mod-6)}$, while $T_{0(mod-6)}$ and $T_{3(mod-6)}$ are their own inverses. These mod-6 transposition classes will be helpful in discussions of abstract modal relations; however, literal mod-12 transpositions will also be used when describing how the individual pcs of one tritone map onto the pcs of another tritone in an actual musical context.

The cloche passages from Messiaen’s “Cloches d’angoisse et larmes d’adieu,” the sixth piece of his Préludes pour piano (1928-29), include a number of TB modes for examination. Example 2.16 shows the cloche statements that are heard throughout the piece. While Messiaen uses TB modes exclusively for these cloche statements, he also creates a strong impression of tonality throughout the piece, which influences the listener’s perception of the way in which these modes relate.
Example 2.16 – Cloche Passages of “Cloches d’angoisse et larmes d’adieu”

a) m. 5

b) mm. 10-13

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Example 2.16 (cont’d)

c) m. 25


d) mm. 31-37
The piece opens with a C-minor key signature and a repeated G in the left hand that may be heard as a dominant pedal to the C-minor (often combined with whole-tone) sonorities entering above it in the right hand. This non-modal material is followed by a G-major triad in m. 5, with a D♭-major triad added on the second sixteenth beat of the measure—the first part of the cloche motive shown in Example 2.16a. The second part of this motive is a superposition of two chord series—an upper chord series expressing Mode 6¹ and a lower chord series expressing Mode 2².¹¹⁴ The abstract relationship between these two modes is shown on the hexagon in Example 2.17a; Example 2.17b provides a short-hand representation of the same relationship.

Example 2.17 – Modal Superpositions in the First Cloche Motive (m. 5)

Taking into consideration the preceding material, the lower series seems to be the more fundamental progression, continuing the G dominant sound into a Mode-2 context. The roots of the G-major and D♭-major triads emphasize the

¹¹⁴ Messiaen discusses these two chord series as forming “superior resonance” of the preceding G-major/D♭-major chord complex (Messiaen 1956, 51; 1944, 70).
only two pcs that are unique to Mode $2^2$ (i.e. not found in Mode $6^1$). The upper series, then, may be heard as a variation of the lower series, altering the tonally important G and its tritone-partner D♭; or in other words, $T_{5(\text{mod}-6)}$ maps tritone 1 onto tritone 0, converting Mode $2^2$ into Mode $6^1$.

Another reason for prioritizing the lower chord series is that it follows a very systematic pattern. As Neidhöfer points out in his analysis of this passage, the “bass” and “tenor” voices move in parallel modal motion with each other, the “alto” voice moves by descending modal step, and the “soprano” voice moves in modal canon at the sixteenth note with the lowest two voices.\textsuperscript{115} Although the stepwise alto voice is at odds with the other voices in the lower series, its descending pattern is picked up by the upper chord series, but altered in three essential ways: 1) it is transformed into Mode $6^1$, 2) the third chord is an insertion which temporarily interrupts the descent, and 3) the last two chords switch temporal places. Example 2.18 provides a detailed account of how the upper chord series may be derived from the lower chord series through a number of steps.

---

Example 2.18 a) The Lower Chord Series of the Cloche Motive

<table>
<thead>
<tr>
<th>Chord:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>E</td>
<td>C♯</td>
<td>C♯</td>
<td>B♭</td>
<td>B♭</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>C♯</td>
<td>B</td>
<td>B♭</td>
<td>A♭</td>
<td>G</td>
<td>F</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>B♭</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>E</td>
<td>C♯</td>
<td>C♯</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>D</td>
<td>D</td>
<td>B</td>
<td>B</td>
<td>A♭</td>
<td>A♭</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{115} Neidhöfer 2005, 10-12.
Step 1 – Enharmonically convert all B♭s to A♭s, and all A♭s to G♭s, and delete the soprano canon, as shown in Example 2.18b.

Example 2.18 b) Transforming the Lower Chord Series into the Upper Series (Step 1 Results)

<table>
<thead>
<tr>
<th>Chord:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>C♭</td>
<td>B</td>
<td>A♭</td>
<td>G♭</td>
<td>G</td>
<td>F</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>A♭</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>E</td>
<td>C♭</td>
<td>C♭</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>D</td>
<td>D</td>
<td>B</td>
<td>B</td>
<td>G♭</td>
<td>G♭</td>
<td></td>
</tr>
</tbody>
</table>

Step 2 – Rotate the bottom note of every even-numbered chord to the top of the texture and delete the last chord, as shown in Example 2.18c.

Example 2.18 c) Transforming the Lower Chord Series into the Upper Series (Step 2 Results)

<table>
<thead>
<tr>
<th>Chord:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>C♭</td>
<td>D</td>
<td>A♭</td>
<td>B</td>
<td>G</td>
<td>G♭</td>
<td></td>
</tr>
<tr>
<td>A♭</td>
<td>B</td>
<td>G</td>
<td>G♭</td>
<td>E</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>G</td>
<td>D</td>
<td>E</td>
<td>B</td>
<td>C♭</td>
<td></td>
</tr>
</tbody>
</table>

Step 3 – Switch the temporal positions of chords 1 and 2, 3 and 4, 5 and 6, as shown in Example 2.18d. The upper chord series now follows the descending-step pattern from the alto voice of the lower chord series.

Example 2.18 d) Transforming the Lower Chord Series into the Upper Series (Step 3 Results)

<table>
<thead>
<tr>
<th>Chord:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C♭</td>
<td>B</td>
<td>A♭</td>
<td>G♭</td>
<td>G</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>A♭</td>
<td>G♭</td>
<td>G</td>
<td>F</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>F</td>
<td>E</td>
<td>D</td>
<td>C♭</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>
Step 4 – Transform the series from Mode $2^2$ to Mode $6^1$ by mapping tritone 1 onto tritone 0 via $T_e$ (that is, change all Gs to F♯s and all C♯s to Cs), as shown in Example 2.18e.

---

**Example 2.18 e) Transforming the Lower Chord Series into the Upper Series (Step 4 Results)**

<table>
<thead>
<tr>
<th>Chord:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
<td>B</td>
<td>A#</td>
<td>G#</td>
<td>F#</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>A#</td>
<td>G#</td>
<td>F#</td>
<td>F</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F#</td>
<td>F</td>
<td>E</td>
<td>D</td>
<td>C</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

---

Step 5 – Interpolate a higher chord in between chords 2 and 3 and switch the temporal positions of the last two chords to disrupt the consistent descending pattern, as shown in Example 2.18f.

---

**Example 2.18 f) The Upper Chord Series of the Cloche motive (Step 5 Final Results)**

<table>
<thead>
<tr>
<th>Chord:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
<td>E</td>
<td>B</td>
<td>A#</td>
<td>F#</td>
<td>G#</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>A#</td>
<td>D</td>
<td>G#</td>
<td>F#</td>
<td>E</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>F#</td>
<td>F</td>
<td>F#</td>
<td>E</td>
<td>D</td>
<td>B</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

The reader may be thinking that with all these intermediary steps, the two chord series are really not all that similar. However, if the first two chords of each series are examined closely, a basic pattern may be seen and heard that suggests the process outlined above. The first chord of the upper series and the second chord of the lower series have pcs B and D in common, while F♯ maps onto G. The first chord of the lower series and the second chord of the upper
series have F and A♭/B♭ in common, while C♯ maps onto C. Essentially, this passage exhibits a modally inflected chord exchange between every pair of chords, with a voice added in the middle of the texture between the two chordal streams. However, this basic pattern is altered with the interpolation and temporal switching of chords in the upper series, as discussed in step 5 above.

The reader may wonder, then, what musical reasons Messiaen might have had for making these alterations. It seems likely that the third chord of the upper series was inserted in order to delay the following E-major triad by one sixteenth note, allowing it to coincide with the E-major triad of the lower series. This E-major triad subdivides the G-major—D♭-major tritone-related triads heard just before the series, articulating the third of four possible minor-third-related “tonal” centres found in Mode 2². Similarly, Messiaen may have switched the positions of the last two chords of the upper series so that the F-minor triad would be heard on the last sixteenth note of this measure, behaving like a subdominant sonority in relation to the G dominant pedal which returns in m. 6.

The modes of the various cloche motives are summarized in Example 2.19. The asterisks in this example indicate that there are two forms of this cloche motive. I consider the first statement (heard in m. 5) to be the main form of the motive, which begins with lower-register tritone-related triads and is followed by higher-register superimposed chord series as discussed above. All non-asterisked statements are transpositions of this main statement, although they may be slightly altered in two ways: 1) semitone-related incomplete neighbour triads may decorate the tritone-related triads that begin the statement
Example 2.19 – Modes Heard in Statements of the Cloche Motive

<table>
<thead>
<tr>
<th>Section 1</th>
<th>measure:</th>
<th>5</th>
<th>10</th>
<th>11*</th>
<th>12*</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>upper series:</td>
<td>6¹</td>
<td>6¹</td>
<td>6⁵</td>
<td>6¹</td>
<td>6³</td>
<td></td>
</tr>
<tr>
<td>lower series:</td>
<td>2²</td>
<td>2²</td>
<td>2³</td>
<td>2²</td>
<td>2¹</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 2</th>
<th>measure:</th>
<th>25</th>
<th>31</th>
<th>32*</th>
<th>33</th>
<th>34*</th>
<th>35*</th>
<th>36*</th>
</tr>
</thead>
<tbody>
<tr>
<td>upper series:</td>
<td>6⁴</td>
<td>6²</td>
<td>6²</td>
<td>6⁴</td>
<td>6⁴</td>
<td>6⁶</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>lower series:</td>
<td>2²</td>
<td>2³</td>
<td>2³</td>
<td>2²</td>
<td>2¹</td>
<td>2²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(see mm. 10 and 31), and 2) the chord series may be slightly truncated (see m. 25). The asterisked statements are clearly related to the main statement (similar lower-register chords followed by higher-register chord series) but are significantly different from the motivic model (but similar to each other), involving different chordal sonorities throughout and more significant truncation of the chord series. I will refer to these as altered forms of the motive. A gradual process unfolds over the course of the piece, whereby the opening lower-register material becomes lengthened (from two to four chords) while the higher-register material becomes truncated (from seven to two chords) until finally, only the lower-register chord material remains.¹¹⁶ This material is then repeated several

¹¹⁶ This is related to Messiaen’s concept of melodic development through elimination. He writes that this procedure “consists of repeating a fragment of the theme, taking away from it successively a part of its notes up to concentration upon itself, reduction to a schematic state…. (Messiaen 1956, 35).” Il consiste à répéter un fragment du thème, en lui enlevant successivement une partie de ses notes, jusqu’à concentration sur lui-même, réduction à un état schématique…. (Messiaen 1944, 39).

This method of thematic development is also analogous to the contraction-expansion rhythm that Julian Hook identifies in Messiaen’s music, whereby a durational lengthening process alternates with a shortening process (Hook 1998, 107).
times in mm. 36 to 38.

Example 2.19 also shows that the cloche statements are grouped into two fairly similar sections. The first section of the piece begins with the G dominant-pedal material, within which the first motivic statement is heard in m. 5, and continues with four consecutive motivic statements in mm. 10 to 13. The second section, which is separated from the first section by contrasting musical material (mm. 14 to 20), begins similarly with B\textsuperscript{b} dominant-pedal material, within which another single motivic statement is heard in m. 25. This is followed by six consecutive, increasingly truncated motivic statements in mm. 31 to 36.\textsuperscript{117}

Aside from the obvious formal and motivic similarities between these two sections, there are interesting collectional and transformational processes to be observed. I will begin by examining the collectional relationships of the first section. As noted above, Mode 2\textsuperscript{2} of the lower chord series in the first and second motivic statements (mm. 5 and 10) is converted into Mode 6\textsuperscript{1} of the upper chord series by mapping tritone 1 onto 0 abstractly via \( T_{5\text{(mod-6)}} \) and literally via \( T_e \).

In m. 11, Mode 2\textsuperscript{3} of the lower series is converted into Mode 6\textsuperscript{5} of the upper series by mapping tritone 5 onto 4 via \( T_e \), after which Messiaen returns to the original collections (Modes 2\textsuperscript{2} and 6\textsuperscript{1}) in m. 12. In the final motivic statement of this first section (m. 13), Mode 2\textsuperscript{1} is converted into Mode 6\textsuperscript{3} by mapping tritone 3

\textsuperscript{117} These two sections comprise the first half of the piece as a whole. This half is characterized by a progression of dominant-function chords, the roots of which ascend by step from G in m. 1, to A in m. 13, to B\textsuperscript{b} in m. 21, to C in m. 26, to D in m. 27, to E in m. 33, and finally, to F\textsuperscript{b} in m. 34. The F\textsuperscript{b}-rooted material in mm. 34 to 38 introduces a B tonic in m. 39. The entire second half of the piece emphasizes B-rooted chords (sometimes major in quality, as reflected by the five-sharp key signature, and sometimes minor) throughout and makes extensive use of non-retrogradable rhythms and palindromic pitch structures.
onto 2, once again via $T_e$. Example 2.20 summarizes these transformations, listing the numbered tritones of each mode.

---

**Example 2.20 – Transforming Lower Series into Upper Series in “Cloches” Section One**

<table>
<thead>
<tr>
<th>m. 5/10/12</th>
<th>m. 11</th>
<th>m. 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6^1$: $\tau{0, 2, 4, 5}$</td>
<td>$6^5$: $\tau{4, 0, 2, 3}$</td>
<td>$6^3$: $\tau{2, 4, 0, 1}$</td>
</tr>
<tr>
<td>$2^2$: $\tau{1, 2, 4, 5}$</td>
<td>$2^3$: $\tau{5, 0, 2, 3}$</td>
<td>$2^1$: $\tau{3, 4, 0, 1}$</td>
</tr>
</tbody>
</table>

In considering how each of these pairs of simultaneous modes is linked to the pair that precedes and/or follows it, the connections implied by the grey dashed arrows of Example 2.20 may be considered. Example 2.21 (roughly chronological when read from bottom to top) reorders the modes of Example 2.20 to better show these linking relationships, which also move tritones by $T_e$.

In the discussion of the first *cloche* statement above, the lower series was considered to be more fundamental to the passage than the upper chord series. It would seem, then, that the middleground structure of this first section involves a progression through the three different Mode-2 collections, repeating the opening Mode $2^2$ in m. 10, moving to Mode $2^3$ in m. 11, reverting back to Mode $2^2$ in m. 12 (a brief interruption of the collectional progression), and moving to the final Mode $2^1$ in m. 13. In the foreground, the forms of Mode 6 both elaborate the forms of Mode 2 over which they are superimposed and provide a link to the form of Mode 2 of the next motive via a $T_e$ tritone transposition. Example 2.21 shows that one by one, each of the tritones of the original Mode $2^2$ moves down a
Example 2.21 – Linking Transformations between the Chord Series in “Cloches” Section One

\[
\begin{align*}
6^3: \tau\{0, 1, 2, 4\} & \quad \uparrow_{T_e} \quad \text{m. 13} \\
2^1: \tau\{0, 1, 3, 4\} & \quad \uparrow_{T_e} \\
6^6: \tau\{0, 2, 3, 4\} & \quad \uparrow_{T_e} \quad \text{m. 11} \\
2^3: \tau\{0, 2, 3, 5\} & \quad \uparrow_{T_e} \\
6^1: \tau\{0, 2, 4, 5\} & \quad \uparrow_{T_e} \quad \text{m. 5/10/12} \\
2^2: \tau\{1, 2, 4, 5\} & \quad \uparrow_{T_e}
\end{align*}
\]

semitone, eventually converting this collection into the final Mode 2^1. From this perspective, the background structure of the passage is a progression from Mode 2^2 to Mode 2^1, with Mode 2^3 as an intermediary collection. (The fact that an altered (asterisked) form of the cloche motive is presented in Mode 2^3, in contrast to the main forms presented in Mode 2^2 and Mode 2^1, also supports hearing Mode 2^3 as intermediary.)

In the middleground of this first section, Messiaen chooses one path through the three pc forms of Mode 2 via certain forms of Mode 6, but there are other possible paths using different forms of Mode 6. In order to understand Messiaen’s choices for the two sections of this piece, the possible ways of modulating from one Mode-2 collection to another through a pivotal Mode-6
collection need to be examined. In order to convert one form of Mode 2 into another, two tritones are transposed, while two tritones are left invariant. If the tritones do not move simultaneously but in two stages, one of two different forms of Mode 6 will be heard as an intermediary step, depending on which tritone moves first. Consider Modes 2\(^2\) and 2\(^3\), the first two forms of Mode 2 in the first section of the piece. In order for Mode 2\(^2\) to be converted into Mode 2\(^3\) most efficiently, tritones 1 and 4 are mapped onto tritones 0 and 3, respectively, by \(T_e\). If tritone 1 moves first, Mode 6\(^1\) appears as an intermediary stage, as shown in Example 2.22a; however, if tritone 4 moves first, Mode 6\(^4\) appears as an intermediary stage, as shown in Example 2.22b.

---

**Example 2.22 – Mode 6 as an Intermediary Stage between forms of Mode 2**

\[
\begin{array}{cc}
\text{a)} & \begin{array}{c}
2^3: \quad \tau\{0, 2, 3, 5\} \\
\uparrow T_e \\
6^1: \quad \tau\{0, 2, 4, 5\} \\
\uparrow T_e \\
2^2: \quad \tau\{1, 2, 4, 5\}
\end{array} \\
\text{b)} & \begin{array}{c}
2^3: \quad \tau\{0, 2, 3, 5\} \\
\uparrow T_e \\
6^4: \quad \tau\{1, 2, 3, 5\} \\
\uparrow T_e \\
2^2: \quad \tau\{1, 2, 4, 5\}
\end{array}
\end{array}
\]

---

Thus, in moving from one form of Mode 2 to another, a composer has two transformational pathways available to him (from this perspective). Example 2.23 shows the two possible pathways that link each of the forms of Mode 2.
Example 2.23 – Two Paths (Using Forms of Mode 6) between the Three Forms of Mode 2

\[
\begin{align*}
2^2: & \quad \tau\{ 1, \ 2, \ 4, \ 5 \} \\
      & \quad \leftarrow \quad \leftarrow \\
      & \quad 3 (6^6) \quad 0 (6^3) \\
      & \quad \leftarrow \quad \leftarrow \\
      & \quad 5 (6^6) \quad 2 (6^3) \\
2^1: & \quad \tau\{ 0, \ 1, \ 3, \ 4 \} \\
      & \quad \leftarrow \quad \leftarrow \\
      & \quad 2 (6^5) \quad 5 (6^2) \\
      & \quad \leftarrow \quad \leftarrow \\
      & \quad 4 (6^5) \quad 1 (6^2) \\
2^3: & \quad \tau\{ 5, \ 0, \ 2, \ 3 \} \\
      & \quad \leftarrow \quad \leftarrow \\
      & \quad 1 (6^4) \quad 4 (6^1) \\
      & \quad \leftarrow \quad \leftarrow \\
      & \quad 3 (6^4) \quad 0 (6^1) \\
2^2: & \quad \tau\{ 4, \ 5, \ 1, \ 2 \} \\
\end{align*}
\]

Example 2.24 shows the path Messiaen took through these collections in the first section with single-headed arrows (reading from the bottom, up).
Example 2.24 – The Transformational Path of “Cloches” Section One

\[2^2: \tau \{ 1, 2, 4, 5 \} \]

\[\overset{?}{\rightarrow} \]

\[\begin{array}{c}
3 \ (6^6) \\
5 \ (6^6) \\
4 \ (6^5) \\
2 \ (6^5) \\
1 \ (6^4) \\
3 \ (6^4) \\
2^2: \tau \{ 4, 5, 1, 2 \} \\
\end{array} \]

\[\overset{m. \ 5/10/12}{\rightarrow} \]

\[\begin{array}{c}
0 \ (6^3) \\
2 \ (6^3) \\
5 \ (6^2) \\
1 \ (6^2) \\
4 \ (6^1) \\
0 \ (6^1) \\
\end{array} \]

The move to Mode $6^3$ at the end of this section (m. 13) suggests a continuation of this process, returning to the original Mode $2^2$ (indicated with a question-marked arrow in Example 2.24), and this is exactly what begins the second section (m. 25). In the middleground of the second section, Messiaen again progresses from Mode $2^2$ (m. 25), to Mode $2^3$ (mm. 31 to 32), to Mode $2^1$ (m. 35), with an interrupting return to Mode $2^2$ in mm. 33 to 34. However, this
time, he traces a different pathway through the Mode-2 collections, using the other possible forms of Mode 6 as intermediary steps. Example 2.25 plots the path of the *cloche* motives of section two with single-headed arrows (reading from the bottom, up).

---

**Example 2.25 – The Transformational Path of “Cloches” Section Two**

\[
\begin{align*}
2^2: & \quad \tau\{ 1, \ 2, \ 4, \ 5 \} \quad \text{m. 36} \\
& \quad \quad 3 \ (6^6) \quad 0 \ (6^3) \\
& \quad \quad 5 \ (6^6) \quad 2 \ (6^3) \quad \text{m. 35} \\
2^1: & \quad \tau\{ 0, \ 1, \ 3, \ 4 \} \\
& \quad \quad 2 \ (6^5) \quad 5 \ (6^2) \\
& \quad \quad 4 \ (6^5) \quad 1 \ (6^2) \quad \text{mm. 31-32} \\
2^3: & \quad \tau\{ 5, \ 0, \ 2, \ 3 \} \\
& \quad \quad 1 \ (6^4) \quad 4 \ (6^1) \quad \text{m. 25/33-34} \\
& \quad \quad 3 \ (6^4) \quad 0 \ (6^1) \\
2^2: & \quad \tau\{ 4, \ 5, \ 1, \ 2 \} \\
\end{align*}
\]

To close off the collectional progression of the second section, Messiaen returns to Mode $2^2$ in m. 36 but omits the form of Mode 6 above it. (Instead, he modifies
the two right-hand Mode-6\textsuperscript{6} chords of the previous measure, moving the first chord up by semitone and the top two pitches of the second chord down by semitone. The result is not a TS collection of pcs.)

From a middleground perspective, these two sections seem comparable, each progressing through the three forms of Mode 2—beginning with Mode 2\textsuperscript{2}, moving through Mode 2\textsuperscript{3}, and ending with Mode 2\textsuperscript{1}. The periodically interrupting insertion of Mode 2\textsuperscript{2} (with superimposed form of Mode 6) into the middleground collectional progression of both sections helps to keep this collection, and its important dominant musical function, strongly in the listener’s ear. While Examples 2.24 and 2.25 suggest a straightforward progression through the collections over the course of each section, the Mode-2\textsuperscript{2} interruptions also provide a rondo-like alternation of collectional contrast and return, as shown in Example 2.26.

Example 2.26 – Rondo-like Alternation of Forms of Mode 2 in “Cloches”

<table>
<thead>
<tr>
<th>Measure:</th>
<th>5/10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>25</th>
<th>31/2</th>
<th>33/4</th>
<th>35</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode:</td>
<td>2\textsuperscript{2}</td>
<td>2\textsuperscript{3}</td>
<td>2\textsuperscript{2}</td>
<td>2\textsuperscript{1}</td>
<td>2\textsuperscript{2}</td>
<td>2\textsuperscript{3}</td>
<td>2\textsuperscript{2}</td>
<td>2\textsuperscript{1}</td>
<td>2\textsuperscript{2}</td>
</tr>
<tr>
<td>Form:</td>
<td>a</td>
<td>b</td>
<td>a</td>
<td>c</td>
<td>a’</td>
<td>b’</td>
<td>a’</td>
<td>c’</td>
<td>a”</td>
</tr>
</tbody>
</table>

From a background perspective, the second section appears to be identical to the first section—each of the tritones of Mode 2\textsuperscript{2} is systematically moved down a semitone until a new Mode-2\textsuperscript{1} collection is formed, and then two additional tritones are moved after that, as shown in Example 2.27.
Example 2.27 – Background Progression of “Cloches” Sections One (and Two?)

\[
\begin{align*}
5 & \quad 2 \\
& \uparrow \quad \uparrow \\
2^1: & \tau \{ 0, \ 1, \ 3, \ 4 \} \\
& \uparrow \uparrow \uparrow \uparrow \\
2^2: & \tau \{ 1, \ 2, \ 4, \ 5 \}
\end{align*}
\]

Example 2.27 suggests that tritones 2 and 5 are left “dangling” (that is, they have not yet been joined by the expected tritones 0 and 3), which seems appropriate for section one because the listener expects the process to continue later on in the piece. However, this seems less appropriate for the end of section two because here, the listener expects some indication of closure when the last cloche motive is heard. (The gradual process of lengthening the first half of the motive and shortening the second half suggests closure here as well.)

Indeed, there is a second possible interpretation of the background structure of section two that better describes both how closure is achieved and how the “dangling” tritones of section one lead into section two. In section one, the fundamental collectional motion progressed from Mode 2\(^2\) to 2\(^1\), skipping over Mode 2\(^3\) because it presented an altered form of the motive and thus, could be considered intermediary. In section two, Mode 2\(^3\) (m. 31) presents a full form of the motive, while the Mode-2\(^2\) collection that supposedly begins the background process of the section presents a truncated form. These observations suggest an alternative background progression of collections, shown in Example 2.28,
which begins with Mode $2^3$ and systematically moves each of its tritones down a semitone to convert it into the final Mode $2^2$.

Example 2.28 – Alternative Background Progression for “Cloches” Section Two

$$2^2: \tau\{ 4, 5, 1, 2 \}$$

$$\uparrow \uparrow \uparrow \uparrow \uparrow$$

$$2^3: \tau\{ 5, 0, 2, 3 \}$$

$$\uparrow \uparrow$$

$$1 \quad 4$$

This second interpretation highlights the importance of Mode $2^3$, and suggests that the section begins (rather than ends) with two “dangling” tritones which introduce Mode $2^3$. When Example 2.28 is compared with Example 2.27, it becomes evident how the two sections might “fit together,” and Example 2.29 shows how a larger-scale progression through the three forms of Mode 2 spans across the two sections, beginning and ending with Mode $2^2$.

Example 2.29 – Background Progression Spanning Both Sections of “Cloches”

Section 2

\[
\begin{array}{cccc}
4 & 5 & 1 & 2 \\
\uparrow & \uparrow & \uparrow & \uparrow \\
\end{array}
\]

$$2^2$$

Between Sections

\[
\begin{array}{cccc}
5 & 0 & 2 & 3 \\
\uparrow & \uparrow & \uparrow & \uparrow \\
\end{array}
\]

$$2^3$$

Section 1

\[
\begin{array}{cccc}
0 & 1 & 3 & 4 \\
\uparrow & \uparrow & \uparrow & \uparrow \\
\end{array}
\]

$$2^1$$

\[
\begin{array}{cccc}
1 & 2 & 4 & 5 \\
\uparrow & \uparrow & \uparrow & \uparrow \\
\end{array}
\]

$$2^2$$
For my next analysis, I will look at another of Messiaen’s piano preludes that also contains a number of different MLT. Before proceeding to this piece, however, I would like to explore in greater theoretical detail the structure of the eight-note TB modes by examining the collections that result from taking a representative form of each of these modes and transposing its four tritones by each of the five non-trivial abstract transpositions (just as I did with the ATB Mode 3 in Example 2.10), as shown in Example 2.30.

Example 2.30

a) The Tritone Transpositions of Mode $6^2 = \tau\{0, 1, 3, 5\}$

<table>
<thead>
<tr>
<th>Transposition</th>
<th>Tritones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{1\text{(mod-6)}}$</td>
<td>0^2 1^2 3^4 5^6</td>
</tr>
<tr>
<td>$T_{2\text{(mod-6)}}$</td>
<td>0^6 1^4 3^1 5^9</td>
</tr>
<tr>
<td>$T_{3\text{(mod-6)}}$</td>
<td>0^1 1^5 3^5 5^4</td>
</tr>
<tr>
<td>$T_{4\text{(mod-6)}}$</td>
<td>0^9 1^1 3^9 5^6</td>
</tr>
<tr>
<td>$T_{5\text{(mod-6)}}$</td>
<td>0^4 1^9 3^1 5^2</td>
</tr>
</tbody>
</table>

b) The Tritone Transpositions of Mode $4^2 = \tau\{0, 1, 2, 3\}$

<table>
<thead>
<tr>
<th>Transposition</th>
<th>Tritones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{1\text{(mod-6)}}$</td>
<td>0^5 1^4 2^9 3^6</td>
</tr>
<tr>
<td>$T_{2\text{(mod-6)}}$</td>
<td>0^5 1^4 2^1 3^4</td>
</tr>
<tr>
<td>$T_{3\text{(mod-6)}}$</td>
<td>0^5 1^6 2^6 3^5</td>
</tr>
<tr>
<td>$T_{4\text{(mod-6)}}$</td>
<td>0^4 1^2 2^9 3^5</td>
</tr>
<tr>
<td>$T_{5\text{(mod-6)}}$</td>
<td>0^4 1^9 2^4 3^5</td>
</tr>
</tbody>
</table>

143
Example 2.30 (cont’d)

c) The Tritone Transpositions of Mode $2^1 = \{0, 1, 3, 4\}$

<table>
<thead>
<tr>
<th>Transposition</th>
<th>Tritones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{1(mod-6)}$</td>
<td>$9^5$ $6^5$ $9^2$ $6^2$</td>
</tr>
<tr>
<td>$T_{2(mod-6)}$</td>
<td>$4^3$ $9^6$ $4^6$ $9^8$</td>
</tr>
<tr>
<td>$T_{3(mod-6)}$</td>
<td>$9^5$ $9^6$ $9^2$ $9^8$</td>
</tr>
<tr>
<td>$T_{4(mod-6)}$</td>
<td>$9^5$ $4^5$ $9^2$ $4^2$</td>
</tr>
<tr>
<td>$T_{5(mod-6)}$</td>
<td>$6^6$ $9^6$ $6^3$ $9^8$</td>
</tr>
</tbody>
</table>

A white square in these tables indicates that transposing this tritone by the specified abstract transposition converts an eight-note TB mode into another eight-note TB mode that shares three tritones, the maximum number of tritones any two non-identical eight-note TB modes can share. A grey square in these tables indicates that transposing this tritone by the specified abstract transposition does not yield a new eight-note mode. In all cases, such transformations map that tritone onto an existing tritone in the collection—a fuse that produces a set of only six pcs. There are only four distinct six-note modal forms in each table, each resulting from the disappearance of a different tritone (that is, all six-note modes within each column are identical). Because Mode 2 maps onto itself under $T_{3(mod-6)}$, none of its tritones may be transposed by this transposition to yield a new eight-note mode. I will return to the fuse and split relationships between TB modes of different cardinalities below; however for now, I will explore the interesting transformational relationships among the three eight-note modes that are suggested by these tables.
The modes that result from the transposition of each of the tritones in a collection are determined by the internal intervallic structure of the original mode being transformed. In order to understand certain relationships between these TB MLT, it is helpful to observe inversional symmetries, in addition to the transpositional symmetries on which I have been focusing all along. Example 2.31 shows the structure of Mode 6² by plotting its tritones on the mod-6 hexagon.

Example 2.31 – Mode 6² on the Mod-6 Hexagon

This representation illustrates that Mode 6² has an I₀(mod-6) axis of symmetry, causing tritones 0 and 3 to map onto themselves under this operation, and tritones 1 and 5 to map onto each other. This axis of symmetry may be composed out on a larger scale when equal-but-opposite transpositions of the I₀(mod-6)-related tritones in this collection, and the collections that are produced by these transpositions, are considered.

For instance, Example 2.30a showed that T₂(mod-6) of tritone 0 produces Mode 6⁴, while T₄(mod-6) of tritone 0 (the inverse of T₂(mod-6)) produces Mode 6⁶;
Modes $6^4$ and $6^6$ map onto each other under $I_{0(\text{mod-6})}$, as depicted in Example 2.32a. Similarly, $T_{1(\text{mod-6})}$ of tritone 3 produces Mode $4^6$, while $T_{5(\text{mod-6})}$ of tritone 3 (the inverse of $T_{1(\text{mod-6})}$) produces Mode $4^1$; Modes $4^6$ and $4^1$ map onto each other under $I_{0(\text{mod-6})}$, as shown in Example 2.32b.

Example 2.32

a) The Inversional Relationship between Modes $6^4$ and $6^6$

b) The Inversional Relationship between Modes $4^6$ and $4^1$

c) The Inversional Relationship between Modes $2^3$ and $2^1$
Example 2.32 (cont’d)

d) The Inversional Relationship between Modes $4^5$ and $4^2$

<table>
<thead>
<tr>
<th>Mode $4^5$</th>
<th>Mode $4^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 5 1 4 3 2</td>
<td></td>
</tr>
<tr>
<td>$T_{3 (\text{mod-6})}$</td>
<td>$T_{3 (\text{mod-6})}$</td>
</tr>
<tr>
<td>$I_{0 (\text{mod-6})}$</td>
<td></td>
</tr>
</tbody>
</table>

Mode $2^3$ (produced by transposing tritone 1 by $T_{1 (\text{mod-6})}$) and Mode $2^1$ (produced by transposing tritone 5 by the inverse $T_{5 (\text{mod-6})}$) map onto each under $I_{0 (\text{mod-6})}$, as shown in Example 2.32c, as do Mode $4^5$ (produced by transposing tritone 1 by $T_{3 (\text{mod-6})}$) and Mode $4^2$ (produced by transposing tritone 5 by the inverse $T_{3 (\text{mod-6})}$), as shown in Example 2.32d.

Next, I will examine the structure of Mode 4 from this perspective, plotting the tritones of the representative Mode-$4^2$ example on the mod-6 hexagon, as shown in Example 2.33.

Example 2.33 – Mode $4^2$ on the Mod-6 Hexagon
This representation shows that Mode 4² has an \( I_{3(\text{mod-6})} \) axis of symmetry, causing tritones 0 and 3, and tritones 1 and 2 to map onto each other under this operation. When the collections that are produced by the inversely-related transpositions of these inversely-related tritones (Modes 6³, 6⁴, 2¹, and 2³, 4¹ and 4³, 6² and 6⁵, as shown in Example 2.30b) are compared, they are found to be related by \( I_{3(\text{mod-6})} \) as well.

Before moving on to the Mode-2 example, I would like to briefly discuss how these inversion relationships might be understood musically. Suppose that a composer begins a piece by using Mode 4², transforming this mode in two ways: first, tritone 3 is transposed by \( T_{1(\text{mod-6})} \) to produce Mode 6³, and second, tritone 0 is transposed by the inverse \( T_{5(\text{mod-6})} \) to produce Mode 6⁴. The \( I_{3(\text{mod-6})} \) relation between these two pc forms of Mode 6 may be said to compose out (on a larger scale) the \( I_{3(\text{mod-6})} \) relation between tritones 0 and 3 within Mode 4².

Since tritones 1 and 2 are also related by \( I_{3(\text{mod-6})} \) (as are the modes derived from transforming them by equal-but-opposite transpositions), this inversionsal axis could play an important structuring role in a piece of music that uses Mode 4² as its main source of material. Similarly, the \( I_{0(\text{mod-6})} \) inversionsal axis might be prominent in a piece that uses Mode 6² as its source material, since tritones 1 and 5 map onto each other and tritones 0 and 3 map onto themselves under \( I_{0(\text{mod-6})} \), as do the modes derived from transforming them by equal-but-opposite transpositions.

When considered from this perspective, Mode 2 provides a greater variety of transpositional and inversionsal relationships with which the composer might
work, and as already discussed in the introductory chapter, the abundant resources of this collection are undoubtedly what made it Messiaen’s favourite TB mode. Example 2.34 plots the representative Mode-2\textsuperscript{1} example on the hexagon.

Example 2.34 – Mode 2\textsuperscript{1} on the Mod-6 Hexagon

![Hexagon Diagram]

This representation shows that Mode 2\textsuperscript{1} has two axes of inversional symmetry instead of one—\(I_{1\,(\text{mod-6})}\) maps tritones 0 and 1 onto each other, as well as tritones 3 and 4, while \(I_{4\,(\text{mod-6})}\) maps tritones 1 and 3 onto each other, as well as tritones 0 and 4. In addition to this second axis of inversional symmetry, Mode 2 also has a higher degree of transpositional symmetry than the other eight-note modes, mapping onto itself under \(T_{3\,(\text{mod-6})}\) as well as \(T_{0\,(\text{mod-6})}\).

This increased regularity creates a neat web of interrelations, which may be modeled by a transformational network where the contents of the nodes are the numbered tritones of Mode 2\textsuperscript{1}, as shown in Example 2.35. (While all of the inversion operations are their own inverses and thus, inversional arrows will always be doubled headed, I noted above that \(T_{3\,(\text{mod-6})}\) is also its own inverse in this system and thus, it may be written with a double-headed arrow as well.)
Example 2.35 – Network of Tritone Relationships in Mode 2¹

Similar networks may be created to show the relationships between the modes that result from transpositions of the four tritones of Mode 2¹. Example 2.36 shows the network of Mode-6 forms which result from transposing each of the four tritones of Mode 2¹ by either T₁(mod-6) or its inverse T₅(mod-6) (refer back to Example 2.30c). The location of each mode in the network corresponds to the location of the tritone (as presented in Example 2.35) that was transposed to produce it.

Example 2.36 – Network of Mode-6 Forms Derived from Mode 2¹
Similarly, Example 2.37 shows the network of Mode-4 forms which result from transposing each of the four tritones of Mode 2¹ by either $T_{2\text{mod-6}}$ or its inverse $T_{4\text{mod-6}}$ (refer back to Example 2.30c). Again, the location of each mode in the network corresponds to the location of the tritone (as presented in Example 2.35) that was transposed to produce it.

Example 2.37 – Network of Mode-4 Forms Derived from Mode 2¹

The networks of Examples 2.35 to 2.37 have the same node-arrow structure and transformations and are thus isographic.

I will now turn to the fifth piece in Messiaen’s *Préludes pour piano*, “Les sons impalpables du rêve…” (1928-29), which has an ABACABA rondo structure. The score for the last measure of the first B section, the entire second A section, and the majority of the contrasting central C section is provided in Example 2.38. As in “Cloches,” tonality plays an important role in the coordination of juxtaposed and superimposed modes in this excerpt as well. Throughout each A section, two rhythmically distinctive streams of chords in different modes (from different modal families) are superimposed. The left hand’s succession of chords
Example 2.38 – “Les sons impalpables du rêve…” – mm. 16-30
Example 2.38 (cont’d)

21

am: tonic

23

tonic

whole-tone dominant

25

-------------

27

whole-tone dominant (E’)

29

-------------

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provides the melody of the section and expresses Mode 2\textsuperscript{1}, while the repetitive right-hand chord series expresses Mode 3\textsuperscript{3}. As the key signature of this section suggests, the superimposed chord series, while maintaining their distinct identities through rhythm, articulation, and contour, are coordinated via their common A-major centre.\textsuperscript{118} As circled on the score, the right and left hands arrive simultaneously with A-major triads (with F\sharp added sixth) on a number of prominent metric downbeats.

The return of the A section is introduced at the end of the B section by material in Mode 6\textsuperscript{1}. The pitch E5 is a literal axis of modal symmetry throughout m. 16, the two lowest voices of the piano right hand and the two highest voices of the piano left hand moving towards it, then away from it by modal step (the top voice of the right hand and the bottom voice of the left hand are slightly skewed from this axis). From a pc perspective then, the passage is symmetrical about the abstract axis E—B.\textsuperscript{b} As labeled on the score, each of the chords of this

\textsuperscript{118} Messiaen writes of this passage, “In this example, the music of the upper staff repeats itself from measure to measure, independent of the music of the lower staff; it is a pedal group. The entire passage is in A major. At the same time it is polymodal and superposes two modes of limited transpositions: the third mode for the upper staff and the second mode for the lower staff.” He defines pedal group in the following way: “Instead of one sustained note, foreign to the chords which surround it, we shall have a repeated music (repetition and sustaining are equivalent), foreign to another music situated above or below it; each of these musics will have its own rhythm, melody, and harmonies” (Messiaen 1956, 55).

Dans cet exemple, la musique de la portée supérieure se répète de mesure en mesure, indépendante de la musique de la portée inférieure: c’est un groupe-pédale. Tout le passage est en la majeur. Il est en même temps polymodal et superpose deux modes à transpositions limitées: le troisième mode pour la portée supérieure et le deuxième mode pour la portée inférieure (Messiaen 1944, 81-82).

Au lieu d’une note tenue, étrangère aux accords qui l’entourent, nous aurons une musique répétée (répétition et tenue s’équivalent), étrangère à une autre musique située sur ou sous elle; ces deux musiques auront chacune leur rythme, leur mélodie, leurs harmonies (Messiaen 1944, 81).
passage can be analyzed either as an E major-ninth chord—\{E, G♯, B, (C), (D), F♯\}—or as a tritone-related, enharmonically spelled B♭ major-ninth chord—\{A♯, D, F, (F♯), (G♯), C\}; in both chords, a sixth is sometimes added and the seventh is sometimes missing. Thus, a symmetrical and tonal E centre, supported by its tritone partner B♭, is heard throughout this measure which, in relation to the A-major material of the following measure, may be regarded as having dominant function.

In the C section that begins in m. 22, the quasi-inversional canon between the two hands at the eighth note, and the accompanying sixteenth-note inner voices, express Mode 6⁵. As this new key signature suggests, a change in tonal mode (from A major to A minor) occurs along with the change in symmetrical mode (from the superimposed Modes 2¹ and 3³ to the single Mode 6⁵).
Throughout the section, A-minor triadic arpeggiation alternates with whole-tone dominant material, as labeled on the score.

This exploration of the tonal implications of this passage is not in keeping with the chromatic perspective of this chapter (I will return to this example in my discussion of the tonal perspective in Chapter 3); however this information is helpful in considering how the music progresses from one mode to another and thus, how one mode is transformed into another. The four modal collections may be ordered as scales, each beginning with their respective focal pc as discussed above. Modes 2¹, 3³, and 6⁵ begin with pc A—\(<A, B♭, C, C♯, D♯, E, F♯, G>\) (or \(1<3, 4, 0, 1>\), \(<A, B♭, C, C♯, D, E, F, F♯, G♯>\) (or \(A<1, 2, 0>\)), and \(<A, B♭, C, D, D♯,\)
E, F♯, G♯> (or τ<3, 4, 0, 2>), respectively—while Mode 6¹ begins with pc E—<E, F, F♯, G♯, A♯, B, C, D> (or τ<4, 5, 0, 2>).

I will begin by examining the transformational relationships between the TB modes of the passage. If Mode 2¹ is considered to be the main eight-note collection of the piece because of its frequent appearance as part of the A-section refrain, Modes 6¹ and 6⁵ may be understood to be generated from it in some way. Consider first the relationship between Mode 2¹ and 6⁵, the two tonic-function TB modes in the piece. It seems clear that to reflect the aural relationship between these two passages, tonic should be mapped onto tonic (with the other pcs mapping accordingly), as shown in Example 2.39.

---

Example 2.39 – “Les sons” – Transforming Mode 2¹ into Mode 6⁵ with Tonal Considerations

2¹: <A, B♭, C, C♯, D♯, E, F♯, G>  2¹: τ<3, 4, 0, 1>  
6⁵: <A, B♭, C, D, D♯, E, F♯, G♯>  or  6⁵: τ<3, 4, 0, 2>  

This tonally influenced transformation of Mode 2¹ into Mode 6⁵ follows the law of the shortest way, leaving tritones 3, 4, and 0 invariant and mapping tritone 1 onto tritone 2 via T₁. Since C♯/G disappears in this mapping, the TS collection can no longer be made to sound like A major and a contrasting A-minor tonality is heard in the C section instead. The new tritone of Mode 6⁵, D/G♯, is highlighted melodically in the whole-tone dominant material on the downbeats of mm. 24 and 25.

Now consider the relationship between the tonic-function Mode 2¹ and the
dominant-function Mode $6^1$ of this passage. Because of their differing tonal functions, it is less clear how these two collections should be related transformationally. The collections are also less similar in pc content, sharing only two of four tritones. One way in which to understand their relationship is as a two-step transformational process. As the solid arrows of Example 2.40 show, the tonic-function Mode $2^1$ may be converted into a dominant-function Mode $2^2$ via a $T_7$ transposition, before converting this intermediary collection into Mode $6^1$ by mapping pcs G and C♯ onto F♯ and C via $T_e$ (or tritone 1 onto 0 via $T_{5(mod-6)}$).

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**Example 2.40 — “Les sons” — Transforming Mode $2^1$ into Mode $6^1$ with Tonal Considerations**

<table>
<thead>
<tr>
<th>Tonic</th>
<th></th>
<th>Dominant</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2^1$: $&lt;A, B&gt;, C, C#, D#, E, F#, G&gt;$</td>
<td>$\downarrow T_e$</td>
<td>$2^2$: $&lt;E, F, G, G#, A#, B, C#, D&gt;$</td>
</tr>
<tr>
<td>$6^6$: $&lt;A, B&gt;, B, C#, D#, E, F, G&gt;$</td>
<td>$\downarrow T_e$</td>
<td>$\rightarrow$</td>
</tr>
</tbody>
</table>

 abstract shorthand representation:

<table>
<thead>
<tr>
<th>Tonic</th>
<th></th>
<th>Dominant</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2^1$: $τ&lt;3, 4, 0, 1&gt;$</td>
<td>$\downarrow T_{5(mod-6)}$</td>
<td>$2^2$: $τ&lt;4, 5, 1, 2&gt;$</td>
</tr>
<tr>
<td>$6^6$: $τ&lt;3, 4, 5, 1&gt;$</td>
<td>$\downarrow T_{1(mod-6)}$</td>
<td>$\rightarrow$</td>
</tr>
</tbody>
</table>

Alternatively, the tritone movement might be understood to occur before the tonal adjustment. As the dotted arrows of Example 2.40 show, mapping pcs C and F♯ onto B and F via $T_e$ (or tritone 0 onto 5 via $T_{5(mod-6)}$) results in an intermediary tonic-function Mode $6^6$, which is then transformed into a dominant-function Mode
$6^1$ via $T_7$. (The lower portion of the example shows the abstract representation of these transformations.)

These observations relate back to the networks of Examples 2.35 and 2.36. In this piece, a referential Mode-$2^1$ collection is transformed in two ways. The first way described above involves mapping tritone 1 onto tritone 2 to produce Mode $6^5$, shown in the top right corner of the network in Example 2.36. The second way described above (in which the tritone move occurs first, followed by the tonal adjustment) involves mapping tritone 0 onto tritone 5 to produce Mode $6^6$, shown in the top left corner of the network in Example 2.36. These two forms of Mode 6 (one in the piece, one not) are related by $I_{1\,(\text{mod-6})}$ in the network and thus, might be said to compose out on a larger scale the $I_{1\,(\text{mod-6})}$ relation heard between tritones 0 and 1 of the original Mode $2^1$. This inversional relationship, however, is not actually heard in the piece because Mode $6^6$ is tonally adjusted to become Mode $6^1$ in order to acquire a dominant function. An $I_{2\,(\text{mod-6})} \ (I_{1\,(\text{mod-6})} \cdot T_{1\,(\text{mod-6})})$ relationship is realized between the actual forms of Mode 6 in the piece instead.$^{119}$

Now that transpositions, splits, and fuses have been defined and explored in both families of modes, Example viii from the introductory chapter can be redrawn with transformational arrows, as shown in Example 2.41. All arrows to the left of the dotted line indicate tritone moves, while all arrows to the right of the

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$^{119}$ Of course, Modes $6^1$ and $6^5$ could be understood to be related by $T_{4\,(\text{mod-6})}$ rather than $I_{2\,(\text{mod-6})}$; however, Messiaen’s use of modal inversion quite prominently in both Mode-6 sections suggests that it makes more sense to consider the relation between these two collections as an inversion rather than as a transposition.
Example 2.41 – Transforming Modes from Both Families

Tritone-Based Modes

Augmented-Triad-Based Modes

Chromatic

Mode 7

Mode 2

Mode 4

Mode 6

Mode 9

Mode 5

Mode 1

Mode 8

Mode 3

dotted line indicate augmented-triad moves. Double-headed, horizontal arrows indicate that these two collections are abstractly related by a single tritone or augmented-triad transposition that preserves the cardinality of the modes involved; single-headed, upward-pointing arrows indicate a single tritone or augmented-triad split; and single-headed, downward-pointing arrows indicate a single tritone or augmented-triad fuse.

Because of space constraints, the transpositions relating modes of equal cardinality are not completely represented in Example 2.41. The eight- and six-note sub-families of modes should actually be represented as shown in Example 2.42. Examples 2.41 and 2.42 show that Mode 1 is an important link between the two modal families. In a single step, it can be transformed into two of Messiaen’s favourite modes, splitting one of its tritones to create Mode 6 or
Example 2.42 – The Eight-note and Six-note Sub-families

a) Eight-note Sub-family

b) Six-note Sub-family

splitting one of its augmented triads to create Mode 3.

This point can be illustrated by returning to “Les sons impalpables du rêve…” (Example 2.38). The TB Modes $6^1$ and $6^5$ of the B and C sections, respectively, are closely connected to the ATB Mode $3^3$ of the A section, despite belonging to different modal families. When read from bottom to top, Example 2.43 shows the chronological progression of these modes in this passage, and the bold print of this example highlights the common Mode-1$^1$ sub-collection that links all three collections.

Example 2.43 – “Les sons” – Mode 1$^1$ as a Link between Modes $6^1$, $3^3$, and $6^5$

| $6^5$: A | B♭ | C | D | D♯ | E | F♯ | G♯ |
| $3^3$: A | B♭ | C | C♯ | D | E | F | F♯ | G♯ |
| $6^1$: A♯ | B | C | D | E | F | F♯ | G♯ |
The sound of this subcollection is emphasized in different ways within each of the modes in this excerpt. In m. 16, the whole-tone aspect of Mode $6^1$ is heard in the augmented-triad subsets of the dominant-ninth chords—{C, E, G♯} within E♯ and {D, F♯, A♭} within B♭♯; in mm. 17 to 21, the whole-tone aspect of Mode $3^3$ is heard in the abundance of (026) chords in the repeated pedal group; and in mm. 22 to 32, the whole-tone aspect of Mode $6^5$ is emphasized through the use of the entire collection as the dominant-function material. Thus, while Mode 1 is often considered to be rather limited in terms of harmonic resources and sound colour, it is extremely useful as a pivotal collection in modulating between the two modal families.

So far in these analyses, I have only discussed relationships between modes that might be termed strong—tritones or augmented triads remain invariant wherever possible and transformations are as efficient and consistent as possible. Both of the Préludes discussed above involve modes that are not so closely related on the surface of the music, but I found ways to explain these weaker relations by implying strong relations in my analyses. In “Cloches d’angoisse et larmes d’adieu,” double-tritone transpositions between forms of Mode 2 are avoided (both in my analysis and in the actual music) by intermediary forms of Mode 6. In “Les sons impalpables du rêve,” the tonal functions of modes allow Mode $2^1$ to be transformed into Mode $6^1$ by a single-tritone transposition followed by a tonally adjusting transposition of the entire collection.

However, it may not make sense to describe modal relations as strong in every musical context; in fact, a composer may choose to exploit weak modal
relations so that superimposed modal layers or juxtaposed modal chunks may be
aurally differentiated more easily by the listener. In my analysis of “Action de
grâces” in Chapter 4, I will examine how Messiaen uses a variety of MLT from
different families, and how the varying strengths or distances of modal
relationships may be interpreted as a depiction of the physical relationships
between the different characters of the text. Before that, however, Chapter 3 will
delve deeper into Messiaen's use of tonality—my last perspective on the MLT—
in modal contexts.
Chapter 3 – A Tonal Perspective

At the end of the introductory chapter of this thesis, I discussed properties that make some of the Modes of Limited Transpositions (MLT) well suited for compositional use as the scalar substrata of musical works. Like the diatonic collection, Messiaen’s favourite MLT are of sufficient complexity to offer a wealth of harmonic and melodic resources, but are not so complex as to become aurally confusing or difficult for the listener to comprehend and remember. In particular, the generic and specific intervals of these collections relate in such a way as to maintain a clear distinction between the melodic and harmonic dimensions of music (steps are not larger than leaps, and leaps are not smaller than steps).

However, it was also noted in the introduction that there are some important diatonic properties that the MLT do not exhibit. For instance, within the transpositionally asymmetrical diatonic collection, each pitch class (pc) occupies a unique intervallic position, allowing for the scalar definition of a tonic pc and the subsequent hierarchization of all other pcs in reference to this tonic. In contrast, Messiaen’s MLT are generated by a repeated intervallic pattern, making it impossible (by definition) for any single pc to inhabit a unique intervallic position within the transpositionally symmetrical (TS) scale.\(^\text{120}\) The intervallic features of the MLT, then, seem to work against the scalar definition of a single tonic pc.

\(^\text{120}\) Indeed, the analytical work done in Chapter 2 took as its point of departure the observation that pcs related by \(T_4\) (or \(T_8\)) occupy analogous intervallic positions within the augmented-triad-based modes and thus, may be considered to be functionally equivalent (to the extent that function is determined by position) within these modal contexts; similarly, pcs that are related by \(T_6\) occupy analogous intervallic positions within the tritone-based modes and thus, may be considered to be functionally equivalent within these contexts.
Rather than regard this intervallic ambiguity within his MLT as a deficiency, Messiaen seems to have enjoyed the compositional flexibility that this property afforded him. He makes the following statement numerous times throughout his writings: “The Modes of Limited Transpositions are in the atmosphere of several tonalities at once, without polytonality, the composer being free to give prominence to one of the tonalities or to leave the tonal impression unsettled.”

In other words, while the symmetrical nature of each mode prevents the emergence of a single focal pc by virtue of its scalar position, a composer can create the aural impression of a tonal centre by manipulating other musical parameters and by creating other types of emphasis.

The main focus of this chapter, then, is to examine how these other musical parameters can be used to articulate (or to obscure) a potential tonal centre. I will work through a number of musical examples, exploring the various ways in which Messiaen exploits the resources of his modes in order to create a sense of tonality, tonal ambiguity, or (despite his apparent assertion to the contrary) polytonality in different musical contexts. However, before proceeding to these examples, it is important first to sketch out an answer to the question, “What kinds of features contribute to the creation of tonality in this music?”

In Technique de mon langage musical, Messiaen states quite simply that his modes may be tonally inflected “by frequent return of the tonic of the chosen key or by the use of the dominant-seventh chord in that key,” and that “nothing is

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121 Messiaen 1956, 64 (nearly identical statements are found on pp. 21, 58, and 67 as well).
Les <<modes à transpositions limitées>> sont <<dans l’atmosphère de plusieurs tonalités à la fois, sans polytonalité—le compositeur étant libre de donner la prédominance à l’une des tonalités, ou de laisser l’impression tonale flottante>> (Messiaen 1944, 94 (16, 85, 100)).
so valuable as the dominant seventh for the affirmation of tonality." In fact, there are many other aspects of Messiaen’s music that also contribute to a sense of tonal centre. Melodically, pitches are made focal by frequent repetition, as well as contour, agogic (durations), metric, and dynamic accents. In addition, the existence of a melodic “dominant”—a pitch that divides an octave span from tonic-to-tonic (either exactly or approximately)—often provides an important counterweight that stands in contrast or opposition to the tonic. Harmonically, the use of tertian sonorities (particularly, consonant triads and, as Messiaen himself emphasizes, dominant-seventh chords), as well as functional progressions, contribute strongly to the creation of tonality in this music. Finally, melody and harmony are often carefully coordinated via the principles of counterpoint and voice leading, as demonstrated recently by Christoph

\[\text{122 Messiaen 1956, 64.}\]
\[\text{Par le retour fréquent de la tonique du ton choisi, ou par l’utilisation de l’accord de 7e de dominante de ce ton (ce dernier moyen étant le plus efficace), nous mélangéons le mode à la tonalité majeure...rien ne vaut la 7e de dominante pour l’affirmation d’une tonalité (Messiaen 1944, 95).}\]
\[\text{123 Charles Smith calls this “presentational tonality”—the establishment of a tonal centre by “brute-force repetition, registral prominence, and motivic fixing” (Smith 1986, 129). Similarly, Daniel Harrison discusses “position assertion,” providing a list of characteristic behaviours and rhetorical devices that can help to establish a tonic pc in chromatic environments where “position finding” (i.e., a reliance on the rarity of certain intervals in the diatonic collection to determine a tonic pc) is no longer applicable (Harrison 1994, 73-83).}\]
\[\text{124 Rahn 1977 discusses such scalar “dominants” as aliquant or non-aliquant bisectors. An aliquant bisector can be repeated cyclically to generate an entire scale or pc collection, which is a feature of the diatonic collection but not of the MLT, as discussed in my introductory chapter.}\]
\[\text{125 Messiaen’s favourite modes (2, 3, 4, and 6) are all capable of forming major and minor triads, as well as dominant-seventh chords. For a listing of all of the mod-12 set classes (scs) found in Modes 1–6, see Neidhöfer 2005, Appendix B.}\]
Neidhöfer.¹²⁶

As my first illustration of some of these tonality-defining features, I will return to "Alléluias sereins d’une âme qui désire le ciel" from L’Ascension for organ (1933-34). As mentioned in Chapter 1, the piece opens with an eleven-measure melodic line in the right hand expressing Mode 3² (refer back to Example 1.2). The first phrase (mm. 1 to 3) is subdivided into three flourishes. The first flourish begins with an F-minor triad arpeggiation up from F₄ and ends on a durationally accented C₅ at the end of the first full measure. The second flourish begins again with F₄ and ends with a durationally accented G₄, which falls, as would an upper neighbour, back to F₄ to begin the third flourish in m. 3. This final flourish can be heard as an arpeggiation of an F-major triad back up to C₅ (embellished by G₄s appearing as passing and incomplete neighbour tones), and then an arpeggiation of an F-minor triad back down (embellished by a passing B₄) to end the phrase on a durationally accented F₄.

By placing F₄ as the lowest pitch in the contour of the line and as the root of arpeggiated consonant triads, by returning to it at the beginning of each flourish, and by giving it durational emphasis at the end of m. 3, Messiaen establishes this pitch as a clear tonic in the opening phrase of this piece. The pitch C₅ is also given emphasis as the traditional dominant, providing a temporary melodic goal and counterweight to F₄ in the line. The key signature of

¹²⁶ Neidhöfer 2008 argues that Messiaen’s desire to recast contrapuntal techniques in new and often covert ways has led to a misperception that he was unconcerned with counterpoint. Neidhöfer provides convincing analytical evidence that quasi-traditional contrapuntal principles are used on both the microscopic and macroscopic levels of Messiaen’s music.
the piece clearly suggests F major. (Indeed, there seems to be no other reason
to use this key signature, as it forces Messiaen to write several natural signs
throughout the passage in order to accommodate Mode 3\(^2\), which includes B\(_5\)
and not B\(_9\).) However, the use of both major and minor triads leaves the mode
(in the traditional sense of this term) of the opening ambiguous.

In the second phrase, F4 continues to be emphasized by durational
accent and frequent repetition. However, secondary emphasis is now given not
to the traditional melodic dominant C5 but to the tritone melodic dominant B4 by
its placement at the beginning of repeated melodic figures, as well as durational
and metric accents (in fact, considering meter, B4 has already taken some focus
away from C5 in m. 3, as it falls on the second beat of this measure). (Note that
while the use of a tritone dominant has the potential to be functionally confusing
within the tritone-based (TB) modes, there is no such confusion within the
augmented-triad-based (ATB) modes because their modular equivalences do not
occur at T\(_6\).) The melodic figure heard in mm. 5 to 6 (moving twice between B4
and F4 and then approaching F4 from below by step) is repeated twice in mm. 7
to 11 in increasingly augmented rhythm.

While F5 is not actually heard in this opening passage, the listener gets a
sense that the octave from F4 to F5 defines the outer boundaries of this melody
(the melody reaches up as far as E5, so the octave is almost achieved), and that
this span is subdivided first by the traditional melodic dominant in phrase one,
and then by the tritone melodic dominant in phrase two. Thus, Mode 3\(^2\) might be
considered to be in “authentic” scalar form (in reference to the analogous scalar
arrangement of traditional church modes) in this melody, written from tonic to
 tonic with the dominants B and C in the centre, as shown in Example 3.1.

---

Example 3.1 – Mode $3^2$ in “Authentic” Scalar Form

This opening melody forms the A section of the piece’s ABA’B’A” rondo
structure, and an F tonic is heard throughout all five sections. In the A’ section,
the original eleven-measure melodic line is repeated exactly but is now played by
the left hand, while the right hand adds a harmonic layer consisting of the
repeating trichord series discussed in Chapter 1 (see Example 1.3). This twelve-
chord series begins on a D$b$-major triad three times (mm. 24 to 27), is transposed
by $T_4$ to begin on an A-major triad three times (mm. 28 to 32), and is then
transposed by $T_4$ again to begin on an F-major triad in m. 32. Thus, while the
melodic layer provides a clear F centre throughout, the simultaneous harmonic
layer begins by articulating the other two centres that are positionally equivalent
to F within the Mode-$3^2$ scale (D$b$ and A), creating some tonal ambiguity before
finally supporting the melody’s F tonic. As Example 3.2 shows, the last
statement of the chord series breaks out of its original pattern at the beginning of
m. 34 and cadences on an $\{F, A, D_b\}$ chord in m. 36, crystallizing the positionally
equivalent “tonics” articulated in this section into a single durationally accented
augmented triad.
Example 3.2 – “Alléluias sereins d’une âme qui désire le ciel” – mm. 32-37

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In the final A’ section (mm. 56 to 75), the original melody has made its way into the organ pedal an octave lower and is now accompanied by two harmonic layers. The left hand provides a slow-moving progression of mainly tertian harmonies (although they are not always spelled as such), beginning and ending with an F-major triad. While this harmonic progression does not remain entirely in Mode $3^1$, it does emphasize the three positionally equivalent centres heard previously in the A’ section. Messiaen undermines the potential tonic status of the Di and A-rooted sonorities in this final section by adding sevenths to these chords, and thus, they are not heard as significant rivals to the F-major
tonic of this section. The right hand generally follows the left-hand progression with sixteenth-note sextuplets alternating between an arpeggiation of the left-hand harmony and a neighbouring (N) harmony (occasionally, it arpeggiates the {A, D>, F} augmented triad instead of following the left-hand harmony). In addition, Messiaen accentuates the F tonic by arranging the arpeggiated chords so that an F6 (the root of the F-major triad, the fifth of the B>−minor triad, and the third of the D>−major triad) alternates with a G6 upper neighbour at the top of the texture throughout the entire passage. This A" section is reproduced in Example 3.3.

Example 3.3 – “Alléluias” – mm. 56 to 75
Example 3.3 (cont'd)
“Alléluias” provides a good example of how a particular tonic can be created within an ATB mode. I will now turn to “Ta voix,” the sixth piece from *Poèmes pour Mi* (1936) for soprano and piano, as an illustrative example of some of these tonality-defining features within a TB mode. The form of the piece is ternary: an opening A section in mm. 1 to 8 (verse one) is followed by a contrasting B section in mm. 9 to 16 (verse two), followed by the return of A material in mm. 17 to 22 (verse three), and ending with a cadential flourish in mm. 23 to 25. Example 3.4 reproduces the last ten measures of the piece. (Note that the following analysis largely applies to the first A section as well.)

The majority of the final A section and cadential flourish shown in Example 3.4 is in Mode 2\(^1\), the only exception being the material heard in m. 22, which switches to Mode 2\(^2\). It has already been noted above that consonant triads play
an important role in creating an impression of tonality in Messiaen’s music. If any major or minor triad within Mode $2^1$ could be convincing as a tonal centre, there are eight potential “tonalities” for this mode: F♯ major or minor, A major or minor, C major or minor, E♭ major or minor.

Example 3.4 – “Ta voix” – mm. 16 to 25
Example 3.4 (cont’d)

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Richard Cohn has noted that these particular triads can be arranged into a maximally smooth harmonic progression, where a single-voice semitone motion (the result of the mod-12 neo-Riemannian contextual inversion P) alternates with a single-voice whole-tone motion (the result of mod-12 neo-Riemannian contextual inversion R), as shown in Example 3.5a;\(^{127}\) Example 3.5b highlights the cyclic nature of this progression.

---

**Example 3.5 – Maximally Smooth Voice Leading Between Triads in Mode 2\(^1\)**

<table>
<thead>
<tr>
<th>a)</th>
<th>P</th>
<th>R</th>
<th>P</th>
<th>R</th>
<th>P</th>
<th>R</th>
<th>P</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>C#</td>
<td>C#</td>
<td>C#</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>B♭</td>
<td>B♭</td>
<td>A♯</td>
</tr>
<tr>
<td>A♯</td>
<td>A</td>
<td>A</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>F♯</td>
<td></td>
</tr>
<tr>
<td>F♯</td>
<td>F♯</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>C♯</td>
<td></td>
</tr>
<tr>
<td>F♯M</td>
<td>f♯m</td>
<td>AM</td>
<td>am</td>
<td>CM</td>
<td>cm</td>
<td>EbM</td>
<td>e&gt;m</td>
<td>F♯M</td>
</tr>
</tbody>
</table>

---

Cohn has shown that such third relations and maximally smooth voice-leading patterns are important characteristics of much late-Romantic repertoire. While the right- and left-hand piano chord series found in mm. 17 to 21 of this passage are similar to Cohn’s progression in some ways, they are based on different principles, as I will now demonstrate.

---

\(^{127}\) Cohn 1997, 39-41. The reader will note that while these contextual inversions actually involve an exchange of the pcs in the invariant dyad of each transformation (for example, C# maps onto F♯ and vice versa in the first P inversion of Example 3.5), the dashed slurs indicate that this may be understood as zero overall voice-leading motion for these voices. Of course, another way to describe such a progression would be as the result of transpositions (T.\(_1\) in alternation with T.\(_2\)) working on one voice at a time to transform the chords of the progression gradually.
The right-hand series makes use of five of the eight consonant triads that are found within Mode 2\(^1\); however, the pattern that is established by these chords can be continued to reveal a complete eight-chord cycle, as shown in Example 3.6.

---

**Example 3.6** – “Ta voix” – Parallel Voice Leading Between Triads in Mode 2\(^1\) – Tonic Cycle

a) right-hand chord series:

\[
\begin{align*}
C\# & \rightarrow D\# & \rightarrow E & \rightarrow F\# & \rightarrow G & \rightarrow A & \rightarrow A\# & \rightarrow B\# & \rightarrow C\# \\
A\# & \rightarrow B\# & \rightarrow C\# & \rightarrow D\# & \rightarrow E & \rightarrow F\# & \rightarrow G & \rightarrow A & \rightarrow A\# \\
F\# & \rightarrow G & \rightarrow A & \rightarrow A\# & \rightarrow B\# & \rightarrow C\# & \rightarrow D\# & \rightarrow E & \rightarrow F\#
\end{align*}
\]

<table>
<thead>
<tr>
<th>F#M</th>
<th>b#m</th>
<th>AM</th>
<th>d#m</th>
<th>B#M</th>
<th>fsm</th>
<th>D#M</th>
<th>am</th>
<th>F#M</th>
</tr>
</thead>
</table>

- all arrows indicate \(\sigma_{T_1}\) transpositions within Mode 2\(^1\)
- arrows could be reversed to indicate \(\sigma_{T_1}\) transpositions
- brackets indicate enharmonic spellings of triads

---

This complete cycle is similar to Cohn’s cycle in a number of ways. First, it exhausts all of the consonant triads in the mode; second, it involves an alternation between major and minor triad qualities; and third, it places the major triads in the same locations within the cycle, as highlighted with boldface print in Examples 3.5 and 3.6. The important distinction between the two progressions is in the journey from one major triad to the next. While Cohn describes his progression in a mod-12 system using contextual inversions to achieve the change of quality between adjacent triads, Messiaen’s series can be described using only Mode-2 transpositions that produce the alternation of mod-12 triad
quality as an artifact of the modal context. As well, Cohn’s inversions allow for triads to be transformed via maximally smooth voice leading, while Messiaen’s transpositions involve (for the most part) stepwise modal movement in all three triadic voices simultaneously.

Together, the right- and left-hand chord series articulate all but one of the potential tonic triads available within Mode 2\(^1\) (only F\(\sharp\) minor is missing). However, the passage clearly establishes a single triad (F\(\sharp\) major) as its tonic, which is again suggested by the key signature of the piece. (Perhaps the reason Messiaen excluded the F\(\sharp\)-minor triad from these series is that he felt it would be particularly detrimental in undermining the F\(\sharp\)-major tonic that he wanted to establish in this passage.) Indeed, this combination of Mode 2 with F\(\sharp\) major was for Messiaen “a sparkling of all possible colours,” like the dazzlement of a stained-glass window, and he painted with this colour palette often.\(^{128}\) Given that A-, B\(\sharp\)-, and D\(\sharp\)-rooted triads are heard frequently in both the right- and left-hand chord series, it is important to examine the ways in which Messiaen elevates F\(\sharp\) major above the other potential tonal centres in this passage.

As illustrated in Example 3.6b, the right-hand chord series begins with the F\(\sharp\)-major triad, alternates between this and the B\(\sharp\)-minor triad, climbs up to the B\(\sharp\)-major triad, and returns from this point of furthest remove to F\(\sharp\) major via downward stepwise motion. Thus, the F\(\sharp\)-major triad is emphasized by its metric placement as the downbeat beginning of each repetition of the chord series, by

\(^{128}\) Wu 1998, 91.
its frequent articulation, and by its registral placement as the lowest chord in the contour of the series. The left-hand chord series moves around within this same triadic cycle and also emphasizes $F\#_7$ major by placing it on metric downbeats; however, instead of being the lowest triad in the contour, $F\#_7$ major is now the registral centre of the series, with the upper and lower boundaries being $A$ major and $D\#_7$ major respectively, as shown in Example 3.7.

---

Example 3.7 – “Ta voix” – Left-hand Chord Series

---

$F\#_7$ major is also emphasized in the interaction between the two chord series—it is the only chord on which the series come together to sound the same triad simultaneously. In addition, other harmonic features that emphasize this tonic centre include the $F\#_7$-major-triad pedal that supports the cadential birdsong flourish in m. 23, and the two-measure cadence at the end of the piece. As in “Alléluias,” Messiaen adds sevenths or seconds to the rival triads $E\#_7$, $A$, and $C$ at the cadence in order to diminish their tonic potential in leading to the final $F\#_7$-major triad of the piece.
F♯ is also heard prominently in the melodic line of this section because of a number of rhythmic, melodic, and harmonic features. It falls on accented poetic syllables at the beginnings of vocal phrases (mm. 17 and 19), receives durational accents (mm. 17, 23, and 25) and metric accents (mm. 17, 19, and 25), is repeated frequently throughout the piano birdsong flourish (m. 23), and is the last pc of the piece in both the voice and the piano (at registral extremes). The voice’s F♯s usually coincide with and are supported by the F♯-major triads of the piano chord series. In addition, F♯5 provides the upper contour boundary for the majority of the vocal melody (the line reaches higher only once with the G5 at the end of m. 17), and this same pitch provides the lower boundary for the majority of the cadential piano birdsong flourish (dipping below only a couple of times at the beginning of the second-to-last system).

An F♯5 pitch centre is also supported by the establishment of a melodic dominant. The traditional dominant pc that might be expected to counter the F♯ tonic is C♯, and C♯5 is indeed durationally and metrically accented as the goal of the first vocal phrase (m. 18) and as the beginning of the second half of the second phrase (after the breath mark in m. 19). However, because this pitch is usually supported by an F♯-major triad in the underlying chord series, it functions more as the fifth of the tonic triad than as the root of the traditional C♯-major dominant triad in these measures.

Instead, the B♯ tritone subdivision of the octave behaves more like a dominant would behave in a traditional tonal context. As noted above, one might
expect this pc to function in a way that is similar to the tonic F♯ pc because of its equivalent intervalllic position within the mode. However, in this vocal melody, B♯4 is often used to approach the F♯5 upper boundary, sounding like a “sol-do” anacrusis to begin the first two vocal phrases. Similarly, the enharmonically equivalent C♯5 is used to approach the final F♯5 at the end of the piece. In the birdsong flourish, the F♯5 lower boundary is most often approached from above by B♯5, although occasional emphasis is also placed on C♯6 at the beginnings of slurred groupings.

Example 3.8 summarizes the structure of the vocal and birdsong melodic lines, showing that F♯5 is the literal centre of the passage’s melodic line, being approached first from the dominant below in the voice, then from the dominant above in the piano, and once again from below in the vocal cadence.

---

Example 3.8 — “Ta voix” – Melodic Structure – Mode ² in “Plagal” Scalar Form

Vocal Line (mm. 17-21, 24-25)  Piano Flourish (m. 23)

Thus, in contrast to the “Alléluias” melodic line, which is in “authentic” scalar form spanning from tonic-to-tonic, Mode ² may be considered to be in “plagal” scalar form, written from dominant-to-dominant with the tonic F♯ in the centre.
Finally, the Mode-2\(^1\) material is contrasted collectionally with the Mode-2\(^2\) material that is used to set the parenthetical vocal phrase at the end of verse three (m. 22). This change in modal colour at the entrance of the bird (according to Messiaen, a change from blue-violet to gold-brown) also signals a change in collectional function from tonic to dominant. While the dominant C\(\#\)-major triad within Mode 2\(^2\) is not emphasized in this measure to the same extent as was the tonic F\(\#\)-major triad within Mode 2\(^1\), it is the point of departure for a similar cycle of parallel modal voice leading through which the right- and left-hand chord progressions move, as shown in Example 3.9.

Example 3.9 – “Ta voix” – Parallel Voice Leading Between Triads in Mode 2\(^2\) – Dominant Cycle

a) 
G\# \(\rightarrow\) A\# \(\rightarrow\) B \(\rightarrow\) C\# \(\rightarrow\) D \(\rightarrow\) E \(\rightarrow\) F \(\rightarrow\) G \(\rightarrow\) G\#
E\# \(\rightarrow\) G \(\rightarrow\) G\# \(\rightarrow\) A\# \(\rightarrow\) B \(\rightarrow\) C\# \(\rightarrow\) D \(\rightarrow\) E \(\rightarrow\) E\#
C\# \(\rightarrow\) D \(\rightarrow\) E \(\rightarrow\) F \(\rightarrow\) G \(\rightarrow\) G\# \(\rightarrow\) A\# \(\rightarrow\) B \(\rightarrow\) C\#
C\#M (gm) EM (asM) GM c\#m (asM) em C\#M

- all arrows indicate \(\circ T_1\) transpositions within Mode 2\(^2\)
- arrows could be reversed to indicate \(\circ T_{-1}\) transpositions
- brackets indicate enharmonic spellings of triads

In a paper given at the 2004 meeting of the Society for Music Theory, William Benjamin discusses the use of polychords within transpositionally symmetrical (TS) pc collections in creating functional harmonic progressions. He writes,
Where the octatonic scale has been invoked as one of the organizing factors in a passage, it has typically been one transposition at a time…. But no TS collection has the capacity to support hierarchical distinctions among its elements or its intervallically similar sub-collections in the way major scales do, by uniqueness of position, since every sub-collection in a TS collection is positionally equivalent to between one and five others. For this reason, no single octatonic collection, independent of how it is used in a particular context, can underpin a harmonic or melodic pitch syntax with anything like the precision of the diatonic scale.129

Benjamin then goes on to analyze a number of excerpts by a variety of early twentieth-century composers (including Messiaen) in which polychords from two different TS pc collections (in some cases, these are two unique transpositions of the same collection, and in other cases, these are two different TS collections altogether) are juxtaposed so as to create the effect of a traditional harmonic progression.

I have already discussed an example in which different hexatonic and whole-tone sub-collections within Mode 3 may be understood to represent tonic, dominant, or subdominant functions (refer back to Example 1.25 and the accompanying discussion in Chapter 1). One of the most striking examples of this type of association of different pc transpositions of an MLT with different harmonic functions is found in “Le baiser de l’Enfant-Jésus,” the fifteenth of Messiaen’s Vingt regards sur l’Enfant-Jésus for piano (1944), the first fifteen measures of which are reproduced in Example 3.10.

In her analysis of this passage, Jean Marie Wu notes that Messiaen uses an F♯-major triad with an added sixth from within Mode 21 as a tonic sonority. In the first eleven measures, this sonority alternates with a C♯ dominant-seventh

129 Benjamin 2004, 2.
Example 3.10 – “Le baiser de l’Enfant-Jésus” – mm. 1 to 15

Très lent, calme ($\frac{4}{8}$)
(Le sommeil)

(Thème de Dieu en berceuse)

$2^1 = I$

$2^2 = V^7$

$2^1 = I^{add6}$

$2^2 = V^7$

$2^1 = I^{add6}$

$2^2 = V^7$

$2^1 = I^{add6}$

$2^2 = V^7$

$2^2 = V^7$

$2^1 = I^{add6}$

$2^2 = V^7$

$2^1 = I^{add6}$

$2^3 = IV^{add6}$
Example 3.10 (cont’d)

chord within Mode $2^2$ (over an F₄ tonic pedal) to create the gentle rocking motion of a lullaby. In m. 12, a B-major triad with added sixth within Mode $2^3$ is heard as a subdominant sonority. In other words, each chord in this passage has a traditional harmonic function in the key of F₄ major and the three transpositions of Mode 2 are used to ornament or colour these chords. Thus, each transposition of Mode 2 takes on the tonal function of the chord with which it is associated, and the F₄-major tonality is clearly established by means of a tonic-subdominant-dominant-tonic harmonic progression through these three modal colours in mm. 13 to 15.

In the examples discussed thus far, various melodic and harmonic elements work together to create a single unified tonal centre; however, this is not always the case in Messiaen’s music. As noted in Messiaen’s statement regarding the nature of his MLT that was quoted at the beginning of this chapter, it is also possible for a composer to leave the tonal impression of these modes

---

$2^1 = I^{\text{add}6}$  
$2^3 = IV^{\text{add}6}$  
$2^2 = V^7$  
$2^1 = I^{\text{add}6}$

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$^{130}$ Wu 1998, 91.

Neidhöfer 2008, 3 also discusses this passage, analyzing m. 4 as a right-hand melody combined with a left-hand countermelody, each reinforced with chord clusters that move in parallel within the mode.
more or less unsettled by fluctuating between different possible centres within the same textural layer or by articulating conflicting centres simultaneously in different layers.

I would argue that the tonal implications of “Le baiser” are relatively unambiguous, and that the tonal ambiguities heard in “Alléluias” and “Ta voix” are fairly subtle, with a particular tonic pc or triad clearly winning out over other potential centres in the mode. I will now examine a piece in which Messiaen highlights the positional equivalences of pcs within the modes in order to leave the tonal impression more significantly unsettled. Refer back to Example 2.2, which reproduces the first fifteen measures of “La Vierge et l’Enfant” from La Nativité du Seigneur: neuf méditations for organ (1935). The first two phrases of this piece are entirely in Mode 2¹ which, as already noted, has intervallic equivalences at T₃, T₆, and T₉.

In the right-hand melodic line of the first phrase (mm. 1 to 4), A5 is particularly emphasized by contour (as the lowest pitch in the line), by coincidence with changes of harmony in the left hand, by metric placement (on downbeats and at the beginnings of beamed groupings), by durational accent, and by beginning and closing the phrase. However, A5 is rivaled throughout the phrase by C6, which is also emphasized by changes of harmony, metric placement, and duration. F♯6, although less focal than A5 and C6, is emphasized by contour (as the highest pitch in the line) and by its initiation of the flourishes which descend to the focal A5 at the beginning of mm. 1 and 2. E♭6, while not particularly focal in the phrase in most respects, does receive a contour
accent as the highest point within each measure (after the opening flourish) and completes the arpeggiation of a diminished triad up from A5, which proves to be an important melodic structure in the remainder of this opening section.

The melodic line of the second phrase (mm. 5 to 7) is almost an exact transposition of the first phrase by T.3, and its analogous focal pitches in order of importance are therefore F#5, A5, E♭6, and C6. The omission of the expected F#5 at the end of this second phrase results in closure on the original A5 and thus, a rounding of the opening period-like structure. It is tempting to hear A5 as a focal centre across both of these opening phrases; however the various types of melodic emphasis that are placed on the equivalent pcs F#5, C, and E♭ within the mode also create strong rivals to this centre and thus, a sense of tonal ambiguity within this layer.

As Example 3.11 shows, the melodic line of mm. 8 to 15 further clarifies and elevates the status of the symmetrical fully-diminished-seventh chord (or its diminished-triad subset) as the essential motivic unit in this section. After the arpeggiation of the first diminished-seventh chord {F#, A, C, E♭} in mm. 1 to 7, a two-measure sequential model is established in mm. 8 and 9 that moves through a triadic subset of the second diminished-seventh chord {F, Ab, B, D} (within a Mode-3\(^1\) context), and then a triadic subset of the third diminished-seventh chord {E, G, B♭, D♭} (within a Mode-2\(^1\) context). This pattern is transposed by T.2 in mm. 10 and 11, moving through triadic subsets of diminished-sevenths 1 (within Mode 3\(^3\)) and 2 (within Mode 2\(^2\)). The pattern is then truncated, with only its
Example 3.11 – “La Vierge et l’Enfant” – reduction of mm. 1 to 15 (m. 4 omitted)

second half being transposed by $T_2$ during the second half of m. 11, which results in a return to a diminished-seventh 1 subset (now within a Mode-$2^3$ context). In mm. 12 to 15, the $<C5, E^5, G^5>$ diminished triad is momentarily
reduced to the tritone <C5, G♭5> (within the original Mode-2\textsuperscript{1} context), expands to the entire fully-diminished-seventh chord <C5, E♭5, F♯5, A5> (changing to a Mode-3\textsuperscript{3} context under the F♯5), and ends finally on C5 at the cadence.

Thus, as Example 3.12 shows, the melody of this section moves at the background level first by T\textsuperscript{-3} from A5 to F♯5 in mm. 1 to 7 and eventually by T\textsuperscript{-6} to C5 in m. 15.

Example 3.12 – “La Vierge et l'Enfant” – Background Structure of mm. 1 to 15

Instead of subdividing the tritone from F♯5 to C5 with E♭5 as might be expected, Messiaen moves down sequentially by T\textsuperscript{-2} from F♯5 to E5 (m. 9), to D5 (m.11), and finally to C5 (mm. 11 to 15), the goal of the fully-diminished-seventh-chord background descent from A5.

I will now turn to the left-hand harmonic layer of this section, a reduction of which is found in Example 3.11 beneath the melodic layer. Almost all of the sonorities used in this section are tertian—either triads or seventh chords—and may be heard as having traditional roots. As Example 3.11 shows, all chordal
roots in the first two phrases belong to the same fully-diminished-seventh-chord 1 that is arpeggiated by the melodic line \{C, F#, E≫, A\}. However, the root of a harmony never belongs to the same pc as the melodic pitch it supports. The focal A5 of the melody, for example, is sometimes supported with a C-rooted chord (dominant seventh in mm. 1 and 2 and major triad in m. 3) and sometimes with an E≫-rooted chord (major triads in mm. 1 and 2), but never with an A-rooted chord. In fact, Messiaen avoids A-rooted sonorities entirely in this first phrase. Instead, the C-rooted chords are made to sound focal through durational and metric accents and by beginning and ending the phrase (although not through functional harmonic progressions).

Melodic pitches and harmonic roots are similarly uncoordinated in the second phrase. With the T₃ transposition of the first phrase, the missing A-rooted harmonies now appear and are made focal in the second phrase, but they are used to support melodic F♯s. Tonal ambiguity is thus created in mm. 1 through 7 both by the horizontal fluctuation between positionally equivalent tonal centres within the mode and by the vertical discontinuity between the melodic and harmonic layers. To create further disruption, pitches that do not belong to the prominent fully-diminished-seventh-chord 1 are used as pedal tones throughout these two phrases. In the first phrase, the pitch B≫4 is first heard as the seventh of the C dominant-seventh chord; it is then held constant while the two upper voices rise by step to create F♯- and E≫-major triads and then descend to return to the focal C chord. The B≫4 pedal sounds a major-seventh
dissonance against the focal A5 melodic pitch. Similarly in the second phrase, the pitch G4 is heard first within the A dominant-seventh chord and then within the E♭ and C-major chords, clashing against the melodic pitch F♯5.

Like the melodic line, the background progression of roots for this section outlines a descending fully-diminished-seventh chord, but spans from C to E♭ instead of from A to C, as shown in Example 3.12. After descending from C to A over the first two phrases, the listener might expect the root progression to parallel the melodic line exactly by continuing directly down by step to E♭.

Instead, C-rooted harmonies return in mm. 8 and 9, and it is from here that the root progression continues sequentially down by whole tone to B♭-rooted harmonies in mm. 10 and 11, and to an A♭-rooted harmony in the second half of m. 11. The leap back up to C in m. 8 results in interval-class (ic)-4 relations (often associated with ATB modes such as Mode 3, forms of which are heard throughout these measures) against the melodic line, which contrast with the ic-3 relations (associated with TB modes such as Mode 2) heard in the first two phrases. To return to ic-3 relations with the melodic line, the E♭ root-progression goal in m. 12 is approached by descending fourth. The line then continues one descending fourth further to end the section on a B♭ dominant-ninth sonority. The listener might expect this dominant to confirm an E♭ tonic in the following section, but as with many other tonal implications in this piece, this resolution does not materialize.
The second section, the first system of which is given in Example 3.13, contrasts significantly with the first section; however, the same tonal ambiguities and lack of coordination between the melodic and harmonic layers are at work.

Example 3.13 – “La Vierge et l’Enfant” – mm. 16-17

The entire B section is in Mode 6\(^1\) and consists of three superimposed layers: a repetitive pedal bass line that uses only pitches D3, E3, F3, and G#3 (derived from Messiaen’s first melodic cadence formula), a repeated series of trichords in the left hand, and a melodic line (also fairly repetitive) in the right hand.\(^{131}\) The right-hand melodic line places strong emphasis on D6 as a focal centre (by repetition, durational and metric accents, and so on), and the pedal line supports this centre with durationally and metrically accented D3s, although durational and contour emphasis is also placed on the positionally equivalent G#3. The left-

\(^{131}\) Messiaen highlights this passage in the discussion of his use of plainchant as “an inexhaustible mine of rare and expressive melodic contours.” He writes, “We shall make use of them, forgetting their modes and rhythms for the use of ours” and says that the right-hand material of this section transforms a fragment from the *Introït de Noël* (Messiaen 1956, 33). Le plain-chant est une mine inépuisable de contours mélodiques rares et expressifs... Nous nous en servirons, en oubliant leurs modes et leurs rythmes au profit des nôtres (Messiaen 1944, 34).
hand chord series begins each time with an F-minor triad (spelled with a G♯) and arrives on another consonant triad (E major, B minor, or B♯ major) with every second chord. The chords which alternate with the consonant triads in the series belong to mod-12 scs (048) or (027).

Despite the consonant triads, there are no clear tonal implications in this left-hand harmonic layer. The F-minor triad receives some emphasis as the first and lowest chord in the series, and the B♯-major triad receives some emphasis as the highest chord of the series, but no real centricity emerges as a result. Perhaps the more important point to note, however, is that Messiaen does not support the D centre of the right-hand and pedal melodic lines with D-rooted chords, despite the fact that both D-major and -minor triads are available within Mode 6¹. Just as in the first section, he seems to avoid supporting the tonal centre of the melodic layer(s) with the harmonic layer, creating tonal ambiguity in the section.

The final section of this piece (beginning in m. 35) is closely related to the first section. In fact, the first two phrases of the final section are an exact transposition of the first two phrases of the first section down a major ninth, and thus, Mode 2² is heard until m. 42. Following a short right-hand cadenza that moves through all three transpositions of Mode 2 (m. 43), the piece finishes with a single chord belonging to Mode 2². Because of the major-ninth transposition, this A’ section begins with a melodic G focal centre over a harmonic A♯ focal centre. Thus, there is no confirmation of the piece’s opening centres (A/C) or mode (Mode 2¹) in the final section. Instead, there is an arpeggiation of fourths.
in the melodic and harmonic centres of the three sections, as shown in Example 3.14.

Example 3.14 – "La Vierge et l'Enfant" – Arpeggiation of Fourths across the Three Sections

<table>
<thead>
<tr>
<th></th>
<th>A section</th>
<th>B section</th>
<th>A' section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melodic Centre:</td>
<td>A</td>
<td>D</td>
<td>G</td>
</tr>
<tr>
<td>Harmonic Centre:</td>
<td>C</td>
<td>F?</td>
<td>A#</td>
</tr>
</tbody>
</table>

When different layers articulate different tonal centres, it is tempting to term this situation *polytonality*; however, Messiaen specifically states that when the superimposed layers employ the same pc transposition of the same mode, this is not an instance of polytonality. So, what does it mean for a passage to be “in the atmosphere of several tonalities at once, without polytonality?” Based on comments that he makes in *Technique de mon langage musical*, it is likely that in this statement, Messiaen was referring to the polytonality of composers such as Darius Milhaud, where superimposed layers are differentiated not only by their differing tonics but also by their differing diatonic collections. It seems that, for Messiaen, polytonality cannot occur in a passage where only a single mode is used at any given time (even if there are multiple simultaneous layers and tonal centres), because the music is still unified by a common modal colour (or palette of colours). He writes of such so-called polytonal sonorities that “the modal force

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132 Messiaen 1956, 52; 1944, 72. Here, Messiaen cites a chord progression that exhibits “a polytonality particularly dear to Milhaud.”
always absorbs them."^{133}

However, musical contexts where superimposed layers (or juxtaposed blocks) are differentiated by having different modes (colours)—what Messiaen terms polymodality—present other possibilities for consideration. If tonality is involved in the layers (or blocks) of a polymodal context, one of two situations can occur: 1) the layers (blocks) share a common tonal centre and are thus unified by tonality, or 2) the layers (blocks) have different tonal centres and are thus further differentiated by tonality, adding a dimension of actual polytonality to the polymodality of the passage.

Excerpts that illustrate the first polymodal situation have already been analyzed in this thesis. In Chapter 2, I briefly mentioned that one of the ways in which Messiaen unifies the different modes heard in mm. 1 to 10 of “Amen du Désir” is by choosing chords in the left hand of piano two that all belong to a G-major diatonic collection (see Example 1.32 and accompanying discussion at the beginning of Chapter 2). More substantial discussion was devoted in Chapter 2 to the way in which superimposed forms of Modes 2 and 3 are unified (and also linked to a juxtaposed form of Mode 6) via a common tonal centre (and a similar Bluish hue) in “Les sons impalpables du rêve...”^{134} In my analysis of the A sections of this piece (refer back to Example 2.38), I noted that the superimposed chord series maintain their distinct identities through rhythm, articulation, and

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^{133} Messiaen 1956, 67.
^{134} In his discussion of modal colours, Messiaen describes Mode 2\(^1\) as predominantly blue-violet, Mode 3\(^3\) as predominantly blue and green, and Mode 6\(^5\) as predominantly gold, pale blue, and violet, with brown patterns (Messiaen 2002, 118, 123, 134).
contour, but also work together to articulate an A-major centre; as circled on the score, the right and left hands arrive simultaneously with A-major sonorities on a number of prominent metric downbeats.

If these two chord series are also considered separately, other ways in which A major is emphasized may be discovered. In almost all of its repetitions, the right-hand chord series begins with an A-major triad, which also receives a contour accent as the highest point in the series. In addition, a functional harmonic progression supporting A major may be heard, particularly if an accompanying bass line is imagined like the one posited in Example 3.15.

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**Example 3.15** – “Les sons impalpables du rêve...”— Right-hand Chord Series – (Mode 3°)

As this example shows, the chords that fall on the quarter-note beats, as well as the last chord of the series, may be analyzed with Roman numerals to indicate their traditional identity in the key of A major. The major-third-related F-major triad (the lowered submediant) may be considered to be an extension of
the tonic-function A-major triad, while the major-third-related B♭-major triad (the Neapolitan) may be considered to be an extension of the subdominant-function D-major triad. The (026) whole-tone chord at the end of the measure fulfills a dominant-function role, presenting the G♭ leading tone that resolves up to A at the beginning of the next statement of the series. The parsing of the Mode-3\(^3\) scale shown below the chord series suggests that, rather than assigning different harmonic functions to different TS collections, perhaps different harmonic functions could be associated with different augmented triads within this single collection. That is, chords with roots belonging to the augmented-triad \{A, C♯, F\} may be said to take on tonic function, chords with roots belonging to augmented-triad \{D, F♯, B♭\} take on subdominant function, and chords with roots belonging to augmented-triad \{E, G♯, C\} take on dominant function.

The left-hand material sounds even less traditional than the right-hand material, but its pitch centre is nonetheless fairly clear. The A-major triad (with added F♯ sixth) is established more by frequent repetition (most significantly, at the beginnings and endings of slurred articulation groupings) than by functional harmonic progressions. However, a rough alternation between the two minor-seventh chords which may be used to parse the pcs of this Mode-2\(^1\) scale creates a harmonic fluctuation between stability and tension, as shown in Example 3.16. Thus, in each chord series, Messiaen works with the materials that are available within each MLT in order to create a unified tonal impression.
Messiaen’s comments on the subject of polytonality suggest that he had an aversion to thinking of his music in this way, and his polymodal layers are indeed most often unified (rather than differentiated) by tonality in his music.\footnote{It has already been observed that Messiaen had a desire to distinguish himself from his predecessors, avoiding the current musical trends of the time. His rejection of the whole-tone collection was intended to put distance between his music and that of Debussy and Dukas. Similarly, Neidhöfer notes that Messiaen was also opposed to neo-classicism (associated particularly with Stravinsky and members of Les Six), which has led to the misconception that he was generally unconcerned with contrapuntal principles (Neidhöfer 2008, 1-2). It seems likely, then, that this aversion to polytonality was yet another attempt to assert his compositional independence by distancing his music from that of Milhaud, and perhaps also from the controversial debate in the French musical press over the artistic legitimacy of polytonality in general (see De Médicis 2005 for a discussion of this debate).} However, I would argue that examples of the second type of polymodal situation can be found. In Chapter 2, I discussed the opening of “Le collier,” noting the way in which common mod-12 subsets are used to link the superimposed modal
layers (see Example 2.3 and accompanying discussion). However, it is also interesting to take note of the tonal relationships within this passage.

The left-hand chord series of the piano returns frequently to an E-major triad throughout the passage, regardless of whether its mode is $2^2$ (as in mm. 1 to 4 and 9 to 10) or $3^1$ (as in mm. 5 to 8). The right-hand chord series, which always differs in mode from the left-hand material over which it is superimposed, provides triads that clash against this E-major centre, emphasizing C minor (in mm. 1 to 4 and 9 to 10) and B♭ major (in mm. 5 to 8) in particular. This polytonal atmosphere is quickly disrupted, however, when an extended and emphatic B dominant-ninth chord enters in m. 11, confirming the E-major triad of the left hand as the real tonic chord of the passage.

The analysis of “Action de grâces” in Chapter 4 also provides an example of a passage where musical layers are differentiated both by their modes (colours) and by their tonal centres—an instance of true polytonality in addition to polymodality. However, instead of focusing on the polytonal features of such passages, Messiaen speaks poetically of the resulting colourful effect:

If we juxtapose two very different but non-complementary colours (for example a turquoise blue and a violet red, with the same saturation, the same lucidity, and the same amount), it will produce a scintillating phenomenon. In the same way, if we juxtapose several different chords, of the same strength, the same register, the same duration, in a fast enough tempo, the music will appear to throw fire, like diamonds, like the light of stars....

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136 Messiaen 2002, 103. Translation is mine.
Si nous juxtaposons deux couleurs très différentes mais non complémentaires (par exemple un bleu turquoise et un rouge violet, avec la même saturation, la même clarté, la même quantité): il se produira un phénomène de scintillement. De même: si nous juxtaposons plusieurs accords différents, de même force, de même registre, de même durée, dans un tempo assez rapide, la musique semblera lancer des feux, comme les diamants, comme la lumière des étoiles....
Chapter 4 – Combining all Three Perspectives: An Analysis of Messiaen’s “Action de grâces” from Poèmes pour Mi for Soprano and Piano

Messiaen’s marriage to his first wife, Claire Delbos, whom he nicknamed ‘Mi,’ was the inspiration for the song cycle Poèmes pour Mi, composed early in his career in 1936 (and orchestrated in 1937). The texts of these pieces, which Messiaen wrote himself, speak passionately about the bliss of marital love, but they are also steeped in religious imagery, an expression of the composer’s deeply Catholic spiritual beliefs. Using the analytical tools developed in Chapters 1 to 3, I will show in this final chapter how modal, chromatic, and tonal elements combine in the first piece of this cycle, “Action de grâces,” to produce a rich musical fabric that beautifully depicts the sentiments of the text.

The piece begins with what could be described as a counterpoint of two chord series, one for each hand of the piano. This pair of superimposed piano chord series serves as an introduction (mm. 1 to 2) to the vocal entrance in m. 3, and is then repeated as a refrain following verse one (in mm. 5 to 6), and (with significant extension) following verse two (in mm. 15 to 18). After each statement of the superimposed series, the piano plays a figure that is characterized by converging trichords in the two hands (in mm. 2 to 3, 6 to 7, 19 to 20); this same figure is also used throughout verses two and three to punctuate vocal words and phrases (in mm. 8, 10, 12 to 13, 20, 22, and 24 to 27). The first twenty-eight measures constitute Part 1 of the piece. As shown on the score (see Appendix B), the music of Part 1 may be parsed into superimposed layers and juxtaposed blocks of material based on the various forms of Modes 2, 3, and 6 that are heard throughout.
The opening piano material is an effective point of departure as it displays interesting features from all three perspectives. I will begin by examining the right-hand chord series. As noted at the end of Chapter 1, this series involves a six-trichord pattern moving in parallel motion within Mode $3^2$ (N2). In fact, Messiaen uses the same modal trichord $n(025)$ as was found in the chord series of “Alléluias sereins d’une âme qui désire le ciel” (refer back to Example 1.3). Example 4.1 shows that the modal transformational structure of the chord-series melodic contour (as articulated by the first, last, highest, and lowest boundary chords) may be derived from the internal structure of each of the chords in the series; the similarity to the “Alléluias” analysis is striking (compare Example 4.1 with Examples 1.4 and 1.5).

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**Example 4.1 — “Action de grâces” – Transformational Relationships in the N2 Chord Series**

a) Individual Chord Structure (First Chord \{A♭, D♭, F\} as a Representative Example)

![Diagram of individual chord structure](image)

b) Large-Scale Series Structure

![Diagram of large-scale series structure](image)

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While Example 4.1 provides an analysis of the small-scale harmonic structure and large-scale melodic structure of the series from the modal
perspective only, Example 4.2 examines and compares these features from all three perspectives. For now, the tonal perspective (last column and bottom row) simply provides the label that would be given to these chords (often enharmonically respelled) in a traditional tonal context, indicating chord quality and root, if applicable. A more careful examination of harmonic function, progression, and centricity will be undertaken later in the chapter.

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**Example 4.2** – “Action de grâces” – Harmonic and Melodic Structure of the Right-Hand (N2) Chord Series

<table>
<thead>
<tr>
<th></th>
<th>First/High Chord</th>
<th>Low Chord</th>
<th>Last Chord</th>
<th>Mod-9 sc (melodic)</th>
<th>Mod-12 sc (melodic)</th>
<th>Traditional Name (melodic)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top Voice</strong></td>
<td>F</td>
<td>A</td>
<td>Eb</td>
<td>n(025)</td>
<td>(026)</td>
<td>(whole tone)</td>
</tr>
<tr>
<td><strong>Middle Voice</strong></td>
<td>D♭</td>
<td>F</td>
<td>B</td>
<td>n(025)</td>
<td>(026)</td>
<td>(whole tone)</td>
</tr>
<tr>
<td><strong>Bottom Voice</strong></td>
<td>A♭</td>
<td>C</td>
<td>F</td>
<td>n(025)</td>
<td>(037)</td>
<td>fm triad</td>
</tr>
</tbody>
</table>

The columns labeled “First/High Chord,” “Low Chord,” and “Last Chord” in the table show the pitch-class (pc) content of the boundary chords and the corresponding mod-9, mod-12, and traditional labels for these harmonic pc sets. As in “Alléluias,” all of the chords in this series belong to the same modal set class (sc) n(025), but may belong to one of two mod-12 scs—(037) or (026). In a
traditional tonal context, some of these chords would be labeled as major triads with roots, while others do not have a traditional tonal identity (whole tone). Thus, the harmonic content of this series is completely consistent from a modal (mod-9) perspective, but somewhat varied from both mod-12 and tonal perspectives.

The rows labeled “Top Voice,” “Middle Voice,” and “Bottom Voice” show the melodic pc sets outlined by the contour boundaries and registral associations, as well as the corresponding mod-9, mod-12, and traditional labels. As the table illustrates, the three voices are equivalent from a mod-9 perspective (again, all form \( n(025) \) trichords), but somewhat varied from mod-12 and tonal perspectives (one arpeggiated (037) minor triad and two (026) whole-tone chords). Thus, the melodic content of this series is similar to the harmonic content.

The left-hand chord series is in rhythmic canon with the right-hand series, beginning one quarter note later. While its rhythmic structure is virtually identical to that of the right-hand series (only the endings differ), the left-hand series involves a repeated five-chord pattern and is set in the contrasting Mode 2\(^1\) (O1). For the most part, the trichords of this series also move in parallel motion within the mode; however, there is one small deviation from this voice-leading pattern.

In the movement from the fourth chord \{C\#, F\#, B\#\} to the fifth chord \{G, C, D\#\} in the series, the bottom and middle voices move up by four steps within Mode 2\(^1\), while the top voice moves up by only three steps. To make the voice leading of this series completely parallel within the mode and, thus, make each chord identical in modal intervalllic structure, the D\#5 in the top voice of the fifth chord
would need to be changed to an E5.  It is possible that Messiaen made this change because he wanted to avoid stating the same C-major-to-A-major succession of chords that occurs only one eighth note later in the right-hand series. (I will posit a second interpretation as to the meaning of this deviation shortly; the main point I would like to make here is that I do not believe this D♯ to be the result of a compositional or printing error.)

Example 4.3 provides a similar analysis of the left-hand series from all three perspectives. The harmonic and melodic results of the deviation can be seen in the “High Chord” column and the “Top Voice” row of the table. Interestingly, the unexpected D♯5 does not produce any harmonic inconsistency from the mod-8 or mod-12 perspectives; however, it does produce a variation from the tonal perspective by introducing a minor triad instead of the expected major triad that would result if E5 were used. Melodically, the D♯5 produces more significant inconsistency, as the pc set expressed in the general contour of the top voice (as articulated by the boundary chords) differs in structure from all three perspectives from those expressed by the other two voices.

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137 Alternatively, the middle and bottom voices could be changed to B♯4 and F♯4, respectively. I consider this to be a less convincing possibility because it involves interpreting two voices as skewed from the pattern instead of one, and because these particular pcs have just been played as the top and middle voices of the preceding chord. Holding these two pcs in common between chords four and five would obscure the upward ascent from chords 3 to 5, and would diminish the climactic effect of chord 5 as the high point in the overall contour of the series. As well, this possibility would mean that no C-rooted chord would be articulated by the left hand, and Messiaen is clearly using all four pcs of the fully-diminished-seventh chord {A, C, E♯, F♯} as roots in this chord series.
Example 4.3 – “Action de grâces” – Harmonic and Melodic Structure of the Left-Hand (O1) Chord Series

<table>
<thead>
<tr>
<th></th>
<th>First/Last Chord</th>
<th>Low Chord</th>
<th>High Chord</th>
<th>Mod-8 sc (melodic)</th>
<th>Mod-12 sc (melodic)</th>
<th>Traditional Name (melodic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Voice</td>
<td>C₂</td>
<td>G</td>
<td>D₇</td>
<td>o(014)</td>
<td>(026)</td>
<td>(whole tone)</td>
</tr>
<tr>
<td>Middle Voice</td>
<td>A</td>
<td>D₇</td>
<td>C</td>
<td>o(024)</td>
<td>(036)</td>
<td>a° triad</td>
</tr>
<tr>
<td>Bottom Voice</td>
<td>E</td>
<td>B₃</td>
<td>G</td>
<td>o(024)</td>
<td>(036)</td>
<td>e° triad</td>
</tr>
<tr>
<td>Mod-8 sc (harmonic)</td>
<td>o(025)</td>
<td>o(025)</td>
<td>o(025)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mod-12 sc (harmonic)</td>
<td>(037)</td>
<td>(037)</td>
<td>(037)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional Name (harmonic)</td>
<td>AM triad</td>
<td>E₃M triad</td>
<td>cm triad</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Before speculating further as to why Messiaen might have skewed the pattern of the left-hand series in this subtle way, I would like to begin an examination of the relationship between the two series, as well as of the following musical material. As suggested by Examples 4.2 and 4.3 and discussed in Chapter 1 (see Example 1.29), the trichords found in each hand all belong to the same modal sc χ(025). This modal structure is then translated into Mode 6¹ (F1) in the converging figure that follows the chord series; this figure, with its characteristic contrary-motion voice leading between the two hands, returns frequently throughout the first part of the piece in different forms of Modes 6 and 3, as summarized in Example 1.31. While it is not possible to preserve the exact modal intervallic content when translating a modal sc into another mode of differing cardinality, the fact that almost all of the trichords in this passage may be represented by the transformational network shown in Example 4.4a (which
arranges the nodes so as to reflect the registral presentation of each pc as a member of the top, middle, or bottom voices of the chord) indicates some consistency of structure from this perspective.

Example 4.4 – Modal Transformational Structure of Trichords in Part 1 of “Action de grâces”

The reader will note that it is not possible to reverse the direction of the arrows in Example 4.4a, as the transpositional labels for such arrows will differ depending on the cardinality of the mode in which the trichord is placed (for example, the inverse of $xT_2$ is $xT_6$ in an eight-note mode and $xT_7$ in a nine-note mode). The focus placed on these particular transformational relationships, however, makes analytical sense when the tonal identity of some of these chords is taken into consideration; the majority of trichords in this passage are consonant triads in second inversion with the root (or analogous pc in the case of the other occasional chord types) in the middle voice. Example 4.4b rearranges the nodes and arrows of Example 4.4a to give the visual impression of a triad in root position, and to show that the transpositional relationships which are maintained in any modal context are those from “root” to “third” (middle to top
voice), “root” to “fifth” (middle to bottom voice), and from “third” to “fifth” (top to bottom voice), a fairly traditional way of describing such a trichord.

As shown in Example 1.30, the translation of this modal trichord into different modal contexts results in different patterns of mod-12 scs. Modal sc $\chi(025)$ teases out all of the mod-12 (037) trichords found in Modes 2, 3, and 6, which explains the harmonic preponderance of this mod-12 sc in each chord series, as well as in the statements of the converging figure. Thus, in the harmonic domain, the chord series and converging figures are unified both from a modal perspective with sc $\chi(025)$ and from a chromatic perspective with sc (037).

In contrast, the modal scs expressed in the melodic domain of each chord series indicate dissimilarity between the two hands. However, upon examination of these melodic sets from a mod-12 perspective, an interesting link may be found—one which provides the second possible explanation for the D± deviation in the left hand. By changing the expected E5 to a D±5, Messiaen creates a mod-12 (026) trichord in the left-hand top-voice melodic contour, the same sc that is expressed by the right-hand top-voice melodic contour, as shown in the top row of Examples 4.3 and 4.2, respectively. Thus, the two chord series are also unified by their common melodic mod-12 sc (a sc that is commonly associated with the sound of Mode 3, but usually not associated with the sound of Mode 2), as well as by the fact that these melodic pc sets present five pcs of the same whole-tone collection (Mode 1²).

While this last point may be rather subtle, both whole-tone and hexatonic (Mode 8) subsets are important in the coordination of various layers and blocks
of material throughout Part 1; this coordination is evident in the tonal and mod-12 relationships heard throughout this section. Each chord series has its own particularly focal chord; in the right-hand series, this chord is the Di-major triad (the beginning and highest chord in the series from which the subsequent chords fall), while in the left-hand series, this chord is the A-major triad (the beginning, ending, and most durationally accented chord). Together, these focal chords produce the mod-12 sc (01458), a five-note subset of Mode 8\textsuperscript{1}, as heard harmonically at the beginning of the chord series. At the end of the chord series, the left hand sustains an A-major triad, while the right hand enters with an (026) chord. Together, these chords form sc (012468), which includes a five-note subset of Mode 1\textsuperscript{2}, the same whole-tone collection as was heard melodically in the top voices of each series.

These observations regarding the chord series are, in fact, indicative of larger trends that are carried out over the course of Part 1 in the converging figures. The first figure in mm. 2 to 3 begins with an E-major triad in the left hand and a B-minor triad in the right hand of the piano. Together, these triads form the near-whole-tone sc (02469), including a four-note subset of Mode 1\textsuperscript{1}. Tonally, this complex sounds like an E-rooted ninth chord, the dominant to the focal A-major triad heard in the left-hand series. (In fact, the A-major triad is the only chord that is heard in both modal streams, and Messiaen writes that the

\footnote{A second point of emphasis in the right hand is the F-major triad, which is durationally accented and the lowest point in this series. Similarly, one could argue that the F\#-major triad is a second point of emphasis in the left hand (it is heard most frequently throughout this series), and that this interplay between F\# and F\$ is taken over by the vocal line in the first verse.}
dominant-function material in Mode 6\(^1\) places “the entire passage in A major.”\(^{139}\)

Through a chord exchange which is achieved via stepwise contrary motion within
the mode, the E-major triad migrates into the right hand and the B-minor triad
migrates into the left hand by the end of the figure.

After the first vocal verse, the chord series and first converging figure are
repeated exactly, followed by a second converging figure in Mode 3\(^2\) (mm. 6 to 7)
that extends the first. This second figure begins with an E-major triad in the right
hand superimposed on an A\(\flat\)-major triad in the left hand. Thus, the right hand
continues the E-major dominant of A major from the previous figure, while the left
hand moves up to provide what might be understood as the A\(\flat\)-major dominant of
the focal D\(\flat\)-major triad from the right-hand chord series. Of course, these major-
third-related triads (E and A\(\flat\) major) also form sc (01458), but this time, they
produce a subset of Mode 8\(^4\).

As discussed in Chapter 1, the second converging figure (repeated
throughout the second verse) follows the same modal voice-leading pattern as
the first figure. However, its harmonic scs appear more closely related to the
pattern established by the opening chord series, moving from an (01458) chord
to an (02469) chord. The last chord of this second figure contains exactly the pcs
of the first and last chords of the opening right-hand series (including a four-pc
subset of Mode 1\(^2\), as well as an embedded D\(\flat\)-major triad), which links it

\[^{139}\text{Messiaen 1956, 24.}\]

En B, emploi du « mode à transpositions limitées no. 6 », créant une modulation modale et
situant tout le passage en la majeur (Messiaen 1944, 21).
strongly with the opening material and its tonic function (despite the fact that it can also be rearranged into a ninth chord).

The third converging figure in Mode 3\textsuperscript{3} (mm. 19 to 20, 22) carries the D\textsuperscript{♭}-major tonic triad from the second figure into the right hand (enharmonically respelled), while moving to an F-major triad in the left hand, which brings about a return of sc (01458) and Mode 8\textsuperscript{1}. The association of this F-major triad with the D\textsuperscript{♭}-major triad and its tonic function suggests that major-third-related chords tend to share tonal function throughout this passage. Thus, tonic function might be represented by A\textsuperscript{♭}, D\textsuperscript{♭}, and F-rooted chords, while dominant function might be represented by E\textsuperscript{♭}, A\textsuperscript{♭}, and C-rooted chords. Tonal functions also seem to be associated with particular transpositions of transpositionally symmetrical (TS) collections; tonic function is associated with Modes 8\textsuperscript{1} and 1\textsuperscript{2}, while dominant function is associated with Modes 8\textsuperscript{4} and 1\textsuperscript{1}.

Indeed, the last two converging figures support these assertions. By the end of the third figure, a subset of Mode 1\textsuperscript{1} returns via the established stepwise, contrary-motion voice-leading pattern, and the sound of this collection is carried into the fourth figure (mm. 24, 26). As discussed in Chapter 1 (again, see Example 1.31), the fourth and fifth figures deviate somewhat from the expected stepwise voice-leading pattern. The fourth figure begins and ends with a C-rooted ninth chord (sc (02469)), and its voice-leading deviations ensure that the root and third of this chord are particularly emphasized. Thus, this figure fulfills the expected dominant function through its C-rooted chord (the last major-third-related dominant-function chord to be used), and by its return to Mode 1\textsuperscript{1}.
Interestingly, the voice-leading deviations in the fifth figure (mm. 25, 27) ensure that F-major triads are heard in one of the hands both at the beginning and ending of this figure (which would not be the case had the original voice-leading pattern been followed), providing the expected tonic resolution of the C dominant-ninth chords, as well as a prominent Mode-1\(^2\) sound.

Example 4.5 summarizes the above observations.

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**Example 4.5 — “Action de grâces” — Tonal and Mod-12 Set-Class Analysis of Part 1**

<table>
<thead>
<tr>
<th>Chord Series</th>
<th>Fig 1</th>
<th>Fig 2</th>
<th>Fig 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>context</td>
<td>Beg</td>
<td>End</td>
<td>Beg/End</td>
</tr>
<tr>
<td>chord(s)</td>
<td>(2^1/3^2)</td>
<td>(2^1/3^2)</td>
<td>(6^1)</td>
</tr>
<tr>
<td>mod-12 sc</td>
<td>AM/D(\uparrow)M</td>
<td>(AM)</td>
<td>EM(9)</td>
</tr>
<tr>
<td>subset of</td>
<td>(8^1)</td>
<td>(1^2)</td>
<td>(1^1)</td>
</tr>
<tr>
<td>function</td>
<td>tonic</td>
<td>tonic</td>
<td>dom</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fig 4</th>
<th>Fig 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beg/End</td>
<td>Beg</td>
</tr>
<tr>
<td>context</td>
<td>(6^3)</td>
</tr>
<tr>
<td>chord(s)</td>
<td>CM(9)</td>
</tr>
<tr>
<td>mod-12 sc</td>
<td><strong>02469</strong></td>
</tr>
<tr>
<td>subset of</td>
<td>(1^1)</td>
</tr>
<tr>
<td>function</td>
<td>dom</td>
</tr>
</tbody>
</table>
Among other things, the table above shows the clear alternation between tonic and dominant functions, and the major-third-related chords that coincide with these functions. The only anomaly in the table is the B♭-rooted chord at the end of the third figure. According to its Mode-1\(^1\) sound, this chord should be dominant in function, and thus represented by an E-, A♭-, or C-major triad or ninth chord. However, these chords are not available within Mode 3\(^3\), and so Messiaen substituted another (02469) chord that exhibited the Mode-1\(^1\) sound instead. Another possible interpretation for this substitution is that Messiaen wanted to create a B♭ subdominant chord that would lead to the C dominant in the fourth figure, and finally to the F tonic in the last figure of Part 1. In other words, a somewhat traditional IV-V-I progression in F major is created here, providing the final segment in an overall T-D-T-S-D-T progression (which uses complete cycles of major-third-related tonics and dominants) that is articulated over the course of Part 1.

Thus, in music such as this, where layers of material are superimposed (or blocks of material are juxtaposed), two main analytical questions arise. First, to what degree and in what way(s) are the individual layers (blocks) differentiated so as be aurally distinguishable? Second, to what degree and in what way(s) are the layers (blocks) coordinated so as to create a sense of unification? In the above discussion, I demonstrated that there are many ways in which differentiation and unification can be achieved, and that a listener’s impression of these aspects of a passage may change drastically depending on the conceptual approach taken. For instance, I have tended to focus on identifying the features
that link the two superimposed piano chord series despite their obvious distinctions. In fact, I have now painted a picture which seems to suggest that the modal character of the left-hand series is somewhat absorbed by that of the right-hand series. The hexatonic, whole-tone, and major-third relationships that I have highlighted in this passage coincide well with (and indeed, seem to grow out of) the properties of the augmented-triad-based (ATB) Mode-3 right-hand series, but are not at all characteristic of the tritone-based (TB) Mode-2 left-hand series.

I would now like to turn to an approach which considers the two chord series more as equal partners, each with unique properties that influence the course of the rest of the piece. This approach is based on the work done in Chapter 2 and will compare the pc content of different modes in order to determine the potential strength of their relation. However, instead of examining the movement of tritones or augmented triads in converting one mode into another, I would like to focus simply on the number of common tones shared between any two given modes, and to create an analytical narrative for the piece based on this information.\(^{140}\) In doing so, I will devote more significant attention to addressing the musical content of the vocal verses, as well as to the relationships between music and text.

\(^{140}\) I believe that the voice-leading implications of such tritone and augmented-triad transpositions do not generally apply to this particular musical context; thus, describing modal relations in this way has the potential to impose unnecessary analytical limitations.

There are many precedents for comparing the number of common tones held between two collections and for considering the strength or distance of the relation to be a function of this number. See Alan Forte’s *K and Kh relations* (Forte 1973), David Lewin’s *common-note function* (Lewin 1977) and especially Dmitri Tymoczko’s work on *maximally intersecting* scs and the common-tone relationships between scales (Tymoczko 2004).
In Example vii of the introductory chapter, the TS scs are organized according to their abstract subset-superset relationships. This example shows that Modes 2 and 6 have the potential to share a common Mode-9 subset (formerly known as truncated Mode 2), while Modes 3 and 6 have the potential to share a common Mode-1 subset. However, these abstract subset-superset relations may or may not be manifest in the pc realizations of these modes. For instance, Example 4.6a shows that if Mode $3^1$ is compared with Mode $6^1$, there is indeed a common Mode-$1^1$ subset, shown in bold print, and that these collections have seven pcs in common altogether.

Example 4.6 – Common Tones between Forms of Modes 3 and 6 (Two Examples)

a) Mode $3^1\{B\flat, B, C, D, E, F\sharp, G, A\flat\}$

| | | | | | |
|---|---|---|---|---|
| Mode $6^1\{A\flat, B, C, D, E, F, F\flat, G\sharp\}$ |

b) Mode $3^2\{B, C, C\flat, D, E, F, G, G\flat, A\}$

| | | | | | | | |
|---|---|---|---|---|---|---|
| Mode $6^1\{A\flat, B, C, D, E, F, F\flat, G\flat\}$ |

However, as shown Example 4.6b, Modes $3^2$ and $6^1$ contain different whole-tone collections as subsets and have only five pcs in common altogether.

Example 4.7 shows the number of pcs that are held in common for each pair of unique pc forms of Modes 2, 3, and 6. This table is a reproduction of Example 2.1, but highlights certain relationships with shading and bold print. Since I am mainly concerned with finding a way to relate different modes (as opposed to relating different pc forms of the same mode), I will focus on the relationships shown in the bold portion of the table. Here, it is evident that any
form of Mode 3 compared with any form of Mode 6 will have at most seven pcs in common (as is the case in Example 4.6a) and at least five pcs in common (as is the case in Example 4.6b). Thus, relationships between paired forms of Modes 3 and 6 come in two possible strengths or distances. Those forms that share the maximum seven common tones are relatively closely related, while those forms that share the minimum five common tones are relatively distantly related.

Similarly, when forms of Mode 2 are paired with forms of Mode 6, they too have the potential to be at two possible distances—the minimum of four pcs in common is a relatively distant modal relationship, whereas the maximum of six pcs in common is a relatively close modal relationship. Interestingly, forms of Modes 2 and 3 always have six pcs in common and thus remain at a constant or fixed distance no matter which forms of the modes are used. As well, these six
common tones do not form another TS mode, as reflected in Example vii by the lack of a common abstract modal subset linking these two modes.

Based on this common-tone criterion, the relative distances between the modes found in Part 1 of “Action de grâces” may now be judged. The modes of the opening piano chord series (Modes 2₁ and 3²) are found to be at the fixed or constant distance of six common tones that is to be expected when comparing any pc forms of Modes 2 and 3. The relationship between Mode 3² of the right hand and Mode 6₁ of the first converging figure and vocal verse is relatively distant (the minimum five common tones for Modes 3 and 6), as is the relationship between Mode 2₁ of the piano left hand and Mode 6₁ (the minimum four common tones for Modes 2 and 6). This is portrayed in the spacing and disconnection of the modal circles in Example 4.8a.

The use of these relatively distant modal relationships helps to keep the three streams of this first verse as distinct as possible—the fewer the common tones, the more likely the listener will be able to distinguish the different collectional streams aurally. The voice, despite its distant modal relationships with the two piano chord series, does establish a motivic connection with each of these modes. Its opening chromatic trichord is particularly characteristic of and usually associated with Mode 3, while its five-note motive (circled on the score in m. 4.5) belongs to and is later heard within the context of Mode 2.¹⁴¹ Tonally, the

¹⁴¹ As noted in the discussion of “La Vierge et l’Enfant” in Chapter 2, Messiaen borrows this motive from the opening of Moussorgsky’s Boris Godounov, labeling it his first melodic cadence formula, and making it his own here in “Action de grâces” through the use of irrational rhythms (Messiaen 1956, 31-32; 1944, 30-31).
Example 4.8 – A Summary of the Modal Relationships Found in Part 1 of "Action de grâces"

### Part 1

<table>
<thead>
<tr>
<th>a) Refrain 1 &amp; Verse 1</th>
<th>b) Refrain 2 &amp; Verse 2</th>
<th>c) Refrain 3 &amp; Verse 3</th>
<th>d) (mm. 29-31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(mm. 1-4.5)</td>
<td>(mm. 5-14)</td>
<td>(mm. 15-28)</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram](image)

- **Empty Circle**: new mode form introduced in the section (not previously heard)
- **Filled Circle**: mode form present in the section (but first introduced in a previous section)
- **Filled Circle with Dashes**: mode form not present in the section (but heard in previous section(s))

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- **Solid Line**: maximum 7 common tones (shared Mode 1)
- **Dashed Line**: maximum 6 common tones (shared Mode 9)
recitative-like melody revolves first around F#4; however, by the end of the verse, this pitch gets “transformed” (as the text suggests) into F#4, unifying it with the D♭-major triad on the downbeat of m. 5.

As already discussed, the piano refrain returns after verse one with the same pc forms of Modes 2 and 3 as heard at the beginning of the piece. The Mode-6\(^1\) converging figure also reappears, this time with an extension that adopts the right-hand refrain’s Mode 3\(^2\). The voice then enters with the same melodic material as in verse one, but transposed up two semitones, changing its mode from 6\(^1\) to 6\(^3\). As shown in Example 4.8b, this change of transposition puts the voice into a closer relationship with the piano left-hand refrain (Mode 6\(^3\) has the maximum six pcs in common with Mode 2\(^1\)), perhaps depicting the sentiment of the phrase, “An eye near my eye, a thought near my thought.”

Given that the vocal melody of verse two is essentially a T\(_2\) transposition of verse one, the listener might expect it to cadence on a G♯4. Instead, Messiaen extends the vocal melisma at the end of this verse so that the voice cadences once again on F♯4, “uniting” it (as the text suggests) once again with the D♭-major triad on the downbeat of m. 15. Over the course of the second verse, the piano begins to take a more active role by punctuating the ends of vocal phrases with its converging material.

In the refrain that follows the second verse, the rhythmic canon between the two superimposed piano chord series is significantly extended, perhaps a rhythmic reflection on the recently heard text, “And two feet behind my feet.” The hands then join (“as wave to wave is joined”) in the converging figure—Modes 6\(^1\)}
and $3^2$ are restated and further extended with Mode $3^3$. As shown in the upper portion of Example 4.8c, this new transposition of Mode 3 brings the piano into a closer modal relationship with the vocal collections (Modes $6^1$ and $6^3$) heard previously in verses one and two, as well as with the vocal collection of the third verse, which begins in the next measure. In this verse, the vocal melody is transposed four semitones up from the pitch level of verse two (or six semitones up from verse one), bringing it back to the original Mode $6^1$. The piano continues to punctuate the vocal phrases with increasing frequency throughout the third verse, first with Mode $3^3$, then with an alternation between Modes $6^3$ and $6^2$.

The lower portion of Example 4.8c shows that the addition of Mode $6^2$ finally bridges the gap between the two modes of the original piano chord series—$3^2$ and $2^1$. However, these three modes do not occur in close temporal proximity in the music and thus, the relationships between them are harder to grasp. What is perhaps more evident is the fact that Mode $6^2$ heard in the piano and Mode $6^1$ heard in the voice of verse three are both closely related to Mode $2^3$ and thus, help to prepare its entrance in m. 29. As Example 4.8d shows, the entrance of Mode $2^3$ marks the beginning of the second half of the piece. As circled on the score, it is at this point that the five-note Mode-6 vocal motive is taken over by the piano in a Mode-2 context.

Example 4.9 shows how the modal relationships found in this piece may be situated within a larger network of common-tone relationships between all pc

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$^{142}$ The F-major sound of this material in Mode $6^2$ also provides tonal closure as the goal of the S-D-T progression, linking the opening D-major and A-major centres of the opening chord series via the completion of a cycle of major-third-related tonics.
Example 4.9 – A Spatial Representation of the Common-Tone Relationships between all Forms of Modes 2, 3, and 6

a) Relationships between Forms of Modes 3 and 6

b) Relationships between Forms of Modes 2 and 6

c) Relationships between Mode Forms in “Action de grâces”
forms of Modes 2, 3, and 6. For ease of reading, I have divided my depiction of the relationships between Modes 3 and 6 (see Example 4.9a) from my depiction of the relationships between Modes 2 and 6 (see Example 4.9b), but they should all be understood to be part of the same network. Example 4.9c shows the portion of this network of possibilities that Messiaen navigates in the first half of the piece.

To summarize this analytical narrative of common-tone relations and to posit a more specific interpretation for the text-music relationships found in the piece thus far, suppose that the piano right hand, the piano left hand, and the voice each represent a different character in this musical drama, and that the rich web of modal relations which is constructed over the course of Part 1 musically reflects the interconnections between these three characters. Suppose that the two hands of the piano represent two individuals who are being joined in marriage. The use of Modes 2 and 3, which remain at a fixed modal distance no matter what the transposition, portrays the marital couple as two distinct individuals who maintain a constant relationship throughout the piece. In the converging figure that follows the superimposed chord series each time, the two individuals come together rhythmically and modally to prepare for the entrance of the voice. If the voice, as the third musical entity, represents God, then the converging figure that elicits the voice and later responds to its musical material might be understood as an act of unified prayer in which the two individuals, represented by the two hands of the piano, both take part. (For now, I am examining the voice’s role in this passage as an instrument that expresses its
own modal material, as do the two hands of the piano; however, I will return to a
discussion of the voice’s other important role as the communicator of the text
below.)

The first verse of text sets the general scene for the piece and, while it
marvels at the natural world, does not speak about any specific relationships
between the three characters. This is depicted by the relatively distant modal
relationships between the voice and the two piano chord series in this verse, as
shown in Example 4.8. While the text of verse two seems to speak about the
joys of finding a partner with whom to walk through life, these words could also
be interpreted as describing an intimate relationship between an individual and
God. This second interpretation is suggested by the voice’s change of
transposition, which brings it modally closer to the piano left hand in the
preceding refrain. In verse three, the piano (that is, the marital couple) moves
closer to the voice (that is, God) via an adoption of Mode 3\textsuperscript{3}. Then, by moving to
Mode 6\textsuperscript{2}, the gap between the modes of the piano refrain is bridged, uniting the
couple in Holy matrimony.

While this modal marriage is taking place in the piano, the text of verse
three paints a vivid image of the Son of God, himself a unification of the human
(“clothed in a garment of flesh and bone”) with the divine (or “immortal” as the
text states), and who was sent to earth to interact with the human race and to
represent the closeness of God’s presence. Finally Mode 2\textsuperscript{3} may be understood
as symbolic of the resurrection—the beginning of Part 2, in which familiar motivic
pitch material “springs up” (as indicated in the text of verse three) in an unfamiliar context and is carried forward in a different and renewed way.

My interpretation of the voice as God focuses on its modal relationships with each of the two hands of the piano, and considers all three of these instruments to be equally involved in the portrayal of the sentiments of the text. However, the voice is, of course, linked to the text in a stronger and more immediate way than is the piano, as it is the soprano (a human being) that articulates the words of the song. Despite the fact that the voice is female, my first instinct was to consider the narrator to be Messiaen himself because he is both the composer of the setting and the author of the text. However, in personal correspondence, Alan Dodson suggested to me the following intriguing reading of the piece, which interprets the narrator as a woman whose love-object is male/Christ-like:

As the narrator/protagonist becomes enraptured, she turns toward increasingly powerful images of partnership: eye – thought – face (smiles and cries) – synchronized feet behind mine – soul – robe of flesh and bone springing up for the resurrection (erotic/religious) – truth/spirit/grace (transcendence). It is as though she is coming to see her lover as Jesus, little by little.

(Given that Messiaen wrote this song cycle for his first wife shortly after their wedding, Dodson wonders if perhaps this interpretation involves some wishful thinking on Messiaen’s part!) Indeed, this reading works especially well when the text of Part 2 is also taken into consideration.

The second half of the piece is also three pages long, but a large portion of it (from m. 46 until the end) consists of a long vocal melisma on the word “Alleluia.” As mentioned above, the character of Part 2 is quite different from that
of Part 1. While modal material may still be heard, it is often less clearly segmented (a gesture may begin in one mode and gradually morph into another—see mm. 29 to 31), it may involve extraneous or missing pcs (as indicated on the score), and it is frequently interrupted by blocks of chromatic material. The material in mm. 32, 34, 36, and 38, for example, is reminiscent of the figures from Part 1, presenting contrary stepwise motion between the two hands and punctuating the ends of vocal phrases throughout the final verse. However, while the figures from Part 1 employed modes and contracted inward, this material is chromatic and expands outward. Thus, while the converging material might be described as a beckoning gesture (perhaps, as I suggested above, a drawing of the two hands together in an act of prayer for God’s presence and illumination), I imagine this material as a depiction of the radiating light of the resurrection mentioned at the end of verse three.\footnote{In his discussion of Mode 7 (which is only two pcs short of the total chromatic), Jonathan Bernard suggests that this collection either has too many notes to evoke vivid colours, or that it has an effect similar to a stained-glass window chord, in which all hues of the rainbow are present at once (Bernard 1986, 46). Given the meaning of the text, this second interpretation seems to fit Messiaen’s use of the chromatic in this particular piece better.}

The piano material from mm. 29 to 32 serves as a dramatic build-up to the climactic entrance of the voice in m. 33. This first vocal phrase of verse four involves the melodic presentation of the tritones of Mode 4\(^6\), minus one pc. In order to complete the mode and follow the pattern of descending tritone, descending perfect fourth, the G at the end of the measure should move to a C\#. Indeed, the rest of Part 2 leading up to the final vocal melisma seems to focus on this missing C# in various ways. First, three shorter diverging chromatic
passages proceed to chords with this low C♯ in the bass; however, in the first two instances, this bass pc clashes with the chord of the upper voices (in m. 35, the upper voices sound a D major-minor-seventh chord, and in m. 37, the upper voices sound an E major-minor-seventh chord—this second “clash” is a characteristic Mode-2 sound). It is not until the third attempt in m. 39 that the C♯ bass is presented as the root of the major-minor-seventh chord in the upper voices (although a clashing D-A fifth is also included above this).

From this point, material in Mode 3\(^3\) leads to a longer passage in Mode 2\(^2\) (mm. 41 to 42). This Mode-2 material recalls the material in mm. 29 to 30 with the return of the five-note motive (as circled on the score), but transposed up a perfect fourth (thus, in a Mode-2\(^2\) context with an emphasis on a D\(\flat\)-major triad, rather than in a Mode-2\(^3\) context with an emphasis on an A\(\flat\)-major triad). This D\(\flat\)-major triad enharmonically continues the emphasis on C♯, while also recalling the focal triad of the opening right-hand piano chord series. Interestingly, while the tonic D\(\flat\)-major and the dominant A\(\flat\)-major triads are always heard within different Mode-3 contexts in Part 1 of the piece, here in Part 2, Messiaen places these triads within different Mode-2 contexts. The D\(\flat\)-major triad is emphasized in the left hand throughout mm. 41 and 42, although there is also emphasis placed on the minor-third-related triads, B\(\flat\) and G major.

From here, the music progresses through two nearly-chromatic (Mode 7), minor-third-related collections in m. 43, the bass moving down by step from C\(\flat\) to G\(\flat\)\(2\). This G\(\flat\) resolves as a dominant to the C\(\flat\)\(2\) that returns in the bass of m. 44.
Here, C♯ is heard within a Mode-3⁴ context, but it soon becomes clear that this pc now functions not as a tonic, but rather as the root of a dominant-seventh chord when it resolves to a new tonic triad, F♯ major (with added D♯ sixth) in m. 46. The final “Alleluia” material articulates this new tonic within the context of Mode 2¹.

(As mentioned in the “Ta voix” analysis of Chapter 3, Messiaen considered this mixture of F♯ major with Mode 2 to be a particularly dazzling colour combination, perhaps a depiction here of the sparkling stars of the heavens.)

Because the use of modes in the second half of the piece is less consistent than in the first half, it is not possible to provide a continuation here of the common-tone comparison approach undertaken above. However, it is useful to recall some of the conclusions regarding Part 1 that were reached prior to the exploration of the common-tone analysis. While Part 1 involves both TB and ATB modes, the overall structure of the section seems to grow out of the major-third relationships exhibited by Mode 3. In contrast, the second half of the piece challenges the organization of Part 1 by emphasizing minor-third and tritone relationships, usually within the context of Mode-2 collections. In particular, the fundamental tonic-function D♭-rooted chord of Mode 3² is now placed within a Mode-2² context and often spelled enharmonically as a C♯-rooted chord. The unusual treatment of this important chord prepares for its reinterpretation as a dominant which eventually leads to a new tonic—F♯ major—in the final Alleluia.

Thus, while the dramatic interpretation that was based on common-tone relationships between the modes suggested that the two piano series might
represent man and woman, another interpretation could involve understanding the right hand as representing the human nature of Christ, and the left hand as representing the divine nature. The text of Part 1 focuses on earthly things (the beauty of nature, loving partnership, the flesh and bone of Christ), and thus the relationships of the right hand are heard more prominently. In the text of Part 2, the voice addresses Christ directly, marveling at the sacrifice that was made on the Cross, as it is through the crucifixion and resurrection that the rules of earthly reality are upset—death is overcome and new life begun—and the divine nature of Christ is fully revealed. Appropriately, there is a gradual shift of power over the course of Part 2, and the relationships of the left hand are revealed to be more structurally important, and, certainly, to have the last word in the final “Alleluia.”

In this chapter, I have described the musical richness of “Action de grâces” by examining its pitch organization through modal, chromatic, and tonal lenses. While I do not suggest that the work presented here comprises an exhaustive analysis, I believe that I have begun to reveal the depth of pitch relationships that may be found in this piece and in Messiaen’s earlier music in general, and have suggested some of the ways in which the composer used these relationships to give symbolic substance to the content of his religious imagination and emotional life.
**Conclusion**

I believe that my work in this thesis is among the most comprehensive explorations into the theoretical structures, the compositional uses and possibilities, and the musical effects of Messiaen’s Modes of Limited Transpositions that has been completed to date. In order adequately to perceive, describe, and model the richness and complexity of this intriguing and colourful repertoire, it has been necessary for my analytical approach to be focused and systematic, but also varied and flexible, and to incorporate three different but interrelated perspectives—modal, chromatic, and tonal.

In the introductory chapter, I examine Messiaen’s unique perspective on these pitch-class collections, including an investigation into his synaesthetic sound-colour perception and artistic preferences that takes into consideration the potential of each of the modes to function as a scalar substratum from which melodic and harmonic materials may be drawn. Taking Messiaen’s own writing as my point of departure, I develop a more systematic method for generating and labeling these modes (situating them in a larger family of augmented-based and/or tritone-based transpositionally symmetrical collections) than is found in the composer’s own description, and I posit a plausible explanation as to how he may have missed the hexatonic collection.

My work in Chapter 1 (a modal perspective) primarily develops ideas from Christoph Neidhöfer and Richard Cohn, using a variety of excerpts from Messiaen’s repertoire to discover, define, and explore an interesting modal transformational space—the mod-9 parsimonious Tonnetz. While my discussion
of the augmented-triad-based modes (Mode 3 in particular) is quite comprehensive in this chapter, there is still much analytical and theoretical work to be done on the tritone-based modes, as well as on the modal transformational relationships between the two families, from this perspective. Indeed, Appendix A further develops the concept of the abstract Tonnetz, highlighting some ways in which new objects, transformations, and spaces may be considered in order to accommodate a wider variety of analytical contexts.

In Chapter 2 (a chromatic perspective), my first task was to examine the ways in which Messiaen exploits the mod-12 subsets that may be shared between modes of different types, providing counterexamples to Neidhöfer’s claim that such links do not often occur in Messiaen’s polymodal music. I then geometrically model the structure of the augmented-triad-based and tritone-based modal families, using their smallest respective transpositionally symmetrical subsets as units that could be transposed, split, or fused to transform one mode into another mode belonging to a different set class, cardinality, and/or family. While I demonstrate the analytical usefulness of the augmented-triad-based tetrahedron and square as well as of the tritone-based hexagon on both the micro- and macro-levels of this music, I do not provide any examples which make use of the tritone-based octahedron (although I do discuss the musical significance of this representation), so this could also be an area for future development.

My analyses in Chapter 3 (a tonal perspective) are organized in a progression from tonally straightforward to problematic passages. In particular, I
discuss the various ways in which focus on a particular pitch or pitch class is created in Messiaen’s music (via tonally suggestive pitch structures, but also through emphasis created by other musical parameters). I then explore the musical effects that are produced by his use of multiple superimposed and juxtaposed modes, and by the articulation of multiple focal centres within a single passage.

Because I believe that the listener often draws from an understanding of all three of these analytical perspectives simultaneously when approaching this repertoire, I synthesize the work of the previous chapters in order to provide a more complete analytical picture of the modal relationships found in Messiaen’s “Action de grâces” in the final Chapter 4. This analysis also demonstrates some of the ways in which the rich musical relationships that Messiaen creates throughout the piece may be heard as an illustration of the powerful dramatic content of the text.
Bibliography


Appendix A – Alternative Tonnetze

In this appendix, I introduce some ideas on how to expand the analytical potential of the Tonnetz. In particular, I am interested in exploring some different types of objects, transformations, and spaces than are discussed in Chapter 1.

Richard Cohn begins his 1997 article, “Neo-Riemannian Operations, Parsimonious Trichords, and their Tonnetz Representations,” by showing that set-class (sc) (037) (the consonant triad) is unique among the mod-12 trichordal scs in its ability to map onto itself under inversion via parsimonious voice leading (two voices remain invariant and the third voice moves only by semitone or whole-tone step). Cohn mathematically determines that parsimonious trichords are only available if the cardinality of the modular system is an integral multiple of three. He also proves that in each such system, there is only one parsimonious trichord class, the interval normal form of which will be the series of ascending consecutive integers \( <x, x+1, x+2> \), and the prime form of which will be \( \{0, x, 2x+1\} \).

In representing any trichord geometrically, the triangle is a particularly meaningful shape because it makes clear the relationship between any two pitch classes (pcs) in the trichord, as demonstrated in the transformational network of Example A.1. Here, the three elements of the prime form are placed in nodes that are understood to represent pcs. The relationships between pairs of pcs may be discussed as distances (i.e. intervals) or, as the directed arrows of the example show, as actions (i.e. transformations) that change one pc into another.

After identifying the generic prime form of the parsimonious trichord, then,
Example A.1 – Transformational Network of an Abstract Parsimonious Trichord

Cohn mathematically defines a generic parsimonious Tonnetz (a two-dimensional (toroidal) grid) in order to model visually transformations that act on this trichord, which is represented as a right triangle with a northeast-to-southwest (NE-SW) hypotenuse. The primary dimensions (horizontal and vertical) of this space are generated by the two smallest step-intervals (x and x+1) of the parsimonious trichord (in the sense that each row increments from west to east by the value of x, and each column increments from south to north by the value of x+1), as shown in Example A.2a. The NE-SW diagonals that result from the construction of these rows and columns may be said to be generated by the third and largest step-interval of the trichord (x+2), while the resulting southeast-to-northwest (SE-NW) diagonals are generated by +1. Either set of diagonals (NE-SW or SE-NW) might be considered to be an alternate primary dimension of the Tonnetz, in the sense that the grid could be reconfigured visually so that the diagonal in question is displayed vertically or horizontally instead; I will explore two such reorientations below.

Examples A.2b and A.2c show two alternative generic parsimonious Tonnetze not discussed by Cohn, the primary dimensions of which are generated
Example A.2 – The Three Possible Generic Parsimonious Tonnetze

Modular Congruence: \(3x + 3 \equiv 0\)

a)

\[
\begin{array}{ccc}
\times +1 & 2\times +1 & 3\times +1 \\
0 & x & 2x \\
2x + 2 & 3x + 2 & x - 1 \\
\end{array}
\]

dimensions: \\
\(-x\) \rightarrow \ (+x + 1) \\
(+x + 2) \rightarrow \ (-2) \\
triangular scs: \\
\{0, x, 2x + 1\}, \{0, x, x + 1\} \\
NE-SW \quad SE-NW

b)

\[
\begin{array}{ccc}
3\times + 1 & x & 2\times + 2 \\
2\times + 1 & 0 & x + 2 \\
x + 1 & 2x + 3 & 2 \\
\end{array}
\]

dimensions: \\
(+x + 2) \rightarrow \ (+x) \\
(+x + 1) \rightarrow \ (-2) \\
triangular scs: \\
\{0, x, 2x + 1\}, \{0, x, x + 2\} \\
NE-SW \quad SE-NW

c)

\[
\begin{array}{ccc}
2\times + 2 & 0 & x + 1 \\
x & 2\times + 1 & 3\times + 2 \\
3\times + 1 & x - 1 & 2x \\
\end{array}
\]

dimensions: \\
(+x + 1) \rightarrow \ (+x + 2) \\
(+x) \rightarrow \ (+1) \\
triangular scs: \\
\{0, x, 2x + 1\}, \{0, x + 1, x + 2\} \\
NE-SW \quad SE-NW

by different pairings of the step-intervals of the parsimonious trichord. The rows of Example A.2b are generated (from west to east) by the step-interval \(x + 2\) and the columns (from south to north) are generated by \(x\), while the resulting NE-SW and SE-NW diagonals are generated by \(x + 1\) and \(-2\), respectively. Similarly, the
rows of Example A.2c are generated by the step-interval x+1 and the columns are generated by x+2, while the resulting NE-SW and SE-NW diagonals are generated by x and +1, respectively. The rearrangement of the step-intervals in these three Tonnetze does not affect the visual representation of the parsimonious trichord \{0, x, 2x+1\}—in each example, trichords belonging to this sc are shown as right triangles with NE-SW hypotenuses. What is affected by the rearrangement is the sc of the trichords that are represented as right triangles with SE-NW hypotenuses, the prime forms of which are shown to the right of each Tonnetz in Example A.2.

Most neo-Riemannians make no mention of this other triangular sc (because these trichords do not participate in parsimonious voice leading), nor do they consider the SE-NW diagonals of the Tonnetz (because they are not generated by one of the step-intervals of the parsimonious trichord). It is true that if the analyst is only interested in applying the three standard neo-Riemannian contextual inversions to the parsimonious trichord, the differences between these three generic Tonnetze are rather unimportant. All three are capable of modeling these transformations, as shown by the dotted arrows in Example A.2. However, the structural similarities between the parsimonious trichords and the other right-triangle trichords on the Tonnetz suggest that the relationship between these two scs may be interesting to explore, in which case, the differences between the three Tonnetze become significant.

As an illustration, I would like to consider the three mod-9 enneadic parsimonious Tonnetze. The boxes on the left of Example A.3 show the three
Example A.3 – The Three Possible Enneadic Parsimonious Tonnetze

a) triangular scs: $\mathbf{n}(013)$, $\mathbf{n}(025)$

b) triangular scs: $\mathbf{n}(024)$, $\mathbf{n}(025)$

c) triangular scs: $\mathbf{n}(014)$, $\mathbf{n}(025)$

abstract Tonnetze that result when $x$ (from Example A.2) = 2, and the boxes on the right map the pcs of N3 {A, B$, C, C^\#, D, E, F, F^\#, G^\#} onto these abstract
structures when $0 = A$. Beneath each pair of boxes, I have listed the two scs that are modeled as right triangles on the *Tonnetz*—the $N(025)$ sc of the mod-9 parsimonious trichord (with NE-SW hypotenuse) and the sc of another trichord (with SE-NW hypotenuse) which differs with each example (shown in bold print). I will distinguish between these three *Tonnetze* by referring to their unique pair of triangular scs: Example A.3a will henceforth be termed the $N(013/025)$ *Tonnetz*, Example A.3b will be termed the $N(024/025)$ *Tonnetz*, and Example A.3c will be termed the $N(014/025)$ *Tonnetz*.

The $N(013/025)$ and $N(014/025)$ *Tonnetze* have a structural feature that the $N(024/025)$ *Tonnetz* does not—each of their four dimensions is generated by one of the four mod-9 interval classes (ics). This is an important property because it minimizes pc redundancy within the *Tonnetz*, ensuring that each pc is adjacent to each of the other eight pcs in the collection along one and only one column, row, or diagonal.¹⁴⁴ In contrast, the redundancy of the $N(024/025)$ *Tonnetz* might be considered a disadvantage because it creates ambiguity and limits the versatility of the space (there are two direct ways to represent an ic $N_2$ relation and no direct way to represent an ic $N_1$ relation).¹⁴⁵ However, as observed in Examples 1.10, 1.11, 1.18, and 1.23 of Chapter 1, the $N(024)$ trichord that this *Tonnetz* presents as the second triangular sc is frequently used by Messiaen in

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¹⁴⁴ For instance, in Example A.3a, pc C is adjacent to pcs A and D along the horizontal row, $G_\#$ and E along the vertical column, $F_\#$ and F along the NE-SW diagonal, and $B_\flat$ and $C_\flat$ along the SE-NW diagonal.

¹⁴⁵ For instance, in Example A.3b, pc A is adjacent to pcs $F_\#$ and C along both the vertical row and the SE-NW diagonal, and is not adjacent to $B_\flat$ or $G_\#$ in any dimension.
combination with the $N(025)$ trichord and so, this Tonnetz has specific analytical advantages in examining this particular repertoire that the other two do not.

In order to relate the $N(025)$ and the $N(024)$ trichords of Example A.3b, I will now discuss some abstract ways in which one triangular sc on a Tonnetz may be transformed into the other triangular sc, while still maintaining two common tones (the analytical reasons for this specification will become clear shortly). Given a pair of pcs (a and b) that are adjacent on a row of the Tonnetz, there are four triangles which share that particular side, as shown in Example A.4a.

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Example A.4 — Trichordal Transformations that Preserve a Common Horizontal Dyad

<table>
<thead>
<tr>
<th>a)</th>
<th>b)</th>
</tr>
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<tbody>
<tr>
<td><img src="" alt="Diagram" /></td>
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<table>
<thead>
<tr>
<th>c)</th>
<th>d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="Diagram" /></td>
<td><img src="" alt="Diagram" /></td>
</tr>
</tbody>
</table>
Dotted-line triangles (\{a, b, c\} and \{a, b, f\}) belong to one modal sc, while solid-line triangles (\{a, b, d\} and \{a, b, e\}) belong to another. Examples A.4b and A.4c show how trichords that belong to different modal scs, but that share the \{a, b\} dyad, may be related. In Example A.4b, the pcs a and b map onto themselves while the remaining pc in each trichord flips vertically about an axis (shown with a dashed line) that falls on a row of the Tonnetz to produce a mirror-image trichord. I will call this transformation an on-row vertical flip (F_{\text{V-on}}). In Example A.4c, all of the pcs in a trichord flip horizontally about an axis (shown again with a dashed line) that is halfway between the columns of the Tonnetz to create a new trichord; that is, a maps onto b and vice versa, while the remaining pc of the original trichord maps onto a new pc. I will call this transformation an off-column horizontal flip (F_{\text{H-off}}).

Before discussing Example A.4d, I would like to consider the analogous transformations that may be defined when trichords share a common vertical dyad. Given a pair of pcs (a and c) that are adjacent on a column of the Tonnetz, there are four triangles which share that particular side, as shown in Example A.5a. Again, dotted-line triangles (\{a, b, c\} and \{a, c, g\}) belong to one modal sc, while solid-line triangles (\{a, c, h\} and \{a, c, d\}) belong to another. Examples A.5b and A.5c show how trichords which belong to different modal scs, but that share the \{a, c\} dyad, may be related. In Example A.5b, the pcs a and c map onto themselves while the remaining pc of each trichord flips horizontally about an axis that falls on a column of the Tonnetz to produce a mirror-image trichord. I will call this transformation an on-column horizontal flip (F_{\text{H-on}}). In Example
Example A.5 – Trichordal Transformations that Preserve a Common Vertical Dyad

A.5c, all of the pcs in the trichord flip vertically about an axis that is halfway between the rows of the Tonnetz to create a new trichord; that is, a maps onto c and vice versa, while the remaining pc of the original trichord maps onto a new pc. I will call this transformation an off-row vertical flip (F_{V-off}).

Examples A.4d and A.5d show transformations that are of the same generic type as two of the standard neo-Riemannian contextual inversions.
While such inversions are described in Chapter 1 (and are commonly described in music-theory literature) simply as flips about the rows or columns of a *Tonnetz*, these descriptions are not entirely accurate. As Example A.4d demonstrates, an inversion which preserves a common horizontal dyad between two trichords of the same sc is really a two-step process involving both an on-row vertical flip ($F_{V_{\text{on}}}$) and an off-column horizontal flip ($F_{H_{\text{off}}}$). Similarly, Example A.5d demonstrates that an inversion which preserves a common vertical dyad between two trichords of the same sc is really a two-step process involving both an off-row vertical flip ($F_{V_{\text{off}}}$) and an on-column horizontal flip ($F_{H_{\text{on}}}$).\(^{146}\)

The third neo-Riemannian contextual inversion preserves a common diagonal dyad and also involves a two-step process, although this is not obvious from its geometric representation on the *Tonnetz*. As Example A.6a shows, the trichord \{a, b, c\} appears to map onto the trichord \{b, c, d\} (or vice versa) via a single flip about an axis that falls on the NE-SW diagonal.

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**Example A.6 – Trichordal Inversions that Preserve a Common Diagonal Dyad**

\(^{146}\) The horizontal flips ($F_{H_{\text{on}}}$ and $F_{H_{\text{off}}}$) commute with the vertical flips ($F_{V_{\text{on}}}$ and $F_{V_{\text{off}}}$), so it does not matter which of these transformations occurs first. Incidentally, horizontal flips of different types do not commute with each other, nor do vertical flips of different types.
However, in order for this to be a true inversion, pcs b and c must map onto each other, and this is achieved by an additional flip about an axis that falls on the NW-SE diagonal. (An analogous discussion holds true for the other triangular sc of the *Tonnetz*, shown in Example A.6b.) Because the hypotenuse is the feature that distinguishes one triangular sc on a *Tonnetz* from the other, there can be no contextual transformation which both preserves the diagonal dyad of a trichord and maps the trichord onto a member of the other triangular sc; since I am primarily concerned with mapping between trichords of different scs in this appendix, I will not explore these diagonal flips any further.

To illustrate the analytical usefulness of these new contextual transformations and of this new $n(024/025)$ *Tonnetz*, I will return to the brief excerpt from “La Bouscarle” shown in Example 1.10 and reproduced here (with some additional annotations) as Example A.7.

Example A.7 – “La Bouscarle” – Zigzag Progressions Linking Parallel Chord Series

As discussed in Chapter 1, the presentation of the N3 mode found in this excerpt is extremely common in Messiaen’s music—each hand of the piano presents a
chord series moving by parallel enneadic voice leading. What has not yet been discussed is how the \( N(024) \) trichords of the lower chord series interact with the \( N(025) \) trichords of the upper chord series and vice versa.

At the beginning of this passage, the top two pitches in the right hand of chord 1 move down an octave to become the bottom two pitches in the left hand of chord 2, while the top two pitches in the left hand of chord 1 move up an octave to the become the top two pitches of the right hand of chord 2. These double voice exchanges are modeled well by the flip transformations that are shown on a segment of the \( N(024/025) \) Tonnetz in Example A.8; the transformations also account for the movement of the third pc in each hand.

---

**Example A.8 – “La Bouscarle”**

a) Mapping Chord 1 of the Upper Series onto Chord 2 of Lower Series

b) Mapping Chord 1 of the Lower Series onto Chord 2 of the Upper Series

That is, the first trichord of the upper series \{A, C\#: E\} is transformed into the second chord of the lower series \{C\#, E, F\#\} by an off-row vertical flip (\( F_{V-off} \))—the ic\( -N2 \) dyad is held invariant as pcs \( C\# \) and \( E \) are exchanged, while \( A \) moves down
two enneadic steps to F♭ (Example A.8a). At the same time, the first chord of the lower series {C, D, F} is transformed into the second chord of the upper series {B♭, D, F} by an on-column horizontal flip (F_{H-on})—the ic_{N2} dyad is held invariant as pcs D and F map onto themselves, while C moves down one enneadic step to B♭ (Example A.8b).

This double voice-exchange pattern continues throughout the passage with each N(025) chord of the upper series consistently mapping onto the following N(024) chord of the lower series via an F_{V-off} transformation, while each N(024) chord of the lower series consistently maps onto the following N(025) chord of the upper series via an F_{H-on} transformation. The annotations on the score of Example A.7 show that, in addition to the chord series which are characterized by parallel voice leading in each of the hands, Messiaen has created two chord progressions that zigzag between the two staves (and thus, between the two different scs) preserving one dyad between each pair of consecutive trichords.

The full zigzag progressions are written out in Example A.9, with the right-hand chords of sc N(025) shown in bold to distinguish them from the left-hand chords of sc N(024). The reader will note that while the pcs of the invariant dyad in the F_{V-off} transformations are actually exchanged (as shown with grey arrows for the first transformation), it is common practice in the neo-Riemannian literature to understand such voice leadings as producing an overall static effect (as depicted by the dotted slurs throughout the example).
Example A.9 – “La Bouscarle” – Zigzag Progressions of $n(025)$ and $n(024)$ Chords

Zigzag 1:

1 2 3 4 5 6 7 8 9 10

$\text{E}$ $\text{E}$ $\text{E}$ $\text{D}$ $\text{C}$ $\text{C}$ $\text{C}$ $\text{C}$

$\text{C}\#$ $\text{C}\#$ $\text{C}$ $\text{A}$ $\text{A}$ $\text{A}$ $\text{A}$ $\text{A}$ $\text{G}\#$ $\text{F}$

$\text{A}$ $\text{F}\#$ $\text{F}\#$ $\text{F}\#$ $\text{F}\#$ $\text{F}$ $\text{D}'$ $\text{D}'$ $\text{D}'$

$\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$

Zigzag 2:

1 2 3 4 5 6 7 8 9 10

$\text{F}$ $\text{F}$ $\text{F}$ $\text{F}$ $\text{F}$ $\text{E}$ $\text{C}\#$ $\text{C}\#$ $\text{C}\#$ $\text{C}\#$

$\text{D}'$ $\text{D}'$ $\text{D}'$ $\text{C}\#$ $\text{B}\#$ $\text{B}\#$ $\text{B}\#$ $\text{B}\#$ $\text{A}$

$\text{C}$ $\text{B}\#$ $\text{G}\#$ $\text{G}\#$ $\text{G}\#$ $\text{G}\#$ $\text{F}\#$ $\text{E}$ $\text{E}$

$\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$ $\text{F}_{\text{V-off}}$ $\text{F}_{\text{H-on}}$

Example A.10 plots these zigzag progressions on the complete $n(024/025)$ Tonnetz. Here, the right-hand chords are always shown with the following orientation: ◄. However, the left-hand chords are shown in two orientations; when an $n(024)$ trichord is involved in an $F_{\text{V-off}}$ transformation, it is oriented as ◄; when it is involved in an $F_{\text{H-on}}$ transformation, it is oriented as ◄. (The redundancy of the $n(024/025)$ Tonnetz makes this possible.) The reader will notice that the first chord of zigzag progression 1 is the same as the last chord of zigzag progression 2, and vice versa. If the Tonnetz were wrapped so as to match up the $\{A, C\#, E\}$ trichords in the northwest and southeast corners, these two progressions would be two halves of one long and complete cycle.
Example A.10 – “La Bougarle” – Zigzag Progressions on the $\mathbb{N}(025/024)$ Tonnetz

It should also be noted that both $F_{V\text{-off}}$ and $F_{H\text{-on}}$ could be considered to yield parsimonious voice leading in this mod-9 context according to the traditional
definition, as in each of these transformations, two voices remain invariant, and the moving voice moves only by mod-9 “semitone” or “whole-tone” step. However, one issue that should be addressed is whether the traditional definition of parsimony works well in all modular contexts. In the past, neo-Riemannians have considered voice-leading motion by both the semitone and the whole tone to be “incremental” because both of these intervals are steps within the diatonic collection, reflecting the tonal origins of the theory. However, I note in Chapter 1 that when the PLR operations are generalized and their structure applied to other modular systems, intervallic functions may become confused, as voice-leading intervals may be the same specific size or larger than harmonic intervals. One option would be to restrict the definition of parsimony to include voice-leading motion only by step within a given collection. However, if the steps between adjacent pcs in a collection are themselves rather large in specific size, the suggestion that parsimony can be perceived at all in this modular context is also called into question.

If transformations that do not yield parsimonious voice leading are now considered, many other types of Tonnetze can be constructed. Example A.11 shows all of the possible mod-9 Tonnetze, each generated by a unique pairing of the four mod-9 ics. One of the ics of the pair generates the rows of the Tonnetz and the other generates the columns. Beneath each figure, the ics that generate the four dimensions (the rows and columns (shown in bold), as well as the two resulting diagonals) are listed, as are the two scs that are represented as right triangles on the Tonnetz. (It does not matter which of the two bold ics generates
Example A.11 – All Possible Mod-9 Tonnetze

\[\begin{array}{c|c|c|c|c|c}
\text{a)} & \text{b)} & \text{c)} & \text{d)} & \text{e)} \\
\hline
1 & 2 & 3 & 4 & 5 & 2 \\
0 & 1 & 0 & 1 & 0 & 2 \\
\end{array}\]

Dimension Ics: 0, 1, 1, 2
Triangular Scs: (01), (012)

\[\begin{array}{c|c|c|c|c|c}
\text{f)} & \text{g)} & \text{h)} & \text{i)} & \text{j)} \\
\hline
3 & 5 & 4 & 6 & 7 & 8 \\
0 & 2 & 0 & 2 & 0 & 4 \\
\end{array}\]

Dimension Ics: 1, 2, 3, 4
Triangular Scs: (013), (025)

the rows and which generates the columns because the same two diagonals and triangular scs result in either case.)

Lifting the parsimony restriction also enables the creation of Tonnetze in modular systems that are not integral multiples of 3. For instance, Example A.12 shows all of the possible mod-8 Tonnetze, which have the potential to be analytically useful given Messiaen’s preference for eight-note MLT. Like the mod-9 Tonnetze, these mod-8 Tonnetze facilitate a comparison of any two modal trichordal scs that have two of three modal ic in common.\(^{147}\) While the

\(^{147}\) While some of these spaces might prove to be analytically useful for a particular musical context, they are also highly redundant and, therefore, somewhat limited. Of course, this redundancy is inevitable when representing as a right triangle any trichordal sc in which more than one pair of its pcs is related by the same ic—that is, any sc which is inversionally symmetrical within the mode.

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Example A.12 – All Possible Mod-8 Tonnetze

<table>
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<tr>
<th></th>
<th>a)</th>
<th>b)</th>
<th>c)</th>
<th>d)</th>
<th>e)</th>
</tr>
</thead>
<tbody>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Dimension Ics: 0, 1, 1, 2
Triangular Scs: (01), (012)

<table>
<thead>
<tr>
<th></th>
<th>f)</th>
<th>g)</th>
<th>h)</th>
<th>i)</th>
<th>j)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Dimension Ics: 1, 2, 3, 3
Triangular Scs: (013), (025)

analytical exploration of these new modal trichords, transformations, and spaces is outside the scope of this appendix, it provides an interesting avenue for future research.

To summarize, through this modal approach, I have worked on expanding the variety of objects that may be analyzed using transformational theory. In Chapter 1, the first step was to examine objects from a modal perspective, which enabled the discussion of transpositional and inversionsal relationships between objects that belong to different mod-12 scs. The second step in that chapter was to translate these objects into different modal environments and to examine the mod-12 variety that results. Continuing this modal work in this appendix, the third step was to examine different types of Tonnetze and to define transformations that allow mappings between different modal trichord scs. A
possible future step (in addition to the further analytical exploration of these ideas that is necessary) would be to examine transformations on larger modal scs and to explore three-dimensional modal Tonnetz spaces, perhaps modeled on work done in the mod-12 universe by Edward Gollin, Adrian Childs, Jack Douthett and Peter Steinbach, or Julian Hook.\footnote{See Gollin 1998, Childs 1998, Douthett and Steinbach 1998, Hook 2002.}
I. Action de grâces
Thanksgiving

PART 1

Très modéré

Verse 1

Le ciel,
The sky,

Et l'eau qui suit les variations des nuages,
And the water which follows the variations of the clouds,

Et la terre,
And the earth,

et les montagnes qui attendent toujours,
and the ever-waiting mountains,

Verse 2

Et la lumière qui transforme.
And the light which transforms.

Et un œil près de mon œil,
And an eye near my eye,

une pensée près de ma pensée.
a thought near my thought.
Et un visage qui sourit et pleure avec le mien,
And a face which smiles and cries with mine,
Et deux pieds derrière mes...
Verse 3

Et une âme, invisible, pleine d'amour et d'immortalité, Et un vêtement

And a soul, invisible, full of love and of immortality, And a robe

of flesh and bone which will spring up for the resurrection, And the Truth, and the Spirit, and

grâce avec son héritage de lumière.

With its heritage of light.

Part 2

Modéré

changing collection

Reproduced with the kind authorization of Éditions Durand, Paris
Et dans un Pain plus doux que la fraîcheur des étoiles.
And in a Bread sweeter than the freshness of the stars.