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Analysis of Early 20th century Chromatic Modal Music with the use of the Generative Theory of Tonal Music - Pitch Space and Prolongational issues in selected Modal Idioms

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ABSTRACT

The Generative Theory of Tonal Music in its original form (Lerdahl & Jackendoff 1983) applied to music belonging to the Western tonal idiom only. However, during the last decade, theoretical and analytical research has been conducted on its application on diatonic or chromatic modal music. More specifically, Lerdahl addresses chromatic pitch spaces in chapters 6 & 7 of his "Tonal Pitch Space" (2001) and conducts analyses of late 19th century and 20th century music, while Temperley (The Cognition of Basic Musical Structures, 2001) and Tsougras (Modal Pitch Space, 2003) explore mainly the diatonic modal space. The present paper aims to clarify the concepts of modal mixture, modal interchange, hypermodulation and triadic or non-triadic modal harmony as encountered in early 20th century chromatic modal music in relation to the four components of the Generative Theory analysis methodology (GS, MS, TSR, PR) and Tonal Pitch Space. Selected modal idioms are analyzed theoretically (calculation of their corresponding pitch spaces) and practically (GTTM analyses of selected excerpts of music by Debussy, Bartok, Messiaen, etc). The research sheds more light into a relatively unexplored area of GTTM and TPS and extends the scope of the analytical methodology toward chromatic modal music. The application of GTTM to quasi-tonal 20th century music may contribute to a better understanding of the nature of this music and its perceptual and cognitive attributes.

I. Introduction-Background

The *Generative Theory of Tonal Music* (GTTM, Lerdahl & Jackendoff 1983) is grounded on the point that an *experienced to a musical idiom listener* organizes the musical sounds (musical surface) into coherent mental structures. The theory correlates music cognition with language cognition arriving at the formulation of a *musical grammar*, a system of rules that construct the hierarchical structure that the experienced listener assigns to a musical surface. The theory in its original form (Lerdahl & Jackendoff 1983) applied to music belonging to the Western tonal idiom. However, its authors claim (chap. 11 of GTTM, pp. 278-289) that a considerable part of the theory's rules possess *universal* validity and that by enriching the existing or adding new rules it can be used for the analysis of music belonging to other musical idioms. Through the 25 years that have passed since the theory's enouncement, many research projects have contributed to the enrichment of its principles, some of which are related to its expansion/modification towards its application on diatonic or chromatic *modal* music. More specifically:

- Fred Lerdahl's *Tonal Pitch Space* Theory (TPS, Lerdahl 1988, 1994, 2001) introduces a simple mathematical model that provides explicit stability conditions and optimally clarified preference rules for the construction of GTTM's time-span reduction and prolongational reduction. The model is used in the GTTM analysis of tonal and chromatic post-tonal music. Lerdahl addresses chromatic pitch spaces (mainly hexatonic, octatonic, whole-tone and mystic spaces) and their applications in prolongational analysis in chapters 6 & 7 (pp. 249-343).

- Costas Tsougras's *Modal Pitch Space* model (2003) is an expansion of Fred Lerdahl's *Tonal Pitch Space*, its purpose being a more accurate description of the situations involved in the analysis of diatonic modal music. The model calculates the stability of pitches, chords, modal regions, as well as melodic and chordal attraction values in various cadence types within the modal context.

- Costas Tsougras's PhD research (2002) involves the adaptation of GTTM in order to enable its application to the analysis of Yannis Constantinidis's modal idiom through the analysis of his *44 Greek miniatures for piano*. The research arrives at the description of the work's stylistic features and at the formulation of special well-formedness and preference rules introduced either as new rules to the theory or as adaptations of the existing ones.

- David Temperley's "The Cognition of Basic Musical Structures" (2001) develops a model of six preference rules systems (for metrical structure, phrase structure, contrapuntal structure, tonal pitch-class representation, harmonic structure and key structure) and applies it to a broad spectrum of music, including modal rock music.

- Other analytical papers investigate the use of GTTM on specific modal pieces (Tsougras 1999 on Manolis Kalomiris' "Chant du Soir", Auvinen 1995 on Arvo Pärt's "Fratres").

The present paper attempts to test GTTM's analytical potential on chromatic modal music of the early 20th century, to clarify the concepts of chromatic modality (e.g. modal mixture, modal interchange, hypermodulation and triadic or non-triadic modal harmony) in the context of GTTM's analytical methodology and TPS theory and to question the scope and limits of this application.

At this point a short discussion about modality would be useful. According to Mantle Hood (1971: 324)[1] the concept of *mode* encompasses four features that represent the full spectrum between the *generalized scale* and the *particularized melody*: "Basic features of Mode seem to include: 1) a gapped scale, 2) a hierarchy of principal pitches, 3) the usage of ornamental pitches and 4) extra-musical association". So, a *mode* is a complex entity that includes, apart from the pitch classes of a scale, a pitch hierarchy, typical cadence formulas and melodic figurations and semantic references. The above contradict the concept of modality adopted in 20th century music, according to which modes are just scale types and the possible adoption of folk tunes is just an element of ethnic

character. Both concepts may pertain during the audition of a modal work, depending on the work's nature and origins. The 20th concept of mode perhaps originates in the use of folk music material, but it is in no way confined to it.

Diatonic modality refers to the use of the seven diatonic modes that stem from a diatonic pitch collection by the circulation of the pitch center (mainly six modes after the exclusion of the Locrian mode, due to the problematic diminished 5th at level b of its basic space, see Lerdahl 2001: 272-3). Chromatic modality can be either intrinsic (use of modes not stemming from diatonic collections) or external (chromaticism as a result of chromatic saturation of diatonic material). Intrinsically chromatic modes may contain different numbers of pcs in an octave (usually 5-9 pcs) and they can be symmetrical (having one or more symmetry axes, thus having limited transpositions [2]) or asymmetrical (having all 12 transpositions). The most common symmetrical modes are the hexatonic, octatonic and whole-tone scale (studied in relation to TPS in Lerdahl 2001, ch. 6). The asymmetrical modes may stem from the chromatic transformation of the 7-note diatonic modes (e.g. the "acoustic" scale) but they can also have original interval structure. Within this context and within triadic of non-triadic harmony, there may be consistent use of one type of chromatic modality, mixed use of diatonic-chromatic modality (e.g. diatonic melody - chromatic accompaniment), polymodality. Also, chromaticism may emerge as a result of real planing (parallel voice-leading with fixed intervals), use of non-scale pcs or sonorities and various types of modulation and mixture (Williams 1997: 186-189): modulation to the same scale type (with change of pc collection and modal center), modulation to a relative mode (same pc collection - different center), mode mixture-interchange (different pc collection - same center), free modulation to a different scale type with a change of tonic and pc collection, modulation to a different tonal space (hyper-modulation). All types of modulations, free chromaticism and polymodality may apply to various combinations of intrinsically diatonic or chromatic modes. Of course, these categories overlap and it is very uncommon for even a short piece to exhibit only one type of modality.

So, chromatic modality is a multi-faceted and complex structural phenomenon that is very difficult to categorize explicitly in either structural or historical way (the use of these types of modal structures started during the second half of the 19th century and continues up to the 21st). Given the multiplicity and complexity of this corpus, the present research needs to restrain the concept of chromatic modality, limit its scope and focus on certain types of chromatic modes for methodological clarity. So, we put a frame and examine music of the first half of the 20th century and music where intrinsically chromatic modes are used, either exclusively or in combination with chromatically saturated diatonic modes or functional tonalities. Also, we refer to cases where the principle of pitch/tonal/modal center applies.

Various stylistic features - that may vary considerably in each style or specific composer - define 20th century modality and its types, however some prominent features apply for nearly every modal idiom (Williams 1997: 184-6): the avoidance of functional harmony (mainly the dominant-to-tonic cadence norm and the circle of 5ths progressions), relatively free use of dissonant sonorities, parallel or free voice-leading and ambiguity (ambiguity pertains to many important structural features: concept of nonharmonic notes, local or global tonal center, chordal roots, type of mode used, etc). Ambiguity regarding the modal center is a major issue, especially in symmetrical modes like the octatonic (problematic tonic finding due to inherent symmetry), but it also applies to the diatonic modes (7-note notes or 5-note pentatonic modes) where every pitch can be considered a modal center.

II. Methodology

This kind of music has already been approached analytically in multiple ways: e.g. schenkerian analysis, post-tonal harmony, set theory, interval cycles, neo-Riemannian transformations (see Dunsby 1993, Lester 1989, Cohn 1997, Lewin 1987, Antokoletz 1984, Salzer 1962, Baker 1983, etc), with each methodology uncovering different aspects of the music. So, how can an analyst proceed to the analysis of chromatic modal music using the GTTM analytical methodology? The application of GTTM is based on the interaction of rhythmic structures and metrical structures within a tonal hierarchy and the result is a multi-level prolongational analysis expressed as an hierarchical tree structure. According to the above, and regarding the fundamental issue of each piece's of each group of pieces' special modal idiom, the following must be taken into account/considered:

- The universal aspects of GTTM (see Lerdahl & Jackendoff 1983: 280) are the basis of the analysis procedure.
- The Tonal Hierarchy supplies stability conditions useful for the TSR, but it may be substantially different in each case, so the specification of the concept of modality in each piece and the clarification of the modal or tonal interaction that takes place is important. Tonal Pitch Space calculations, in combination with the principle of the shortest path (TPS: 73-76), can provide the quantitative tonal hierarchy needed (numerical values of event distances and linear attractions), provided that they are carried out in the correct basic space (e.g. if the current space is the octatonic and the calculations are made in the diatonic space, the results will be misleading). Also, TPS attractional calculations between chords-sonorities may provide additional information when linear progressions are used.
- Additionally, in cases of hypermodulation[3] (shift of basic space) or polymodality (simultaneous use of two or more modes of the same or different basic space), an additional hierarchy must be considered (judged by salience conditions) regarding which mode or space is hierarchically dominant.
- Salience conditions (e.g. pedal notes) are emphasized in chromatic modal context (TPS: 315) because tonal stability loses force through ambiguity in projecting tonic orientation or through the use of symmetrical scales.
- Relations of sensory consonance/dissonance also frequently replace pitch space stability conditions in chromatic music, especially in non-triadic harmonic situations (TPS: 320). The anchoring principle is also important in such cases in disambiguating nonharmonic pitches.
- Idiom-specific research (major harmonic/melodic features, characteristic chords, idiom-specific stable events, etc) and the formulation of special well-formedness or preference rules

are strong disambiguating tools also, but they require the analysis of a large corpus (this will not be pursued in the present paper). Idiom issues are important in modal music, since modality is not only an abstract scale but also a network of musical features (central pitch, other pitches referring to the central - not necessarily through the circle of 5ths - melodic or harmonic schemata, etc).

- The identification and classification of modal cadence types is important for the deeper levels of TSR and PR. This requires the experienced listener's knowledge of what constitutes a cadence in a given modal idiom, if of course the composer wishes to establish cadence formulas in his music. Cadence types are connected with the repertory of prolongational functions (see TPS, ch. 5) that can be assigned to the members of the cadence (S, D, T functions). These functions are useful in this context, as they create phrase-structure articulations and clarify the deeper levels of the TSR.

Of course, the above guidelines interact with or contradict each other imposing difficulties to the analyst. However, the present paper is not trying to impose a new theory or add new rules, but trying to test the assumptions and methodology of GTTM to chromatic modal music analysis as an attempt to explore the chromatic quasi-tonal music of the first half of the 20th century. The analyses are carried out in mostly intuitive way and pitch space calculations are employed when their use clarifies the choice of an event during the Time-Span-Reduction (TSR) or Prolongational-Reduction (PR). Also, a quest for idiom specific rules will not be our target in such a short paper, nor will be a general theory of modal music. Instead, considering the general framework of GTTM as a firm theoretical and practical ground and aided by the TPS concept where needed we will highlight certain issues through analytical practice.

III. Analyses

The framework described in the previous chapter is applied to the GTTM analyses of three selected excerpts or pieces from the first half of the 20th century. The selection tries to capture a wide spectrum of chromatic modality and genres of modal idioms in maximally condensed mini forms. The first excerpt alternates between diatonic modality, octatonicism and tonality, the second is purely octatonic and the third mixes chromatic melodic modality with diatonic and whole-tone accompaniment.

1. Claude Debussy: The Little Shepherd (Nr. 5 from "Children's Corner"), b. 1-10 (see figure 1)

In this excerpt three contrasting tonal spaces are explored with varying degrees of embedded tonal center ambiguity. The passage begins with a prolongation of two notes one tritone apart: G♯ and D. Depending on which one is considered a tonal center, two possible diatonic modes can be projected: G♯ Locrian (G♯-A-B-C♯-D-E-F♯-G♯) or D Lydian (D-E-F♯-G♯-A-B-C♯-D). In my analysis I adopt the Locrian (although this mode is not stable according to the constrains on basic spaces, see Lerdahl 2001: 272) due to the prominence of the arpeggiated G# diminished chord, but I start a left branch at level d from pitch D (b. 2), because this choice results in more linear voice-leading. In bars 3-4 a transition to octatonic space is gradually appearing through the injection of pcs F and G as appoggiaturas. In bars 5-8 the octatonic scale **oct1** is used (C♯-D-E-F-G-G♯-A♯-B-C♯) with the exception of the sonority D♯-F♯ in b. 6 - which can be considered the product of chromatic parallel motion between E-G and D-F - and pitch A in b. 7 (see below). Within this space, although chord distance calculations may also be used, voice-leading proximity, i.e. melodic anchoring gives a more consistent Time-Span Reduction at levels e and d, a choice that projects three parallel minor thirds, all belonging to **oct1**: F-A♭ (or E♯-G♯ enharmonically) → E♮-G♮ → D♮-F♮. These thirds support three corresponding triads: E♯-G♯-C♯ → E-G-B → D-F-B of different types (major-minor-diminished). During the octatonic region no specific tonal-modal center is projected by salience conditions or by any other way. Bar 7 is again transitory as Debussy injects the A-E sonority alternatively with D-F, which creates an anticipation for A as tonal center. This anticipation is fulfilled at the last two bars of the excerpt that unambiguously cadences in A major tonality through the transformation of D-F to D-F♯ and the following functional progression of the type II-V^7-I in A through the circle of perfect 5ths (B minor → E major → A major). As demonstrated in the prolongational analysis of fig. 1 and the prolongational tree, the whole phrase is a gradual move from diatonic modality to tonality through octatonicism. The three spaces used share many common pitches that facilitate the hypermodulations involved. Another interesting aspect of the prolongational analysis is the persistent use of left-tensing branches organized hierarchically and building up the expectation for the structural goal of the phrase, which is the A major tonality. This gradual shift coincides with the tonal disambiguation of the overall structure, as the music progresses from ambiguous diatonic modality to equally ambiguous chromatic octatonic modality and finally to unambiguous diatonic tonality. The prolongational tree actually depicts this shift graphically.

```
root level                                  8
chord level            2                    8        11
scale level         1  2     4     6       8  9     11
chromatic level  0  1  2  3  4  5  6  7  8  9 10  11
```

Basic space of G# Locrian - representation of G# diminished triad

```
root level                    4
chord level                   4        7           11
scale level         1  2      4  5     7  8     10  11
chromatic level  0  1  2  3  4  5  6  7  8  9 10  11
```

Basic space of oct1 - representation of E minor triad

```
root level                                          11
chord level            2           6                11
scale level         1  2     4     6     8  9     11
chromatic level  0  1  2  3  4  5  6  7  8  9 10  11
```

Basic space of A major scale - representation of B minor triad (II)

Figure 1a. Basic spaces of the Debussy excerpt and chordal representations

This ambiguity may be reduced with the help of some TPS calculations and the application of the principle of the shortest path: Moving from level d to level c during the TSR, a choice

has to be made between either C♯ major triad (E♯-G♯-C♯) or E minor triad (E-G-B) (b. 5-6) and accordingly between D-F-B (B diminished triad) and D-F♯-B (B minor triad) (b. 7-8). The choice of B minor in the second case is straightforward, as it is more intrinsically consonant and it is needed for the tonal cadence that follows. This choice also affects directly the choice of E minor over C♯ major because its TPS distance to B minor is smaller (principle of the shorter path): δ(Emin→Bmin)=δ(v/**A**→II/**A**)=0+1+5=6 while δ(C♯maj→Bmin) = δ(III/**A**→II/**A**) = 0+2+7 = 9. Another chord distance calculation useful for the understanding of the passage's idiomatic harmony is: δ(C♯/**oct1**→e/**oct1**)=0+1+6=7, which is a relatively small distance due to the octatonic space and justifies the chords' connection at PR level d.

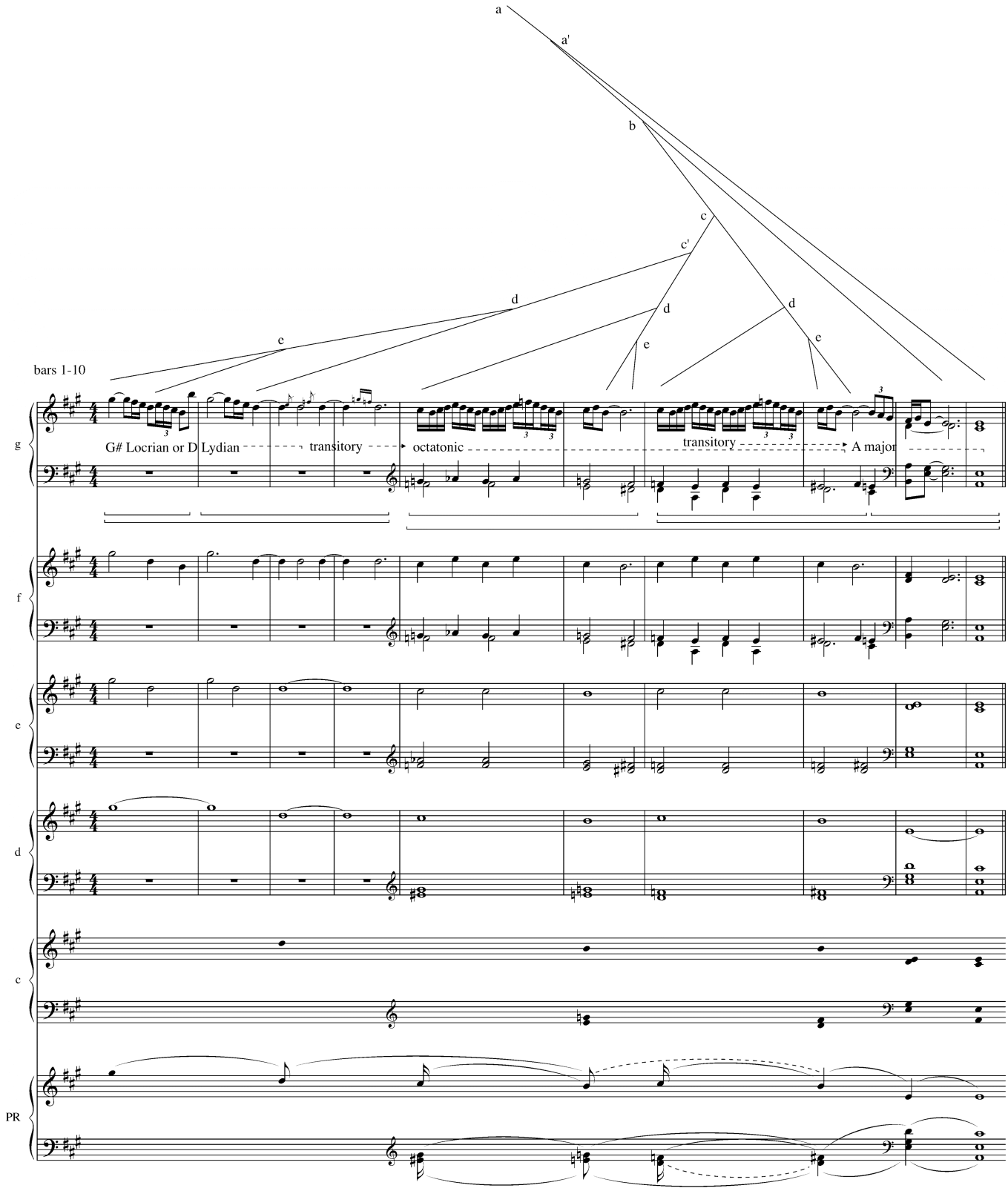

Figure 1: GTTM analysis of Debussy's "Little Shepherd", b. 1-10

2. Olivier Messiaen: Louange à l' Éternité de Jésus (Nr. 5 from "Quator pour la fin du temps"), b. 1-6 and 31-35 (see figure 2)

These two excerpts from the "Quartet for the End of Time"[4], like almost all of Messiaen's music, draw their pitch content from the "7 modes of limited transposition" (all 7 modes lack conformity with some of the constraints on basic spaces due to the existence of symmetry axes). Both excerpts use the 2nd mode, also known as the "octatonic" scale, and in particular the transposition with the following pcs: E-F-G-G♯-A♯-B-C♯-D-E. This abstract symmetrical structure coincides with **oct1**, the same chromatic mode used in the Debussy example. The main difference between the two examples is that in Debussy's excerpt there is an omnipresent underlying functional tonality in the background, while in the Messiaen example no traditional dominant chord can be traced, either in the surface or in the background. However, Messiaen -perhaps not typically- chooses a certain tonal center for this piece (E). The above octatonic mode, if E is considered its central pitch, emerges by semitone-tone alternation (dom7/oct space) and thus includes the major triad rooted on it central pitch, as well as three other major triads whose roots have a distance of a minor 3rd or a tritone from E (G, B♭ and D♭). These four major triads are the only chords used for the piano accompaniment of the cello melody in both excerpts (beginning and end of the piece). If Tonal Pitch

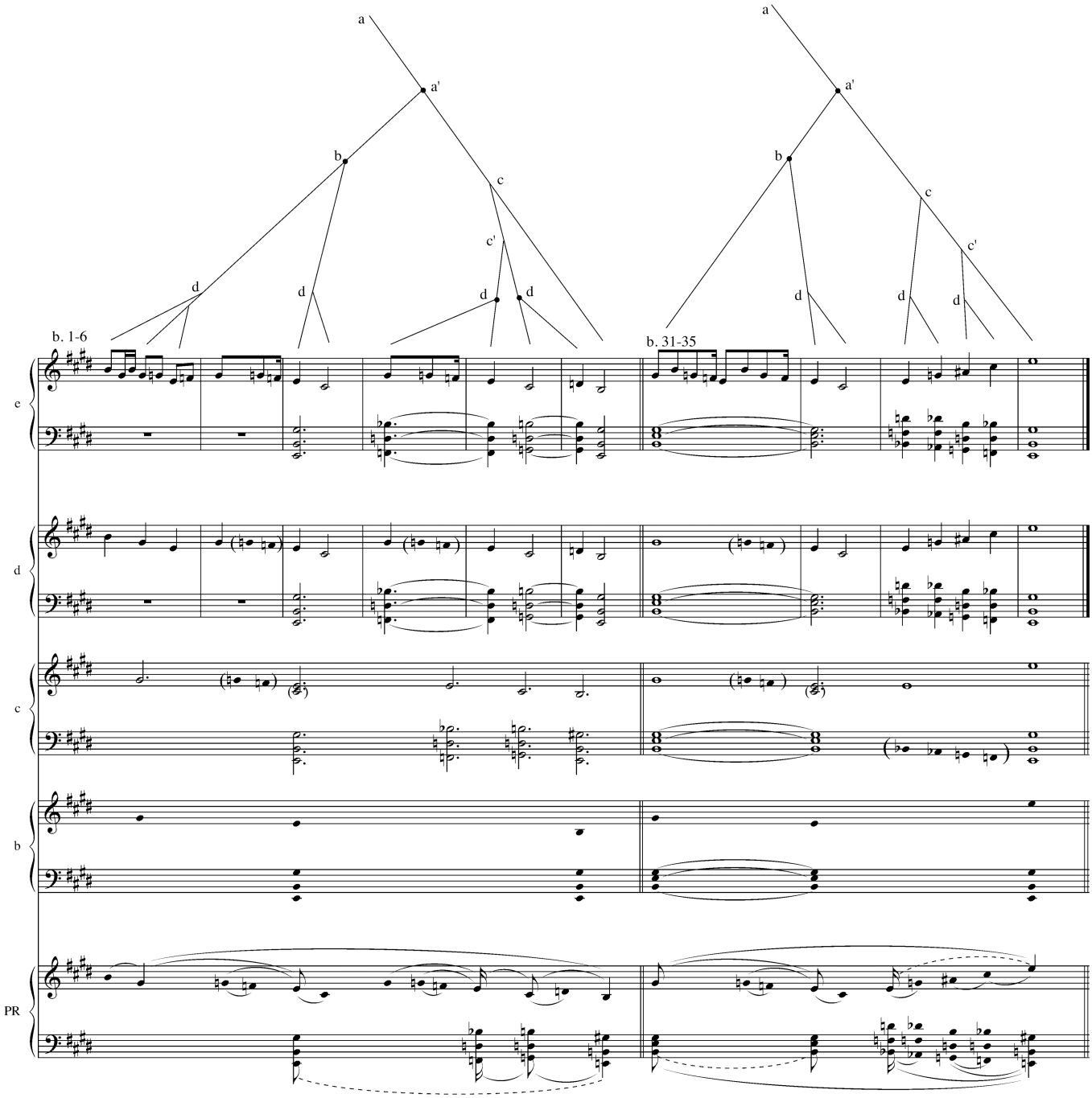

Figure 2: GTTM analysis of Messiaen's "Quator", part V, b. 1-6 and 31-35

Space calculations are executed (according to the Octatonic Chord Distance Rule, see TPS p. 254), the results obtained yield δ=6 for major chords one minor third apart (E maj → G maj, E maj → D♭ maj) and δ=8 for major chords one tritone apart (E maj →B♭ maj). These distances are analogous to the distances between chords in diatonic tonality or modality[5], but they would be much larger if calculated in diatonic space instead of the chromatic-octatonic space[6]. Any chord can function as a tonic due to the mode's symmetrical structure, but Messiaen clearly chooses E major by cadencing to it at the end of both phrases.

Messiaen's additive rhythms create bars of unequal length and mostly without periodicity, so metrical structure is not taken into account at all in this idiom. The pitch space employed is purely octatonic, and there are no modal mixtures or hypermodulations. The E major triad dominates at TSR levels a and b, but at levels closer to the surface more dissonant sonorities emerge by the mixture of the accompanying major triads and the melody notes. The most characteristic sonority is the major triad plus augmented 4th (e.g. G major plus C♯ or B♭ major plus E, see b. 4 and 5). This sonority (which can be described as the all-interval tetrachord [0,1,3,7], see Lester 1989: 166) is a quite frequently used element in Messiaen's harmony and thus it can be considered "essential" or even "structural" by his experienced listeners. In this context, I consider it an important event and include it at TSR level c, although it is a quite dissonant sonority. However, this choice is a special exception to the preference for stable sonorities for the deeper TSR levels, and the sensory consonance rule does applies in this piece regarding the salience of the E major triad. Another important aspect of this idiom's harmony is the free use of chordal inversions and the stepwise voice-leading of the lower voice (E-F-G-E for the first phrase and B-B♭-A♭-G-F-E for the last one) that creates high attraction values and emphasizes contrapuntal-type chordal progressions. For example, the last bars can be considered an arpeggiation of the E major chord, where the melodic E is transferred an octave higher through an arpeggiation of a diminished 7th chord (E-G-A♯-C♯-E) and the bass arpeggiates from B to E through passing stepwise motion (B-B♭-A♭-G-F-E) while major chords in all possible inversions "harmonize" the descending lower voice. This can be considered a purely contrapuntal-linear procedure while chords simply "colorize" the melodic lines (see also Salzer 1962: 195 for his comments on "color" chords).

```
root level                    4
chord level                   4            8        11
scale level          1  2     4  5     7  8     10 11
chromatic level  0   1  2  3  4  5  6  7  8  9  10 11
```

Basic space of oct1 - representation of E major triad

```
root level                                7
chord level             2                 7           11
scale level          1  2     4  5     7  8     10 11
chromatic level  0   1  2  3  4  5  6  7  8  9  10 11
```

Basic space of oct1 - representation of G major triad

Figure 2a. Basic spaces of the Messiaen excerpts and chordal representations

3. Béla Bartók: Mountain Horn Song (Nr. 4 from "Romanian Folk Dances"), b. 3-18 (see figure 3)

This piece is based on an original Romanian folk tune. The original melody is kept unaltered in the upper voice, as is the song's simple form (aa'bb') and the length of its 4 phrases (4 bars each). The melody uses a chromatic asymmetrical mode centered on A, that includes an augmented 2nd between its $\hat{2}$ and $\hat{3}$ melodic degree: A-B♭-C♯-D-E-F-G-A (pitch content coincides with that of D harmonic minor, but with A as tonal center a different modal space is created). This special modal space conforms to all well-formedness conditions about basic spaces (TPS: 272) but misses preference conditions 3 (maximal evenness), 5 (two step sizes), 6 (intervallic generators) and 7 (steps no larger than ic2). The melody however also uses C natural at the beginning of its b-type phrases, yielding temporarily the A Phrygian mode (in this context C♯ could be considered a chromatic inflection). All phrases end typically with the same melodic cadence formula, which can be reduced (at the 8th-note TSR level) to C♯-B♭-A and (at the 4th-note level) to B♭-A. Moreover, the melody can be reduced (at TSR level d) to E-D-(C♯)-B♭-A for a-type phrases and C-D-B♭-A (TSR level d) or C-B♭-A (level c) for b-type phrases. The modal cadences are considered important in this modal idiom due to the use of the folk tune and they are retained at deeper reductional levels. Cadences in this idiom (see fig. 3b) are mainly contrapuntal (based on linear motion) and not harmonic (based on perfect 5ths progressions) and the sonorities that have dominant function vary slightly in each phrase.

Bartók harmonizes each phrase differently, using various neotonal techniques, like parallel voice-leading (planing), pedal notes and modal mixture. The first phrase (b. 3-6) uses simple planing with parallel 3rds and sixths in the context of the A chromatic mode, the only exception being the B natural in the inner voice of bar 4, which can be considered a passing note between C and B♭. In the second phrase (b. 7-10) he uses planing with triads in 2nd inversion ($^6{}_4$ chords) starting with C major and cadencing on F major. With his choice he mixes the chromatic space stated by the melody with the diatonic space (with C natural) creating progressions that emphasize internal chromatic third relations (Cmaj→Amaj→Fmaj, a feature prominent in symmetrical spaces such as the hexatonic or octatonic) within an external diatonic 5th progression: δ(Cmaj→Fmaj)=δ(III/$\mathbf{A_{phr}}$→VI/$\mathbf{A_{phr}}$)=5). This "virtual space" shortens the TPS distances of the connected internal chords but the values are difficult to calculate explicitly due to the ambiguity regarding the modes involved and to the parallel voice-leading, that makes the progression more linear rather than harmonic. An important feature of the harmonization of both a-type phrases is the A pedal note in the lower voice, which emphasizes the modal center. Another interesting feature of the processing is the conflict of metrical structures between the melody (3/4) and the accompaniment (2/4), which creates a sense of polymeter (this hemiolic rhythm is most apparent in bars 9-10, where at level d three events are retained instead of two). However, the metrical structure of the melody is more prominent and hierarchically dominant. In the third phrase (b. 11-14) the mixture of diatonic and chromatic modes is continued, however in this

case the idiomatic cadence of the first phrase is used, making the diatonic C major chord subordinate to the B♭ major (see TSR levels d and c). Moreover, the A pedal note is substituted by the linear progression B♭→A (through G) that is prolonged for the entire phrase. The fourth phrase (b. 15-18) employs a different harmonization of the same melodic phrase based on the whole-tone scale: B♭-C-D-E-F♯-G♯-B♭ (**wt0**). The scale' s pitch center is B♭ due to its placement in the lower voice, similarly to the previous harmonization. The accompaniment introduces gradually all six tones of the scale before cadencing to the final A major chord, with F♯ being the last one. This pitch is placed in the bass, in parallel with the G of the third phrase. The only note not belonging to the WT is the melodic C♯ that embellishes the cadential B♭. The choice of this WT space as a cadential sonority (non-triadic sonority with dominant function) was made perhaps because of the semitonal resolution of almost every pitch to the members of the A major triad, resulting in maximum melodic attraction/anchoring[7] (see fig. 3b): B♭→A, C→C♯, D→C♯, E→E (common tone), G♯→A (only F♯ leads to A with a minor 3rd leap). The two spaces involved (A-B♭-C♯-D-E-F-G-A and B♭-C-D-E-F♯-G♯) have three common pitches, a feature that facilitates their simultaneous appearance.

Finally, a special comment must be made on the recurring phenomenon of the C♯ appoggiatura resolving on B♭: Voice-leading continuity and cadential strength overides the

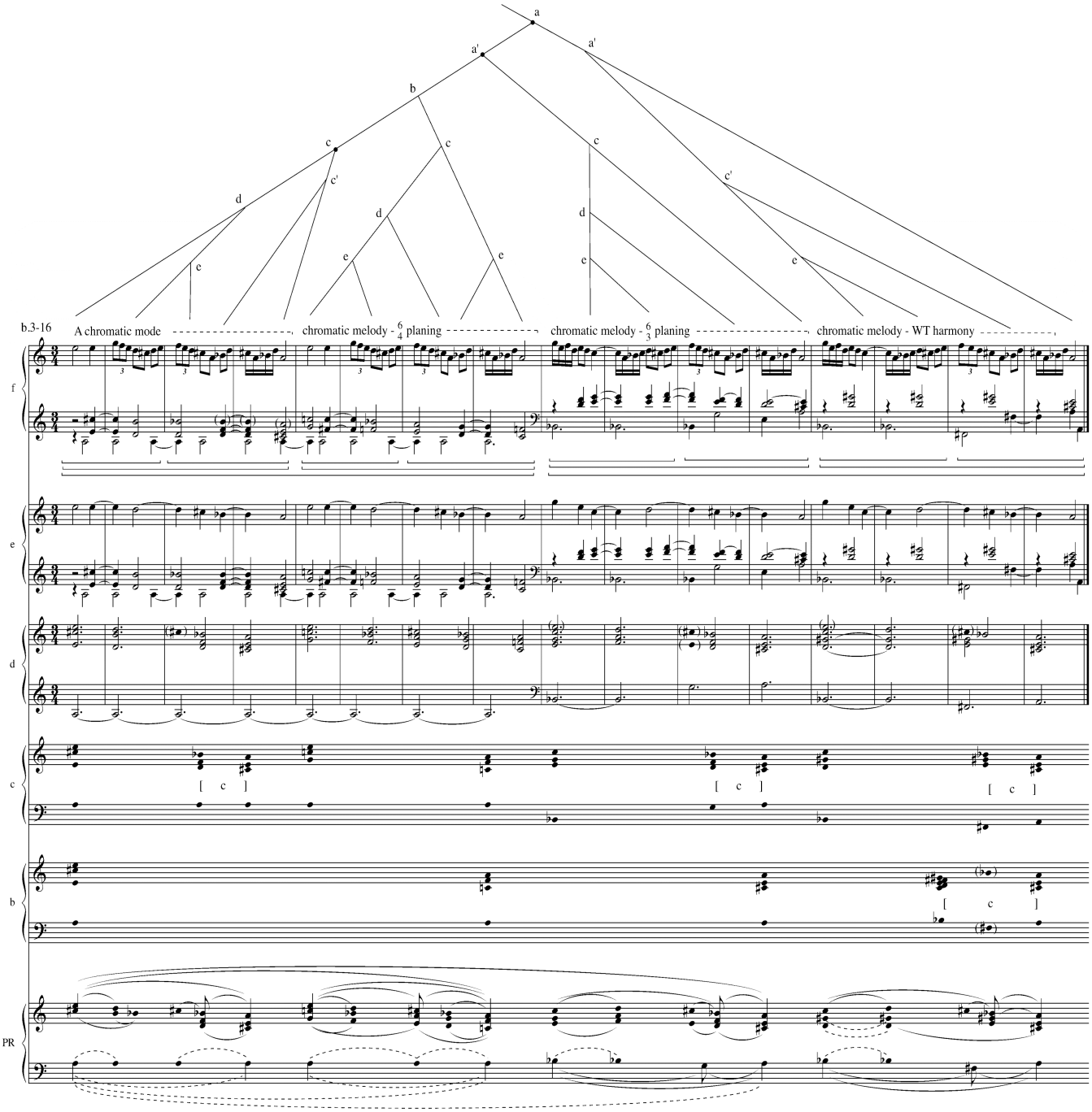

Figure 3: GTTM analysis of Bartok's "Romanian Folk Songs", no IV, b. 3-16.

low attraction value due to the augmented 2nd. Evidently, scalar continuity is maintained in this chromatic space although step intervals larger than the whole-tone are used.

root level									9			
chord level		1			4				9			
scale level		1	2		4	5		7		9	10	
chromatic level	0	1	2	3	4	5	6	7	8	9	10	11

Basic space of Romanian A chromatic mode - representation of A major triad

root level											10	
chord level			2		4				8		10	
scale level	0		2		4		6		8		10	
chromatic level	0	1	2	3	4	5	6	7	8	9	10	11

Basic space of wt0 - representation of Bb-D-E-G# sonority

Figure 3a. Basic spaces of the "Romanian Folk Dance" and chordal representations

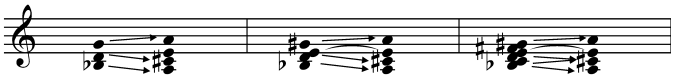

Figure 3b. Cadential structures in the Bartók example

IV. Conclusions-Discussion

The present paper attempted the application of GTTM to a variety of chromatic modal pieces of the early 20th century and arrived at interesting and stimulating analytical results regarding their structural features, their prolongational hierarchies and their harmonic and melodic elements. The analytical methodology of the GTTM, used within the framework described in part II of this paper, yielded plausible reductional/hierarchical analyses of the selected excerpts. Summarizing the analytical practice, one can notice that the flattening of the tonal space through chromaticism and the relatively ambiguous tonal centers create the strengthening of psychoacoustic parameters (salience, sensory consonance, anchoring) and call for more intuitive analytical attitude. TPS calculations (chordal/regional/spatial distances, attraction values, etc) are only partial input to the insight of the analyst and his ability to function as an ideal experienced listener.

Two topics arise for discussion in this context: the concept of reductional-prolongational analysis in chromatic modal music and the concept of ambiguity. While the use of prolongational analysis to post-tonal or atonal music has been regarded as dubious (e.g. Beach 1985, Baker 1983, Straus 1987), its application to modal music is considered viable (e.g. see Salzer 1962, Novack 1983, Dunsby & Whitall 1988: 59-61, Stock 1993) and has mainly been conducted through the strengthening of the *prolongation* concept and the weakening of the *fundamental structure* concept. The GTTM's flexibility and the substitution of the a priori *fundamental structure* (Ursatz) with the tonally unspecialized and cognitively based *normative structure* enable its extensive use beyond its initial analytical range. The normative structure, complemented by the seven proposed types of prolongational functions (see TPS, ch. 5), can accommodate a very wide spectrum of modal structures due to its functional flexibility and its potential integration of multiple modal cadence types.

Ambiguity is a major issue in the analysis of modal music (and neotonal music in general, see Williams 1997: 230) and perhaps sets the limits to what can be accomplished with formal analytical theories in this context. Of course, ambiguity is a prominent aspect of music because, apart from the importance of grammaticality (i.e. correctness and clarity), the diversity in the understanding (the cognition) of a work among the listeners is also significant. Obviously, all the ambiguous interpretations have to conform to all the well-formedness rules, as well as to a number of preference rules, pertaining to grammaticality; however, the significance and relative weight of preference rules in relation to the musical context is defined by the analyst. Within this context, the analyst must rely on his experience and intuition in order to complete the analysis by arriving at one "preferred" structure, and this is of course an act of mental subjective interpretation.

What is most important in the context of the present research is the actual diversity of chromatic modality and its almost endless possibilities that arise from the combinations of diatonic or chromatic modes with diatonic or freely chromatic or symmetrically chromatic accompaniment, poly-modal combinations of varying structural relative gravity, types of modal cadences, triadic or non-triadic harmony, etc, that makes the formalization of a overall "Generative Theory of Modal Music" a very difficult if not impossible task. The present paper only outlined this very broad and interesting issue and described its problems, possible general solutions and potential of the application of GTTM to chromatic modality. We believe that the most efficient way to evolve this research would be to focus on specific/individual modal idioms and to study their particular aspects and modal hierarchies in relation to the principles of the Generative Theory of Tonal Music.

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[1] From the article *Mode: V. Mode as a musicological concept* in the New Grove (1980, v. 12, p. 423).

[2] e.g. Messiaen's seven "modes of limited transpositions" are all symmetrical and they have fewer than 12 transpositions (Messiaen 1944).

[3] For an example of hypermodulation and modal hierarchy see the analysis of Stravinsky's "Symphony of Psalms" in Lerdahl 2001: 313).

[4] See also Lester 1989: 165-166 for a concise PCset analysis of the beginning of the piece.

[5] e.g. Chordal distance: δ(Cmaj→Amin)=7 or δ(Cmaj→Gmaj)=5 in the context of the same diatonic collection.

[6] e.g. Chordal distance: δ(Cmaj→Amaj)=δ(I/**C**→I/**A**)=i+j+k=3+3+8=14

[7] Harmonic attraction: $\alpha_{rh}(\flat II^{+6} \rightarrow I/\mathbf{A})=8.75$ (see TPS: 312).