

Textual and Melodic Accent in Gregorian Chant

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Words and Music Conference
March 14-15, 2003

Human speakers cause certain syllables to stand out from others through various means such as intensity, duration, and pitch. Similarly in music, certain notes may be accented or marked for attention. The means by which intensity and duration create musical accent are obvious, but the means by which pitch contour alone creates accent is not immediately clear. Certainly a sudden rise in pitch creates what we might call a melodic accent in a manner analogous to the tonic accent in language, but just as certainly, melodic accent can be created in myriad other ways as well. Although the notion of melodic accent is widely accepted, no clear consensus has emerged in music scholarship concerning its precise nature.

An exact and defensible definition of melodic accent will be critical to my study. Accordingly, I have chosen Thomassen's model, an experimentally-derived model with strong empirical support. I will use it to test hypotheses concerning the relationship between textual and melodic accent in Gregorian chant, the dominant tradition of monophonic liturgical singing in the western Catholic church.

Gregorian chants are set to Latin exclusively. This language underwent many changes during its remarkably long tenure, but we are concerned primarily with its state during the Middle Ages, the genesis period of Gregorian chant. During this period accent was achieved primarily through increases in intensity called stress. Several decades ago and earlier, an influential French school of

thought had maintained that Latin at this time possessed a tonic accent, that is, a primarily pitch-determined accent. This school influenced early chant studies, since France hosted the birth of modern chant scholarship. These early studies assumed a direct up-and-down relationship between the pitch inflection of the text and the contour of the chant melody. Although the stress-accented nature of Latin renders such a relationship largely moot, we can still inquire as to whether accentual mechanisms of essentially different types, namely stress accent and melodic accent, mutually reinforce each other, contrast each other, or perhaps remain neutral.

The rules of Latin accentuation are fairly straightforward (see Figure 1). In a word of three or more syllables, stress falls on the penultimate or antepenultimate syllable, depending on the configuration of vowels and consonants. In long words, the syllable two or three positions to the left of the primary stress receives a secondary stress. In bisyllables, stress falls on the first syllable, except for certain so-called "atonic" words such as prepositions, which are devoid of stress. Monosyllables may be either stressed or unstressed; "lexical" ones such as nouns, pronouns, and verbs receive stress, while "nonlexical" ones such as prepositions and conjunctions do not.

Although poetry introduces additional considerations, the rules stated so far suffice for describing the prose texts of the type of chant that is my focus today.

At this point a brief overview of previous treatments of this issue will help to place the results of my study in historical perspective.

Modern chant scholarship has its genesis in the later 19th century with the

Abbey of Solesmes in France. Clerical scholars there took on the task of restoring Gregorian chant to a pure state after centuries of corruption. After studying a massive array of medieval manuscripts, they began to publish editions that the Vatican subsequently endorsed in 1903. In support of their restorative work, they also studied issues concerning the performance and appreciation of chant. It is in this corollary work that we find early statements concerning the nature of the relationship between textual and melodic accent. Further statements appear in the work of various church-affiliated scholars sympathetic to Solesmes. During the second half of the 20th century, we must turn to academicians with no church ties for further discussion of this issue.

At the risk of running roughshod over nuances in these various scholars' views, Figure 2 attempts to encapsulate the various opinions put forth over time, starting with Mocquereau, a Solesmes monk, and others in the Catholic tradition up to about the mid-century, and continuing after that time with the academicians. For purposes of comparison I have rendered their definitions of melodic accent as symbols of basic melodic contours. I have also characterized their views concerning the relationship between textual and melodic accent. This overview does not attempt to be comprehensive, but representative of the most significant strands in the history of this issue.

Among the first to venture into this territory was Dom André Mocquereau in 1894. He subscribed to the view that Latin possessed a tonic accent, and formed his definition of melodic accent accordingly. Mocquereau felt that a note higher than its immediate neighbors, or at least higher than the note following it, constituted a melodic accent. He therefore argued that a strong relationship

exists between textual and melodic accent.

In 1921, Peter Wagner, a German musicologist with close ties to the Catholic Church, authored a three-volume study that is still an important reference work on chant. He opined that a positive correspondence between textual and melodic accent is a fundamental law of Gregorian composition. He narrowly defined melodic accent as an upward contour pivot point, as symbolized on the chart.

In 1934, the Italian cleric Paolo Ferretti spilled more ink on this subject than any other person. He believed that it was a universal law, albeit subject to certain exceptions, that melodic accents should coincide with textual accents. Unfortunately he was so vague in his definition of melodic accent and applied with it with such inconsistency that the power of his argument was considerably diffused.

In 1953, Dominicus Johner, a German Benedictine, essentially mirrored the views of Mocquereau in a large volume dedicated entirely to the relationship between words and music in chant.

The dialog on this issue migrated to purely academic quarters after mid-century, where opinion began to shift. In 1958, musicologist Willi Apel, after lambasting the methodology and critical assumptions of Mocquereau, Ferretti, and Wagner, wrote that the correspondence between textual and melodic accent does play an important role but comes nowhere close to achieving the status of a universal law. Apel's criterion for melodic accent was simply that a preceding note must be higher than a following one, which allows for the three melodic contours shown on the chart.

Richard Hoppin's 1978 textbook on medieval music poses the question, What about a *descending* contour pivot, and the myriad other ways in which melodic accent might be achieved that previous scholars seem not to have even considered? Hoppin remained skeptical that the textual-melodic relationship was even a fruitful line of inquiry.

A 1986 study by John Stevens entitled (aptly enough for today), "Words and Music in the Middle Ages," states that this line of inquiry is indeed irrelevant, and puts forth an alternative hypothesis concerning significant modal pitches. In 1990 Terence Bailey said that the belief in a special textual-melodic correspondence has been motivated all along more by a quaint 19th-century Romanticism than by any quality of the chant itself.

As a final blow, David Hiley's all-encompassing reference work on Western plainchant, dating from 1993, remains conspicuously silent on these issues, implying that they are no longer valid or important.

I can only speculate as to why these issues have died a slow death in the voluminous pages of more recent chant scholarship. Perhaps it has something to do with the seemingly intractable nature of melodic accent itself: no progress can be made if a fundamental definition cannot be agreed upon. Perhaps it has something to do with a perceived inevitability of individual biases and methodological roadblocks.

I wish to bring certain tools to bear in an attempt to surmount both these difficulties. I will apply a cautious, systematic method, making what I hope is judicious use of statistics, along with the model of melodic accent proposed by Joseph Thomassen.

In 1982, Joseph Thomassen, working at the Institute for Perception Research in The Netherlands, conducted an experiment aimed at deriving a perceptually-based model of melodic accent. To construct the stimuli for this experiment, he started with the nine possible three-note contours, or basic motifs, as shown in Figure 3a. He embedded these motifs within tone sequences that evoked ternary meter by means of dynamic accent. He systematically varied the placement of the motifs such that the first, second, and third notes in turn fell in a metrically strong position. He then presented pairs of such tone sequences to listeners and asked them to judge which of the two gave a greater impression of metrical regularity. I have reconstructed one possible pair of stimuli from the parameters described in the paper and represented it graphically in Figure 3b.

By making comparative judgments of metrical regularity, the listeners presumably avoided responding on the basis of any preconceived notions of melodic accent. This method rests on the premise that when the note possessing greater melodic accent falls in a metrically strong position, less of a disruption will occur and an impression of greater regularity will be evinced.

From listener responses, Thomassen derived a numerical value between 0 and 1 for the perceived accent weight for the second and third notes, based on the preceding interval, of each basic melodic motif, as shown in Figure 3c. Since each note is simultaneously a member of three overlapping motifs, Thomassen postulated a moving window in which the accent value for any given note is determined by their interaction, as represented in Figure 3d. Specifically, the final accent value is determined as the arithmetic product of the overlapping

motif values.

Huron and Royal (1996) subsequently applied Thomassen's model to samples of both European folksong and Western common-practice music in order to pit the model against other definitions of melodic accent found in modern music theory. Since various types of accent show a tendency to coordinate with one another in these types of music, and since a sense of meter is created in large part by the collective action of these various accent types, they calculated correlations between metrical position and the different theoretical notions of melodic accent, including Thomassen's model. They discovered that Thomassen's model yielded the highest statistical correlation, suggesting that, of all the models studied, it is the one that comes closest to actual perception.

We should bear in mind the following caveats concerning the use of Thomassen's model. First, it probably only approximates listeners' actual perceptions. The complexity of melodic accent probably cannot be captured by a single experiment. Nevertheless, it does seem to be the best model developed so far. Second, the experiment was conducted with modern Dutch listeners in a controlled environment. It may legitimately be asked what connection exists between this setting and medieval listeners in the real world—this is the standard question of ecological validity. I am proceeding on the assumption this model approximates a perceptual process that is common to humans and that has not appreciably changed from the Middle Ages to the present. At the very least, Thomassen's model cannot be any worse than previous, intuitively-generated models. The third caveat is that the use of Thomassen's model requires me to regard the chants simply as sounding objects consisting of a succession of

melodic contours. This puts issues of paleography, notation, and transmission on the back burner; these are important concerns in their own right, but lie outside my immediate purview. Further work on this topic would have to expand to include these research paradigms as well.

At this point I will present the results of four interrelated analyses. My chosen sample of the Gregorian chant repertoire consists of 58 antiphons performed during Advent and Christmas as part of the Divine Office, the daily cycle of ritual observance in monasteries. This is the same sample chosen by Apel to study this issue, and the justification for his choice—that these antiphons are among the oldest and most syllabic of Gregorian chants—remains applicable.

Here is a representative antiphon from the sample (see Figure 4). A purely syllabic setting would maintain a one-to-one ratio between syllables and notes; the antiphon shown here is largely syllabic but also contains some melismas, where two or more notes are associated with a given syllable.

Since Thomassen's model requires three overlapping contours, the first two notes of any melody cannot be assigned a value. I therefore omitted the first word in every chant. I also omitted Hebrew-derived words like "Jerusalem" and "alleluia" since their accentuation in a Latin context is uncertain. After these omissions, the sample contained some 2045 pitches and 1493 syllables.

In keeping with my formal approach to the problem at hand, I begin with a stated hypothesis in two parts: 1) Primary-stressed syllables will be set to pitches of greater melodic accent and unstressed syllables to pitches of lesser melodic accent; 2) Secondary-stressed syllables will have melodic accent greater than unstressed syllables but less than primary-stressed syllables.

To analyze the chants and test this hypothesis, I used David Huron's *Humdrum Toolkit*, a set of encoding conventions and software tools developed for the computerized analysis of music. A sample encoding is shown here as Figure 5. The left column, or spine as it's called in Humdrum, encodes pitches; the middle spine encodes the text, and the right spine encodes stress using a grid notation. Humdrum contains an implementation of Thomassen's model, which I used to calculate melodic accent values for each pitch in the sample. I then compared the values coinciding with syllables of primary stress, secondary stress, and no stress.

I restricted this first analysis to syllabic pitches only; in other words, I omitted melismas entirely. Since a melisma is a type of durational accent acting upon a syllable, and since it might interact with or somehow confound the operation of purely melodic accent, I thought it best at the outset to eliminate melismas and then incorporate them into a subsequent analysis.

Figure 6a presents the results of the comparison. At first glance the mean values of .336, .319, and .205 for primary, secondary, and unstressed syllables, respectively, appear to support the hypothesis. The question arises as to whether these values represent significant differences, or whether they are too slight to warrant any conclusions.

The way to answer this question, of course, is to employ an inferential statistical test. Such a test will generate a p value between 0 and 1 that represents the probability that the observed results could have come about by chance. So a low p value would argue for the validity of the hypothesis, not necessarily proving that it is true, but lending support to it. It is prudent to state

beforehand the threshold below which the p value will be considered significant. I will set this threshold to a customary .05; in other words, I accept a 5% risk that the observed results are due to chance and not to the interaction of textual and melodic accent as hypothesized.

An appropriate statistical test for this scenario is the Mann-Whitney test, which allows me to compare the melodic accent values associated with the various syllable types. Figure 6b presents the three possible comparisons of syllable types. The p values indicate that the difference between primary and secondary is not significant, but that the differences between primary and unstressed, and between secondary and unstressed, are indeed significant. This leads to acceptance of part 1 of the hypothesis and to the rejection of part 2 of the hypothesis. This rejection must occur because no distinction can be made between primary and secondary syllables.

In the interest of seeking converging evidence, I also calculated a correlation in order to assess the strength of the correspondence between textual and melodic accent. A correlation value ranges from -1, a completely negative correspondence, to +1, a completely positive correspondence; a value of 0 would indicate a neutral relationship. As Figure 6c shows, a positive correlation of +0.232 exists between textual and melodic accent in this sample. This value is only moderately positive, so once again the question of statistical significance arises. In this case the p value works out to less than 0.0001. In other words, there is less than one in ten thousand probability that the observed correlation could have come about by chance.

These results taken together suggest a moderate but significant tendency,

in the context of syllabic text setting, for melodic accent to coincide with and underscore textual accent.

The foregoing analysis omitted melismas, but now we can consider melismatic accent on its own. It seems reasonable to hypothesize that melismatic accent will tend to coincide with textual accent, or, to state it differently, that more melismas will occur on stressed syllables than on unstressed ones.

The method for this is simple enough at first. It simply requires a tally of melismas that occur on syllables of each stress category. In order to interpret the significance of these tallies, however, we must also account for the fact that a certain number of melismas would occur by chance on each type of syllable even if the relationship between textual and melismatic accent were neutral. Some kind of control sample against which to compare the tallies is needed. I created such a control by randomly scrambling the positions of syllables within each antiphon. This left the melodies and their essential character intact, but created a new, neutral accentual pattern under each melody.

Figure 7 summarizes the results of this analysis. The chi-squared test is appropriate for this situation in which an actual, observed proportion is to be compared to a hypothetical, control proportion. In the case of primary-stressed syllables, 120 out of 506 are set to a melisma in the scrambled version; the proportion jumps to 171 out of 506 in the actual version. This represents a robustly significant increase; there is a very tiny probability that this could have occurred by chance, and this argues in favor of the hypothesis. Putting aside secondaries for a moment, observe that the opposite situation obtains with

unstressed syllables: since the proportion decreases between the scrambled and the actual version, there is a marked tendency to avoid placing a melisma on unstressed syllables. This also supports the hypothesis. Secondaries, however, present an unexpected situation: there is a significant decrease in number of melismas on secondaries. In this context, it appears that secondaries are treated similarly to unstressed syllables.

These results lead to the conclusion that a distinct preference exists for setting primary-stressed syllables to a melisma, and that a distinct preference for having both secondary-stressed and unstressed syllables avoid melismas is present as well.

Having dealt with both melodic and melismatic accent on their own terms, the question arises as to how they might interact with each other. We might put forward the reasonable hypothesis that the melodic accent within melismas is greater for stressed syllables than for unstressed ones. Since the multiple notes of a melisma yield multiple melodic accent values, a fair means of operationally reducing them to a single value must be found. I decided first to take the mean melodic accent value for each melisma, and then to compare the mean of the means across syllable types. In light of the results for secondaries in Analysis 1, I did not consider primaries and secondaries separately, but grouped them together simply as "stressed."

As seen in Figure 8, the mean melodic accent of melismas on stressed syllables is 0.305, and on unstressed syllables, 0.301. A Mann-Whitney test indicates that this is *not* a significant difference: the very high p value argues strongly *against* accepting the hypothesis.

This is not to say that substantial melodic accent does not occur within melismas. On the contrary, the values here are similar to those obtained for stressed syllables under single pitches in Analysis 1. This simply means that within the context of a melisma, high melodic accent values are just as likely to occur on an unstressed syllable as on a stressed one. It seems that when a melisma occurs, melodic accent becomes neutral with respect to textual accent.

The foregoing analyses have uncovered certain trends in the sample of 58 chants. It will be instructive to consider a few individual chants against the backdrop of these trends.

The antiphon "Veritas de terra," (see Figure 9) sung during Matins on Christmas Day, shows the highest positive correlation between textual and melodic accent in the sample, at $+0.645$. The lower contour line in the example represents the stress pattern of the text, and the upper contour line represents the melodic accent values (not the melodic contour itself, of course). A fairly high degree of conformity between them is evident. One could select this chant as evidence for a very strong correspondence between textual and melodic accent.

However, a contrasting example isn't difficult to find (see Figure 10). The antiphon "Omnipotens sermo tuus Domine," sung at Vespers on the Fourth Sunday of Advent, has the lowest correlation in the sample. It's actually a moderately negative value of -0.246 . The nonconforming contour lines in the example demonstrate why. The contours on "regalibus" and "veniet" do conform, but many others do not. The precise mirror imaging on "sermo tuus Domine" is particularly striking.

Finally, here is chant that reflects the state of the sample as a whole (see Figure 11). "Facta est cum Angelo," sung at Lauds on Christmas Day, shows a moderately positive correlation of $+0.120$. The contour lines are at odds in several places, but in just as many places and then some, they conform.

By way of conclusion, I'd like to summarize the insights gained from each of the analyses and then reflect briefly on their implications for chant studies in general.

Analysis 1 revealed a moderate but significant tendency for stressed syllables to have a greater melodic accent than unstressed syllables in a syllabic text-setting context. Secondaries behaved similarly to primaries in this regard.

Analysis 2 demonstrated that a significantly greater number of melismas, or melismatic accents, occur on stressed syllables than one would expect by chance, and vice versa for unstressed syllables. In this context, secondaries behaved similarly to unstressed syllables.

Analysis 3 showed that melodic accent within melismas does *not* tend to be greater for stressed syllables than for unstressed ones. It appears that different principles are at work in syllabic and melismatic contexts. Once a melisma has occurred, melodic accent becomes neutral with respect to textual accent.

Analysis 4 demonstrated that individual chants may occupy extreme positions with respect to the general tendencies observed for the entire sample. It is possible to find cases of individual chants that seem to argue both for and against a positive textual-melodic correspondence. This fact alone validates the formal approach I have adopted here.

I do not wish to claim too much for this study. First, I dealt only with the

aspects of music that could be easily gleaned from written sources, namely text and melodic contour. Other aspects such as rhythm surely play a role in the performance and perception of chant, but at present they are too debateable or nebulous to incorporate. Melodic accent is but one parameter that interacts with others in performance. Second, we should bear in mind that my results are based on one sample of one chant genre. Different principles may well be in effect in other genres.

I do hope, however, that I have taken at least a few steps toward a fuller understanding of chant. In the spirit of Popperian epistemology, I can offer a few statements as to what this phenomenon is *not* in order to bring into sharper focus what it precisely *is*. This is a little like taking chisel to stone, chipping away at the negative space around the sculpture so as gradually to reveal the beauty of the form within. These Gregorian antiphons are not a repertoire in which the positive correspondence between textual and melodic accent is a fundamental law, as some in the Solesmes tradition have argued. Nor are they a repertoire in which this relationship is entirely neutral, as some modern academic scholars intimate. Rather, these chants appear to strike a compromise between the impetus to support the accentual pattern of the text through melodic means and the impetus to subtly contrast it. On balance this compromise favors the supporting role.

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