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PART TWO

INTRODUCTION TO PART TWO

The purpose of Part Two is to analyse several groups of compositions whose authorship is in doubt and to compare the results with the database of information which was built up in Part One. For each piece an attempt will be made to determine the likelihood of composition by Dunstable and/or Leonel. The works to be considered fall into one or more of the following categories.

i) Compositions with conflicting attributions to both Dunstable and Leonel.

This category is the most important in that it deals with those compositions which the study was designed to investigate. A straightforward comparison with the known styles of the two composers can be made. The results in this category should be the easiest to evaluate.

ii) Compositions with conflicting attributions to these composers and others.

In a few cases conflicting attributions to Binchois, Benet and Forest exist. As the study did not analyse the music of these composers, no comment can be made concerning their likely authorship. However, an opinion can be given on whether the music matches the style of either Dunstable or Leonel.

iii) Compositions assumed to be by Dunstable or Leonel but without attribution in the sources.

The pieces in this category include mass movements which form matching pairs with attributed compositions and also some pieces copied into the original manuscripts alongside other works by the two men. Comment can only be made on the similarity of this music to that of either Dunstable or Leonel and cannot take into account the possible similarity to that of other composers.

iv) Compositions in the general style of Leonel but without attribution in the sources.

Hamm, in the collected edition of works by Leonel, included in the first volume some anonymous pieces which he considered to be in the style of this composer. There is often no external evidence as to authorship in these cases, unlike those in category iii, therefore it is probable that a high proportion are not, in fact, by Leonel. Also, most of these pieces are in the descant style which has not been examined in detail. It is doubtful whether any accurate conclusions can be made about this category on the information collected so far.

v) Compositions which exist in more than one version.

Where a piece is found in more than one source, the manuscripts rarely agree in all details. Sometimes the

variation is sufficient to indicate a reworking of the material. It is possible to check the consistency of style in the reworked passages and to give an opinion as to which version is the original.

vi) Attributed compositions where there exists some doubt to authenticity.

At the outset of this study it was estimated that as many as a quarter of the works bearing Dunstable's name might have been wrongly attributed (see p.17). Any cases which have been shown by the study not to fall into the stylistic pattern of the appropriate composer will be discussed.

The dubious pieces will be considered roughly in this order, though first a selection of mass pairs will be described; these provide a validation of the testing methods to be employed, due to the similarity of results achieved within each pair.

THE TESTS

On the following pages is assembled a summary of the most successful tests developed in this thesis to help differentiate between the music of Leonel and that of Dunstable. No test has been included here that is not at least 70% accurate when applied to the central body of attributed works. Many other lesser differences were described in the text of Part One. Some of these are general trends which are only observed in a survey of substantial amounts of music. Such trends can be of help in dealing with, for example, a whole mass. Other differences, though not significant in isolation, can add increased weight to conclusions.

The concept of 'accuracy' needs some explanation as it could be calculated in various ways. That used here is a measure of how successful a positive test is in predicting the correct composer. An accuracy of 75%, for example, means that three out of four pieces exhibiting a particular characteristic have been allocated by the test to the named individual. Following this is shown the percentage of ascribed pieces by this same composer which are isolated by the test, as a proportion of those suitable for its application. For example, a figure of 80% referring to a test concerning duet writing means that four out of five pieces by the named composer, and containing appropriate duets, give a positive result.

The tests vary in their usefulness. The most valuable are those which are highly accurate, but often

these are applicable to only a small proportion of pieces, and few can be applied to every one. The most useful test overall has proven to be that which measures chord differences (see pp.98-100). It can be applied to any three-part work and predicts the correct composer in 91% of cases contained in the database. In no other single test is this degree of separation of the two composers achieved, although the results of many less accurate tests when considered in combination can be potentially very accurate. Previous studies to determine authorship have usually investigated only a single aspect, or at most a few aspects, of style. The dangers inherent in such an approach are obvious. Throughout Part Two of this study, the results of single tests will often conflict with others. Only in combination do they paint a useful picture. It is hoped that the inclusion of data covering many different features of composition will lead to a close approximation of the truth.

A majority of the features to be tested for are specific to Dunstable as his style seems to be more consistent and easy to define than that of Leonel. The work of this latter composer falls into many style categories, possibly related to different stages in his career. It is more difficult to find common denominators when considering such a varied body of pieces.

Some tests are for the presence or absence of a certain feature and their results are easy to appreciate, being clear cut. It must be remembered, however, that though the presence of a particular element can help to

determine authorship, its absence is not necessarily so significant. Results that produce a sliding table of values are more difficult to interpret. The tables in these cases indicate accuracies above or below certain conveniently chosen values. This is a simplistic approach as in reality the accuracy in these cases is also on a sliding scale and can only be calculated using sophisticated statistical procedures.

Though the figures in the tables can serve as a rough guide to determining authorship, their accuracy in dealing with dubious compositions is not easy to ascertain. Apart from the complications of results on a sliding scale, many other factors must be considered which could affect the calculations. The most important are listed below.

i). Most importantly, it must be assumed that those pieces with conflicting attributions to both composers are by one of them and not by a third party.

ii). Because the tests were developed using only a proportion of the composers' original output, their accuracy would probably be reduced if they could be applied to the whole body of their works. The larger a sample being studied, the more variation will be found within it. A particular characteristic not being observed in the surviving works of a composer does not necessarily imply that it was never employed by him in other, as yet unknown, works.

iii). All works with uncontradicted attributions have been assumed to be by the named composer even though it is probable that some are wrongly attributed. Four possible candidates, chosen because the results of tests on them are more extreme than for other compositions in the database, will be discussed in due course. The inclusion of such music in the database increases the scatter of results and might actually lead to an underestimation of test accuracy.

iv). The above method of calculating accuracy assumes that the amount of attributed music surviving is in direct proportion to the amount originally composed. If, in reality, Leonel had composed three times more music than had Dunstable, the chances of an unknown composition being by him are increased. However, this is unlikely to affect the more sophisticated statistical procedures to be described following the tables.

FEATURE	ACCURACY (%)		
	FAVOURS	(%)	PIECES
.	.	.	.
.	.	.	.
Any individual voice range wider than	.	.	.
an eleventh	DUN	75	7
a tenth	DUN	73	45
.	.	.	.
.	.	.	.
Total composition range wider than	.	.	.
two octaves	DUN	86	14
a fourteenth	DUN	78	60
.	.	.	.
.	.	.	.
Duetting voices overall range	.	.	.
compared to three-part texture	.	.	.
narrower	DUN	75	53
wider	LEO	73	57
.	.	.	.
.	.	.	.
Average chord length of duets longer	.	.	.
than fully scored sections	DUN	78	28
.	.	.	.
.	.	.	.
Ratio of speed of voice III	.	.	.
to speed of voice I	.	.	.
0.62 or greater	LEO	69	77
less than 0.62	DUN	81	68
.	.	.	.
.	.	.	.
Chord difference value	.	.	.
less than 0	DUN	93	93
more than 0	LEO	89	89
.	.	.	.
.	.	.	.
Less than 0.2% rare large melodic	.	.	.
intervals in the top two voices	DUN	80	62
.	.	.	.
.	.	.	.
More than 17% melodic unisons	.	.	.
(repeated notes) in voice I	DUN	100	7
.	.	.	.
.	.	.	.
Less than 0.77% melodic fifths	.	.	.
in voice I	DUN	84	75
.	.	.	.
.	.	.	.

FEATURE	ACCURACY (%)		
	FAVOURS	(%)	PIECES
.	.	.	.
Interval difference value	.	.	.
less than 0	. DUN	. 92	. 79
more than 0	. LEO	. 73	. 89
.	.	.	.
.	.	.	.
14 or more minims per syllable	. DUN	. 100	. 13
.	.	.	.
.	.	.	.
In a Gloria	.	.	.
4 or more minims per syllable	. DUN	. 100	. 83
3 or less minims per syllable	. LEO	. 100	. 67
.	.	.	.
.	.	.	.
In a Credo	.	.	.
3 or more minims per syllable	. DUN	. 100	. 50
2 or less minims per syllable	. LEO	. 100	. 50
.	.	.	.
.	.	.	.
More than half of two-part secondary cadences on the unison	. DUN	. 83	. 31
.	.	.	.
.	.	.	.
Presence of a dipped unison cadence	. DUN	. 86	. 35
.	.	.	.
.	.	.	.
More than 25% two-part cadences overlapping three-part phrases	. LEO	. 83	. 29
.	.	.	.
.	.	.	.
In overlapping two- and three-part phrases an added note is	.	.	.
on the third degree	. LEO	. 100	. 50
on the fifth degree below	. LEO	. 100	. 40
.	.	.	.
.	.	.	.
Resolution of voice II delayed by a rest in standard cadences	. DUN	. 100	. 8
.	.	.	.
.	.	.	.
Appoggiatura in voice II at cadence point in standard cadences	. DUN	. 86	. 23
.	.	.	.
.	.	.	.

FEATURE	ACCURACY (%)		
	FAVOURS	(%)	PIECES
.	.	.	.
.	.	.	.
Presence of an octave leap cadence	DUN	75	23
.	.	.	.
.	.	.	.
Presence of a falling fifth cadence	DUN	86	15
.	.	.	.
.	.	.	.
The proportion of phrases with miscellaneous endings	.	.	.
over 45%	LEO	100	39
less than 11%	DUN	100	27
.	.	.	.
.	.	.	.
The proportion of phrases ending on a close position triad	.	.	.
over 40%	LEO	100	28
less than 11%	DUN	100	35
.	.	.	.
.	.	.	.
The presence of an antepenultimate cadence chord identical to that at the cadence point in an end of section position	DUN	79	42
.	.	.	.
.	.	.	.
The presence of an antepenultimate cadence chord on the fourth degree not prepared by a chord on the cadence pitch	LEO	100	39
.	.	.	.
.	.	.	.
Frequency of all possible cadence types (minims per cadence)	.	.	.
less than 15.7	LEO	100	39
less than 21.0	LEO	91	56
more than 28.5	DUN	100	38
more than 20.3	DUN	76	96
.	.	.	.
.	.	.	.

STATISTICAL TECHNIQUES

Two statistical methods have been explored in order to assess the dubious compositions in relation to all the test results in combination, rather than each test in isolation, and also to deal more effectively with those results which fit on a sliding scale of values. A successful technique should provide a numerical measure of how well a piece of music fits the style of a given composer.

The first technique to be considered is that of correlation. This gives an indication of the similarity of the pattern of two sets of results. A coefficient of correlation is obtained which can range in value from +1 to -1. A positive correlation means that large values in one set of results correspond to large values in the other set, and the same for small values. A negative correlation means that large values in one set match small values in the other, and vice versa. Morehen used correlation in the evaluation of Byrd's dubious works,⁴⁴ though did not describe the exact way in which it was applied.

In the context of the present study, for each of the composers, average test results were calculated for those compositions in the database. These two sets of averages were used in turn as one of the sets of data to be used in

⁴⁴ John Morehen: 'Byrd's Manuscript Motets: A New Perspective' in Byrd Studies, Ed. Alan Brown and Richard Turbet (Cambridge, 1992), pp.51-62.

the correlation calculation. A Pearson product-moment correlation coefficient was then calculated comparing results for each of the 'unknown' pieces against these averages.

The validity of this use of correlation tests is questionable. They do not measure the similarity of the data sets; in fact, if the unknown results were two, or even ten, times larger than the average values, a perfect correlation score could still be obtained. The method is more properly used to study linkage, or cause and effect, in different types of data. For example, earlier in this study, a small positive correlation was demonstrated between the levels of imperfect consonance in Leonel's works and their possible chronology (see pp.85-87).

Another drawback of the technique is that, dealing as it does with averages only, it cannot take into account the spread of results for each test. Much important information is therefore overlooked. For example, the results of a particular test on, say, Dunstable's music might be contained within a much narrower band of figures than those obtained for Leonel, though the average values could be similar. Over half of the test results were also unsuitable for inclusion in their entirety. Those not on a sliding scale but indicating the simple presence or absence of certain characteristics could not be converted into averages and so were omitted. Any dealing with the characteristics of two-part writing were also not included as they could not be applied to compositions without duets. Coefficients based on different numbers of tests

for different compositions (those with and without duets) would not be comparable.

The only validation of using correlation to compare unknown results with averages is derived from an examination of the results obtained by such calculations on the database compositions. Those thought to be by Dunstable usually show a stronger correlation with his average style than with Leonel's and vice versa. However, the value of individual coefficients should be viewed cautiously. For the works in Leonel's database, the coefficient of correlation with his average style varied between +0.314 and +0.996, which might at first sight look impressive. However, the same works compared with Dunstable's database gave values varying between -0.335 and +0.966 - slightly lower in general but covering much of the same area. The large overlap meant that some of the works considered to be by Leonel gave a lower correlation with his style than many other of his works did compared with Dunstable's style. Sometimes the value was similar for the two composers, for instance the Gloria, CMMii no.10, attributed to Leonel, gave coefficients of 0.770 and 0.759 when compared with his and Dunstable's styles respectively. This is, no doubt, a reflection of the fundamental similarity of the music written by the two composers.

It must also be remembered that, though based on a scale with a maximum value of 1, the coefficients are not probabilities and must not be regarded as such, no matter how tempting this may be. The values obtained for the

motet Anima mea (CMM50i no.25) attributed to Leonel are, for him and Dunstable respectively, 0.892 and 0.729. As the sum of these values is well over 1, they cannot possibly represent probabilities. It is possible to measure the significance of correlation coefficients from appropriate tables, depending on the number of results involved. In this study, the coefficients were calculated on the same number of results for each piece and so are directly comparable with one another as they stand without reference to significance levels, so long as they are only regarded as a relative measure. Because there is so much doubt anyway as to the technique's accuracy in the context in which it is being employed, the added complication of considering significance seemed not to be justified.

The actual numerical value of the correlation coefficient does not appear to matter so much as whether it is higher than for correlation with another composer's style. At best, a negative or weak positive coefficient of less than 0.3 probably precludes composition by the relevant composer, though a strong positive correlation does not necessarily prove authorship.

The main purpose of this thesis has been to consider those compositions which bear conflicting attributions to both Dunstable and Leonel. Another statistical technique exists which is better suited to this problem - that of Discriminant Analysis.⁴⁷ This method examines whole data sets, rather than just averages, and so takes into

⁴⁷ For an explanation of the technique see P.A. Lachenbruch: Discriminant Analysis, (New York, 1975).

account the spread of results for each test. It compares results for an unknown composition against those for both composers simultaneously, and therefore calculates a true probability of composition by each of the men, the probabilities together totalling 1 in each case. This still assumes that the piece is definitely by either Dunstable or Leonel and that another party was not responsible, but this is far more likely to be true in the case of a piece which bears ascriptions, rather than that of a completely anonymous work. Due to the complexity of the technique and the large amount of data to be considered, it was necessary to perform the task on a university network computer with the help of a statistics package.⁴⁸

As data were accumulated for the different aspects of style and a picture of each dubious work was built up, the most likely composer became evident in many cases even before discriminant analysis was applied to the problem. None of the subsequent results was therefore surprising, although the confidence with which the composer was chosen in each case by the statistical method was quite amazing. With a little under half of the data in place, all but three of the compositions in the database were allocated to their respective composers with a certainty of over 0.9. This certainty rapidly reached 1.000 (i.e. over 99.9% certain) for the same compositions when approximately three quarters of the amassed data were in

⁴⁸ Minitab, Data Analysis Software Release 7.2, Minitab Inc. (1989).

place, so that the inclusion of further information could produce no further discernible accuracy. Similarly, every piece of disputed authorship was allocated to one of the two composers with such a high degree of certainty that the results make monotonous, though interesting, reading; nearly all also receive a score of 1.

The three compositions which did not reach a perfect score (the Credo MB8 no.5 and Quam Pulchra MB8 no.44, both ascribed to Dunstable, and Regina celi CMM50i no.19, ascribed to Leonel) tended to waver between the styles of the two composers during the process of building up the database, at no time showing a strong bias towards either one. It is quite possible that these pieces were wrongly ascribed in the surviving manuscripts. Considering the abundance of contradictory attributions, it should be expected that many works known only from a single source could have been ascribed in error and indeed it is surprising that so few of the sample examined here have proved suspicious in this respect. The three pieces will be examined in detail alongside the dubious works.

Though information on many aspects of style was included in the database, the analysis of cadence types produced more categories of data than other subjects. Because all categories are given equal weighting in the discriminant technique, a distortion of results through bias towards one subject was considered a possibility. Because of this the data concerning cadence types were added to the calculation last of all so that a result could be recorded both with and without their inclusion.

In fact, most of the results were already given a probability of over 0.95 before the inclusion of this information and only in the case of the two wavering pieces ascribed to Dunstable did its inclusion cause a change in composer allocation.

Experiments were carried out to discover the minimum amount of testing which would correctly allocate the compositions in the database to their respective composers. It was necessary to use only the chord difference values (the most useful overall test) together with cadence spacing and total composition range to exactly reproduce the allocation of works obtained when the complete data set was in use. The probabilities of composition in this abbreviated testing were much reduced from the perfect scoring described above, but in only two cases did the certainty fall below a level of 0.7. This success does not invalidate the premise that many different aspects of style must be studied to gain an accurate assessment of authenticity. In fact, no other combination of only three tests produced the same outcome and there is no way of predicting which tests will be the most useful until they have been tried out.

The several anonymous works to be discussed have also been subjected to discriminant analysis, though in cases where there is no firm evidence that either composer was responsible, the technique is less relevant. The result merely indicates which is the more likely of the two authors, when only given these from which to choose. A low score almost certainly means that neither was

responsible. If this project is, at a future date, extended to include data on other composers of the period (see pp.388 et seq.), the evaluation of anonymous pieces will be much more meaningful.

SANCTUS Da gaudiorum premia

SOURCES AND ASCRPTIONS

Ad no.167 ff.228v-30

EDITIONS

MB8 no.18

COMMENTS

The piece is copied immediately after a Credo (MB8 no.17) which is attributed to Dunstable and the two movements have identical tenors. Though fragments of the probable Kyrie and Gloria to this mass survive in other sources, their incomplete condition makes them unsuitable for analysis.

GENERAL STRUCTURE

As a consequence of being on the same tenor, both movements have the same mensural scheme - a triple section followed by one in duple time. The duple section begins with a duet in the Sanctus, but not the Credo.

VOICE RANGES

Credo	III F-e	II F-a'	I c-e'
-------	---------	---------	--------

Sanctus	III F-e	II E-a'	I c-e'
---------	---------	---------	--------

The ranges of Credo and Sanctus are very similar and both are within the style of Dunstable.

The duet section of the Sanctus has narrower voice ranges than the full sections. This is consistent with

composition by Dunstable.

AVERAGE CHORD LENGTH

The figures for all the duet sections in both movements are less than those for the fully-voiced sections and so are unremarkable, though the Sanctus has shorter chord lengths overall than the Credo, especially in the duple time section.

	triple	duple
Credo	1.38	1.91
Sanctus	1.33	1.50

RELATIVE VOICE SPEEDS

Compared with voice I, the speeds of the other voices are similar for the two movements:

	II	III
Credo	0.72	0.14
Sanctus	0.77	0.13

CHORD ANALYSIS

Overall levels of dissonance and consonance do not match closely for the Credo and Sanctus. These figures are for the three-part chords:

	Credo	Sanctus
Dissonance	14.99%	11.28%
Perfect consonance	27.46%	34.61%
Imperfect consonance	57.55%	54.11%

Each movement contains just two instances of accented dissonance, quite low levels for the length of the pieces, and so are compatible in this respect.

Both the Credo and Sanctus produce positive chord differences, but the chord difference averages were

calculated using only non-isorhythmic pieces, so are not really applicable in this case. However, the results show consistency between the two movements.

MELODIC INTERVALS

The overall pattern of melodic interval use is similar to that in the Credo, except that this movement has a higher proportion of unisons, reflecting a more declamatory style due to its longer, more compressed text.

Ascending fifths voice I: 0.37%

This is in the style of Dunstable.

Interval difference: -0.750

This is in the style of Dunstable and is fairly close to the figure for the Credo (-0.843).

TEXT

There are 18.42 minims per syllable.

Though rather high, this figure is close to that for another Dunstable Sanctus (MB8 no.13) and so is within his style.

CADENCES

43% of the two-part cadences are secondary. 17% of two-part primary octave cadences are of the dipped variety, and one unison cadence is also dipped. All these items are within the style of Dunstable.

The standard cadence formula occurs only five times, there being a large proportion of non-cadencing phrases in both movements (Credo 52%, Sanctus 67%). However, this is the

norm in isorhythmic compositions.

In one instance of the standard cadence, the entry of voice II at the cadence point is delayed by a rest (b.134). The first section of the piece ends on a falling fifth cadence. These are both features of Dunstable's music. Also, in three cases, the antepenultimate chord is on the same pitch as that on the cadence point, including the final cadence of the composition.

There are 29 minims per cadence, close to the figure of 28 for the Credo. This is within Dunstable's style.

CONCLUSIONS

It is generally accepted that the pieces are part of a complete mass composed by Dunstable. Apart from the activity of the parts in the duple time section, all the above investigations confirm the relation of these two particular movements. The scribe did not consider it necessary to repeat the composer attribution as the movements were copied side by side.

STATISTICAL EVALUATION

There is a high correlation between the two movements, coefficient 0.970.

In correlations with average composer styles, both correlate more highly with Leonel due to the positive chord differences:

	Dun	Leo
Credo 17	0.602	0.949
Sanctus 18	0.346	0.991

CREDO

SOURCES AND ASCRPTIONS

Ad no.172 ff.236v-8

EDITIONS

MB8 no.12

COMMENTS

In the manuscript, this piece follows a Gloria (MB8 no.11) which is attributed to Dunstable. The two pieces are very similar in structure. That the two form a pair is obvious and it has always been assumed that Dunstable also wrote the Credo.

VOICE RANGES

Gloria	IV F-g	III F-a'	II c-d'	I c-e'
Credo	IV F-g	III E-g	II c-e'	I c-e'

The ranges for the two movements are very similar, implying that they were designed to be performed as a pair.

The duet ranges are also similar for the two movements.

Both movements have the same clef arrangement:

C1-C1-C3-C3.

AVERAGE CHORD LENGTH

The two- and three-part sections are not in the same mensurations, so comparison of their chord lengths is not valid. However, corresponding mensurations in the two

movements give very similar values, strengthening the pairing between them.

	O a2	G a4	C a4	Q a2
Gloria	1.42	1.18	1.21	2.07
Credo	1.42	1.18	1.23	2.08

RELATIVE VOICE SPEEDS

	II/I	III/I	IV/I
Gloria	1.01	0.77	0.53
Credo	0.98	0.78	0.49

There are no other surviving examples of non-isorhythmic four-part pieces by Dunstable with which a comparison can be made. However, despite not being based on the same tenor, the values match well for the two movements, making it likely that they were composed as a pair.

CHORD ANALYSIS

6/5/3 frequency	0.21%
7/5/3 frequency	0.43%

These frequencies for the Credo are within the characteristic range expected for Dunstable.

Overall levels of dissonance and consonance match very well for the Gloria and Credo:

	Gloria	Credo
Dissonance	9.51%	9.65%
Perfect consonance	32.24%	32.61%
Imperfect consonance	58.25%	57.13%

The levels also match quite well for the four-part chords. The dissonance level in the three-part chords is higher in the Credo but as these make up only a tenth of the piece this is probably not significant. Over half of both pieces is made up of two-part writing.

Incidents of accented dissonance were located in this case without the aid of the computer as no other four-part pieces needed to be examined and developing a programme to perform the task would have been an inefficient use of time. However, the search was performed on a printout of the encoded music and was thorough. The Gloria contains six incidents and the Credo three. Some of those in the Gloria seem uncharacteristic of Dunstable, only one being associated with a cadence preparation and another being an appoggiatura at the actual cadence point, as has been observed in Leonel's style. The manuscript is quite clear, so the incidents cannot be due to difficulties of transcription. It might be inevitable that dissonance is less easily controlled in the handling of four voice parts.

TEXT

There are 4.31 minims per syllable.

This is a slightly larger figure than for Dunstable's other Credo movements, but well within his general style.

Due to the different lengths of the Gloria and Credo texts, the figures for the two movements are not comparable.

CADENCES

In its two-part writing, the Gloria has a larger proportion of secondary cadences on the unison than does the Credo but the levels are similar for the primary class. The Gloria contains two examples of the dipped

unison cadence, a feature of Dunstable's music. None appear in the Credo, though there is a near miss at b.70 and it would be convenient to have a cadence at this point because otherwise the phrase is unusually long at 44 minims.

Some aspects of the four-part cadences correspond very closely for the two movements:

	Gloria	Credo
Proportion based on standard pattern.	47%	45%
Proportion of standard cadences with an added third.	64%	63%
Proportion resolving on a 12-8 chord.	13%	10%
Proportion tonal.	13%	14%
Minims per cadence.	21.2	21.3

The Credo contains an octave leap cadence.

CONCLUSIONS

It is not surprising that under analysis these two movements produce mostly similar results. It has always been obvious from their manuscript positions and overall structural similarity that they were intended to form a pair. This has never been in doubt, although, without an attribution, it is always theoretically possible that the Credo could have been composed by someone other than Dunstable. As has already been discussed, the most conspicuous elements of the Gloria would have been the most easy to copy. However, the pieces have now been shown to correspond in ways which would be extremely difficult to reproduce. The exercise of comparison, both in this case and the previous one for the Sanctus

Da gaudiorum premia, has been valuable; it shows that paired movements written by one individual can correspond in details which are not immediately obvious. The use of these methods to study other possible pairs which have not been copied together is therefore validated.

GLORIA

SOURCES AND ASCRIPTIONS

OH no.24 ff.19v-20

EDITIONS

CMM46 no.24
CMM50ii no.11

COMMENTS

Though separated from it in the manuscript, this Gloria matches Leonel's Credo CMM50ii no.11 in many obvious structural points. Nevertheless, it is interesting to catalogue the less obvious ways in which the movements correspond in order to confirm the possibility that both have the same author.

KEY SIGNATURES

The two movements have the same signatures - one flat in voice I and two in the other voices.

CLEFS

The clef arrangements of the movements are interesting in that they imply the same pitches whilst being written differently, the Gloria employing F clefs and the Credo C clefs:

	▼	
Gloria		C3-F3-F3
Credo		C3-C5-C5

PLAINSONGS

The tenors are based on chants from the Office of Lauds on the feast of St. Thomas of Canterbury. Both are transposed down by a fifth and lightly ornamented.

ISORHYTHMIC STRUCTURE

Though the two movements are isorhythmic, they do not correspond in structure and are not based on the same tenor. They are similar only in that both structures are unusual and that the upper voices are also isorhythmic, though not strictly so.

The Gloria is based on two rhythmic patterns stated twice, the Credo on one stated three times. The first movement has a melodic repeat not coinciding with a change in *talea*. The second has only a loose repeat of part of the plainsong, though again not coinciding with the rhythmic repeat.

GENERAL STRUCTURE

The movements correspond roughly in length, the Credo being a little longer to accommodate its longer text. Both are in three parts with frequent brief resting of the parts but no formally laid out duets.

The Credo is in triple time throughout with no changes in mensuration whereas the Gloria alternates between C and O , with a dual signature in the final section.

Phrases in the Credo are always a multiple of a whole perfection (three minims) in length, whereas those in the Gloria are more irregular, often beginning and ending

mid-perfection.

VOICE RANGES

The ranges and tessituras of the two movements correspond exactly. The chances of this happening accidentally must be remote.

	III	II	I
Gloria	C-d	Bb-d	F-a'
Credo	C-d	Bb-d	F-a'

AVERAGE CHORD LENGTH

No attempt has been made to separate two- and three-part sections of the music as the writing is very fragmentary and there are no clear-cut boundaries to the duets. The Gloria is comparable with the Credo only in the sections where it is in C in all voices. Here the average chord lengths are a little different, though not greatly so:

Gloria 1.39 minims Credo 1.47 minims

RELATIVE VOICE SPEEDS

These are similar for the two movements. That for voice III compared with voice I is 0.32 for the Gloria and 0.34 for the Credo. These figures are low for Leonel who usually has more equal voices, the employment of the isorhythmic style being to some extent responsible for this discrepancy. However, the overall speed of movement in the lowest voice is greater than these figures suggest as they are based only on portions of music in three parts.

CHORD ANALYSIS

Overall levels of consonance and dissonance are similar for the two movements:

	Gloria	Credo
Dissonance	15.60	16.56
Perfect consonance	31.53	34.16
Imperfect consonance	52.87	49.28

The percentage of dissonant accented chords is higher in the Credo, especially in the two-part writing:

	two-part	three-part
Gloria	3.00	1.03
Credo	6.62	1.73

That in the Credo is sometimes associated with a melodic motive in voice I which falls from G via F and D to C.

This same motive occurs in b.10 of the Gloria.

Chord differences:	Gloria	38.321
	Credo	82.056

Though not such a large figure as for the Credo is obtained, the result is ideal for composition by Leonel.

MELODIC INTERVALS

Ascending fifths voice I:

Gloria	1.50%	Credo	0.83%
--------	-------	-------	-------

The result for the Gloria is within Leonel's style, though higher than for the Credo.

Interval differences:

Gloria	-0.295	Credo	0.501
--------	--------	-------	-------

This feature is the most serious discrepancy between the two movements. The figure for the Gloria is within the total range exhibited by Leonel's works but is not typical.

TEXT

The number of minims per syllable in voice I for the Gloria, at 3.86, is a little higher than for any other setting by Leonel.

CADENCES

Because the two-part writing appears only in short bursts there are few (if any) two-part cadences but many overlapping phrases where two-part writing cadences on a three-part chord. This is true of both pieces, but the proportion of overlapping phrases is higher in the Credo; it contains only two standard three-part cadences, one of these being unusual in having the function of the lower voices reversed. A slow moving inflexible cantus firmus tenor generally allows few opportunities for normal cadences and a low level of these is often a feature of Dunstable's isorhythmic music. In these present pieces, however, the plainsong often falls stepwise and yet the chance of forming a standard cadence is missed.

The proportion of three-part phrases with no true cadence is similar for both movements:

	Misc. endings	Close pos. endings
Gloria	63%	53%
Credo	63%	50%

Both also have a similar cadence spacing, well within Leonel's style. The Gloria has 16.7 and the Credo 19.1 minims per cadence.

CONCLUSIONS

The correspondence in voice ranges, plainsong source and in being isorhythmic must make it very likely that these movements were composed to be performed together. There is no structural pairing, however. In some of the finer details of style the similarity persists, though not in the intervallic structure of voice II. All other features of the style are consistent with Leonel's authorship.

STATISTICAL EVALUATION

There is a positive correlation between the two movements, coefficient 0.854.

In a correlation with composer style, the Gloria gives a higher result for Leonel than the ascribed Credo.

Dunstable's authorship is unlikely in either case.

	Dun	Leo
Gloria	0.114	0.958
Credo	-0.335	0.757

In discriminant analysis, both movements indicate with a probability of 1.000 that Leonel is a more likely author than Dunstable.

AGNUS

SOURCES AND ASCRIPTIONS

OH no.140 f.107 (frag)
 Ao ff.245v-6

EDITIONS

CMM50ii no.20
 CMM46 no.140

COMMENTS

Hughes and Bent thought it possible that this Agnus was a pair to a Leonel Sanctus (CMM50ii no.20), ascribed to him in OH (See CMM46 pp.39,41). Both movements also appear in Ao.

GENERAL STRUCTURE

Both the Sanctus and Agnus consist of alternating duet and trio sections in triple meter with many hemiolae.

VOICE RANGES

	full	duet		full	duet
Sanctus	III C-c	C-d	II C-d	I G-a'	a-bb'
Agnus	III Bb-d	C-d	II Bb-d	I G-b'	G-b'

The individual and overall ranges of the Agnus are within the limits expected for Leonel. The ranges and tessituras of the two movements are similar. The duetting voice III of the Sanctus has a wider range than the full sections as in the majority of Leonel's works. However, in the Agnus the reverse is true. This is not so typical of Leonel, but still within his style.

KEY SIGNATURES

These do not match as would be expected in paired movements. The Sanctus has no key signature; the Agnus has two flats in both lower voices.

PLAINSONG TREATMENT

Sanctus: Sanctus 2 transposed up a fifth in voice I.

Agnus: Agnus 7 transposed up a fourth in voice I.

The transpositions do not match.

The Agnus chant is associated with Easter, the Sanctus chant is not.

The Agnus chant is heavily ornamented, the Sanctus chant only lightly.

AVERAGE CHORD LENGTH

In the triple meter sections, the average chord lengths are as follows:

	3-part	2-part
Sanctus	2.04	1.95
Agnus	2.32	2.13

Those for the Agnus are typical of Leonel's style in that the two-part music is more active than the three-part, although this is probably the case in most music of the period so is not specific to this composer. The same is true of the Sanctus, except that the values are a little higher overall.

RELATIVE VOICE SPEEDS

	II/I	III/I
Sanctus	0.71	0.65
Agnus	0.71	0.61

The ratios for the Agnus are typical for Leonel and match well with those for the Sanctus; that for the top two voices is identical.

CHORD ANALYSIS

Dissonance levels in accented chords:

	Sanctus	Agnus
Two-part	8.28%	1.48%
Three-part	4.28%	6.71%

The overall level of dissonance is distributed differently between the two- and three-part chords. The three-part level of dissonance for the Agnus is higher than in any composition attributed to Leonel.

Chord difference: -2.956

The result is a negative figure as is that obtained for the Sanctus (-11.863), giving some weight to the possibility that they were composed by the same person, though neither figure is typical of Leonel.

MELODIC INTERVALS

Voice I has no ascending fifths. This is unusual for Leonel and unlike the Sanctus which has 2.8%. The overall use of intervals larger than a fifth is within Leonel's style but not as frequent as in the Sanctus (one in the top two voices as opposed to three).

Interval difference:	Sanctus	1.523
	Agnus	-2.027

While the Sanctus figure is typical for Leonel, that for the Agnus is not.

TEXT

Sanctus 12.86 minims per syllable

Agnus 11.42 minims per syllable

The figure for the Agnus is within the general range for Leonel, and very close to the only attributed Agnus (CMM50ii no.7 in four parts). The relationship to the Sanctus is also similar in both cases (Sanctus 7 has 12.86 min/syll, Agnus 7 has 11.20 min/syll).

CADENCES

The proportion of secondary two-part cadences is the same as in the Sanctus at 25%. The number of dipped octave cadences is high for the Sanctus at 67% but the Agnus has 100% dipped - this happens in no known attributed piece. Neither piece has overlapping two- and three-part sections.

58% of three-part standard cadences are dipped (36% in the Sanctus). One phrase ends with a falling fourth in the bass, as is sometimes the case in Leonel. There are no other tonal-sounding examples. There is only one cadence progression ending on a chord containing the third degree, whereas the Sanctus contains four.

There is only one miscellaneous phrase ending (8%) and while this is low for Leonel, it matches the Sanctus well (11%).

There are no antepenultimates identical to the cadence chord in either movement, though both contain examples on the fourth degree which are not prepared by the cadence chord.

The spacing of cadences is wider in the Agnus than the Sanctus (28.3 and 20.8 minims per cadence respectively) and is close to the limit for Leonel's known style.

CONCLUSIONS

Despite the superficial similarity of these two movements, there is no strong musical unification between them. In the intervallic construction of its melody and level of three-part accented dissonance, the Agnus is quite untypical of Leonel. Some other aspects are near the limits of his style, though the same is true of the Sanctus and on these grounds even its authorship must be uncertain. It is quite possible that the two movements were treated as a non-unified pair for performance together and it is just possible that Leonel was the composer of both, though the evidence is not conclusive. By intending to place these compositions towards the end of CMM50, a collection which attempts to arrange Leonel's music in a roughly chronological order, Hamm obviously viewed them as late works, outside the composer's general style.

STATISTICAL EVALUATION

The correlation between these two works, at 0.92, is stronger than for correlation of either with the average results for Leonel. In fact, both match the average for Dunstable more closely:

	Dun	Leo
Sanctus	0.966	0.314
Agnus	0.806	0.382

Despite the high correlation with Dunstable's style, the Sanctus was not rejected from Leonel's group in the discriminant test. However, the unattributed Agnus was allocated to Dunstable.

TWO CREDOS

SOURCES AND ASCRIPTIONS

OH no.77 ff.64v-65

OH no.82 ff.69v-70

EDITIONS

CMM46 no.77

CMM46 no.82

CMM50ii no.8

CMM50ii no.12

COMMENTS

Though separated from it in the manuscript, the first Credo, no.8, is thought to be a pair to Leonel's Gloria CMM50ii no.8.

The scoring of another anonymous Credo, also in OH, is similar to that of this pair and the piece is to be included in the collected edition as no.12, presumably on these grounds. Bent, however, thinks that it is probably by Cooke on palaeographic grounds.⁴⁹ She has elsewhere described how many scribal hands in the second layer of this manuscript coincide with composer attributions.⁵⁰ It is convenient to examine all these pieces at once.

SECTIONAL STRUCTURE

The most obvious links between these movements are their scoring and sectional structure. All three are constructed for the most part of alternating sections in

⁴⁹ Margaret Bent: 'Power, Leonel' in Grove, vol.15 (1980), p.179.

⁵⁰ Margaret Bent: 'Sources of the Old Hall Music' in PRMA, vol.94 (1967-8) pp.20-21.

four parts and two parts. In the Gloria and Credo no.8 these are quite short but in the Credo no.12 a little more lengthy. This latter piece is longer overall than the others. All end with a long passage in five parts. In the Gloria and Credo no.8, the fifth part is formed by a division of voice I, whereas in Credo no.12 the division applies to voice II.

The opening bars of the Gloria and Credo no.8 are similar.

CLEFS

All three movements employ the same clef arrangement:

C3-C3-F3-F3

KEY SIGNATURES

All three movements are alike in having a partial signature of one flat in the upper two voices and two flats in the lower two.

RHYTHM

No mensural signs are present but the Gloria and Credo no.8 are obviously in imperfect prolation and the Credo no.12 in perfect prolation throughout. The rhythmic effect is therefore quite different. Common to the first two is an unusually irregular rhythm which makes transcription into regular bar lengths impossible.

VOICE RANGES

These are remarkably similar for all three movements.

		two-part	four-part	five-part	overall
Gloria 8	I	F-g	G-g	F-g	F-g
	Ia			F-g	F-g
	II		F-g	F-g	F-g
	III		Bb-bb	Bb-c	Bb-c
	IV	Bb-c	Bb-G	Bb-bb	Bb-c
Credo 8	I	F-g	G-g	F-g	F-g
	Ia			G-g	G-g
	II		F-g	F-g	F-g
	III		Bb-c	C-bb	Bb-c
	IV	Bb-c	Bb-c	Bb-c	Bb-c
Credo 12	I		F-g	F-g	F-g
	II	F-g	G-g	E-g	E-g
	IIa			F-e	F-e
	III		Bb-c	Bb-d	Bb-c
	IV	Bb-bb	Bb-c	Bb-c	Bb-c

AVERAGE VOICE PITCHES

The similarity of structure and voice ranges could mean that a deliberate attempt has been made to model Credo no.12 after no.8 or vice versa. However, the average voice pitches indicate that in the distribution of pitch, a more subconscious aspect of style, there is more affinity between the no.8 pair than between these and no.12.

	Gloria 8	Credo 8	Credo 12
I	12.76	12.78	13.18
II	12.23	12.25	11.32
III	7.93	7.74	8.81
IV	6.78	7.29	6.97

AVERAGE CHORD LENGTH

The chord length values for Credo no.12 are not directly comparable with the other movements as the mensuration is different, but this movement exhibits a slowing down of pace as more voices join the texture, while the opposite is true in the other cases.

	two-part	four-part	five-part
Gloria 8	1.63	1.33	1.40
Credo 8	1.43	1.24	1.19
Credo 12	1.16	1.37	1.78

RELATIVE VOICE SPEEDS

Rates for the four-part passages are shown below. While the relative voice speeds of the Gloria and Credo no.8 are not very close, those for the Credo no.12 are quite different. This is because voice II in this latter piece is more active than voice I. If the rates are calculated as a proportion of this voice (shown in brackets below), rather than voice I, the results are closer to those for the other movements.

	I	II	III	IV
Gloria 8		0.87	0.74	0.55
Credo 8		0.94	0.62	0.58
Credo 12		1.19	0.90	0.66
	(0.84		0.76	0.55)

CHORD ANALYSIS

Credo no.12 was found to be less dissonant than the other movements, the figures for which agree closely. The following results refer to four-part chords in the four-part sections.

	dissonance
Gloria 8	26.80%
Credo 8	26.12%
Credo 12	14.02%

The number of dissonant accented chords, however, does not vary greatly between the movements. This implies that a larger proportion of the dissonance in the Credo no.12 is accented. The dissonance in this piece is also less carefully handled; four of the fifteen instances are

not prepared or resolved.

	accented dissonance
Gloria 8	4.55%
Credo 8	3.87%
Credo 12	3.69%

The incidence of the two chords which have characteristically high levels in Leonel's four-part writing is particularly high in the Gloria and Credo no.8 and less so in the Credo no.12.

	6/5/3	7/5/3
Gloria 8	4.12	3.09
Credo 8	1.22	3.27
Credo 12	0.55	1.06

MOTIVES

The Gloria and Credo no.8 share similar melodic motives which strengthen the unity between them. The first is a descending scale, five notes in length, in minims but coming to rest on a longer note. The second is four consecutive notes of a minim length on the same pitch. Both movements have short phrase lengths with frequent resting of parts. Sometimes minim rests distributed through the parts create a hocket-like effect.

TEXT

Gloria no.8	3.08 minims per syllable
Credo no.8	2.60 " " "
Credo no.12	3.53 " " "

The Gloria and Credo no.8 both have a distribution of text within the style of Leonel. The Credo no.12 has a wider spacing of syllables than in any other known Credo by this composer.

CADENCES

Again, in cadence patterns, the Gloria and Credo no.8 show similarities not shared by Credo no.12. In the two-part writing, both cadence frequently either by leap or onto an interval other than an octave or unison. This is not entirely characteristic of Leonel, but the two movements are consistent.

The final cadence in both is on B flat, though the internal pitches do not match.

Both include an instance where a dissonant appoggiatura appears at what would otherwise be a cadence point (Gloria b.69, Credo b.25). This phenomenon has been demonstrated elsewhere in Leonel's music.

In both, fewer than half of the four-part cadences employ a third at the cadence point. The Credo no.12 is much more consistent, having a third at all cadence points, except the final cadence.

One discrepancy within the no.8 pair is that the Gloria quite often avoids a cadence on all four voices by the insertion of a rest in voice III.

CONCLUSIONS

It is almost certain that Gloria no.8 and Credo no.8 were written as a pair by the same composer. Many elements of their styles match at a subconscious level. As the Gloria is attributed to Leonel the Credo was probably composed by him too. There is nothing about the style of the music which suggests otherwise.

Credo no.12, because it corresponds with this pair in

obvious features such as scoring, clefs, key signatures and voice ranges, could have been modelled on the pair or vice versa. However, the correspondence does not extend further into those areas which would be more difficult to copy. In fact, no great effort has been made to strengthen the resemblance by adopting the same mensuration. There is every possibility that another composer was responsible for this music. Cooke must be a likely candidate.

GLORIA

SOURCES AND ASCRIPTIONS

BU no.20 pp.24-5 ff.12v-13	Dunstable
Ac no.195 ff.277v-8	
Tr92 no.1370 ff.8v-9	Leonell
Tr90 no.919 ff.143v, 144v-5	
Tr93 no.1729 ff.173v-5	
Tr93 no.1730a f.177 (frag.)	

EDITIONS

MB8 no.3
 CMM50ii no.4(?)
 (Grove lists two compositions as number four in this proposed collection, the other being an Agnus from OH which has no obvious links with this Gloria.)

COMMENTS

Bukofzer, unusually, gives no opinion on the authorship of this Gloria in the collected edition of Dunstable's works, although it is included in the main body of the collection rather than with the compositions of doubtful authorship, implying that he considered it likely that it was, in fact, by Dunstable.

VOICE RANGES

III A-d II B-d I F-b'

A range of an eleventh in voice I is possible in either composer but more common in Dunstable than Leonel (frequency 20% compared to 6%).

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.73. This is nearer to the average for Leonel but does not exclude Dunstable.

CHORD ANALYSIS

Level of dissonance in accented chords:

Two-part 3.13% Three-part 0.58%

Collectively these values could fit either composer; the former favours Leonel slightly and the latter Dunstable.

The instances are too few to draw firm conclusions from the type of dissonance.

Chord difference of -115.832

This indicates a chord frequency quite unlike that used by Leonel, but within the range of Dunstable though quite extreme.

MELODIC INTERVALS

Ascending fifths voice I: 0.38%

This is more typical of Dunstable than Leonel.

Interval difference: 0.134

This is more typical of Leonel than Dunstable.

TEXT

There are 4.09 minims per syllable.

This figure is within the range for Dunstable's other Gloria movements but slightly larger than for any by Leonel.

CADENCES

Two instances of a falling fifth cadence favour Dunstable as composer.

29% of phrases have miscellaneous endings - this could be so in either composer.

The antepenultimate cadence chord is identical to that on the cadence point in three cases, i.e. 23%. One of these is a final cadence. There is one instance of the antepenultimate being on the fourth degree, but it is prepared in the standard way. These facts point to Dunstable as composer.

On four occasions, adjacent standard cadences are on the same pitch (33% of possible cases). This is more likely in Dunstable.

There are 31.5 minims per cadence, more than in any piece by Leonel and indicating composition by Dunstable.

CONCLUSIONS

The evidence clearly points to Dunstable being the author of this Gloria.

STATISTICAL EVALUATION

There is hardly any correlation with Leonel's style - coefficient 0.029 - while for Dunstable it is high at 0.918.

Discriminant analysis indicates that Dunstable was the composer with a probability of 1.000.

ALMA REDEMPTORIS MATER

SOURCES AND ASCRPTIONS

Ao no.157 ff.212v-4	Leonelle
Tr92 no.1524 ff.169v-71	Leonel
ModB ff.100(B)-1	Dunstable

EDITIONS

MB8 no.60
CMM50i no.21

COMMENTS

Bukofzer states that the ascription to Leonel is probably correct (see MB8 commentary) but gives no reason. The double ascription to Leonel is not necessarily proof of its correctness, as Bukofzer himself admits that the Ao and Tr92 manuscripts agree so closely that they must go back to the same source. Hamm also thought that the motet was in the style of Leonel (see CMM50i p.XII). These opinions are not contradicted by Bent, who considers that this puts doubt on the accuracy of ascriptions in ModB.⁵⁴

VOICE RANGES

III C-d II B-f I b-d'

An individual voice range of a twelfth as in voice II is not known in Leonel; neither is an overall composition range of more than two octaves. This favours Dunstable as the more likely composer.

Both duetting voices have ranges narrower than in the full

⁵⁴ Margaret Bent: Dunstable, (London, 1981), p.7.

sections, favouring Dunstable as composer.

AVERAGE CHORD LENGTH

The duet section in triple time has a slightly longer average note length than the fully-scored sections (1.26 compared with 1.24) but is quite short and might not be representative. The duple time duets have a shorter average chord length than those which are fully scored. (1.51 compared with 1.62). These results do not help differentiate between the composers.

RELATIVE VOICE SPEED

The ratio of the speed of voice III to voice I is 0.46. This is a little more typical of Dunstable than Leonel.

CHORD ANALYSIS

The levels of dissonant accented chords are more typical of Leonel, but within the style of both composers:

Two-part 2.37% Three-part 2.56%

All but one of the instances (a simple passing note) are concerned with the preparation of cadences. This favours Dunstable, as does the presence of three dissonant lower accessory notes.

Chord difference: -11.257

This figure is in the expected range for a composition by Dunstable. One piece with uncontradicted ascription to Leonel, his Sanctus no.20, gives a similar figure, but this is exceptional.

MELODIC INTERVALS

Ascending fifths voice I: 0.73%

This level is more typical of Dunstable than Leonel.

Interval difference: 0.437

This value is more typical of Leonel than Dunstable.

TEXT

There are 11.25 minims per syllable.

This is within the range of both composers.

CADENCES

Only one out of four two-part unison cadences is on the unison (25%), slightly favouring Leonel.

67% of primary octave cadences are of the dipped variety.

Such a high level is found more often in Leonel. There are no dipped unison cadences.

No cadences overlap with three-part phrases.

Three-part standard cadences are dipped in 30% of cases.

This does not help differentiate between composers.

There are no cadences with delayed entry or octave leap in voice II.

Three phrase endings are based on a falling fourth, slightly favouring Dunstable as composer, but none uses a falling fifth.

36% of phrases have miscellaneous endings and 24% finish on a chord in close position. This is within the styles of both composers.

One chord antepenultimate to a cadence is identical to that on the cadence point, but it is not an end-of-section

cadence and so is unremarkable. In two cases, the antepenultimate is on the fourth degree above the cadence chord, but both are prepared by a chord on the cadence pitch.

At bb.11-13 is a construction seen many times in Dunstable's music, where a cadence is linked by a short figure in voice II to a chord in which there is an octave between the lower voices.

There are 27.5 minims per cadence. This is just within the range for Leonel's known works, but more typical of Dunstable.

36% of standard cadences repeat the pitch of the previous one. This also favours Dunstable over Leonel.

CONCLUSIONS

Contrary to the views of Bukofzer and Hamm, a majority of the tests described above are clearly in favour of Dunstable as composer. The reliability of ModB is thus vindicated in this case.

STATISTICAL EVALUATION

The coefficient of correlation with Dunstable's style is 0.923 and with Leonel's 0.677.

In discriminate analysis, the composition scores 1.000 in favour of Dunstable.

SALVE REGINA

SOURCES AND ASCRPTIONS

ModB ff.86v-8	Leonel
Ao no.152 ff.203v-6	
Tr92 no.1577 ff.231v-3v	Dumstable
Tr92 no.1081 ff.366v-8v	Dunstaple
Ritson ff.124v-129	(simplified version)

EDITIONS

MB8 no.63
 CMM50ii no.22
 DT014-5 p.191

COMMENTS

Thought by Bukofzer to be probably by Leonel on the grounds that ModB ascriptions are more reliable than those in Tr92, although he considered that the style of the composition did not rule out Dunstable as composer (see MB8 commentary).

Hamm regards the motet as being perfectly in Leonel's style (see CMM50i p.XII).

VOICE RANGES

III C-e II C-f I F-c'

A range of a twelfth in voice I happens elsewhere in Dunstable but not Leonel. The overall range of two octaves is more common in the former composer.

The duetting voices are both wider in range than in the full sections, favouring Leonel as composer. However, as duets form a large proportion of the work, this might not be significant.

AVERAGE CHORD LENGTH

The figures are smaller for the duets as compared with full sections in triple time (1.22 compared with 1.50) but larger in duple time (1.87 compared with 1.82), favouring Dunstable as composer.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.44. Though possible for Leonel, this would be rather low. The result is more typical of Dunstable.

CHORD ANALYSIS

One source (ModB) has an appoggiatura at b.21. This is interesting as this is the only manuscript to name Leonel as composer, and such a dissonance is a feature of his style. Otherwise there is no accented dissonance. Two motets of Leonel with uncontradicted ascription show no such dissonance at all, although low levels are more typical of Dunstable.

Chord difference: -36.083

This indicates composition by Dunstable.

MELODIC INTERVALS

Ascending fifths voice I: 0.50%

This indicates composition by Dunstable.

Interval difference: -1.250

This indicates composition by Dunstable.

TEXT

There are 7.08 minims per syllable.

This is within the style of both composers.

CADENCES

41% of the two-part cadences are in the secondary category. This favours Dunstable, though only slightly as the music sample size is not large.

Just over half of the secondary two-part cadences are on the unison (55%). This favours Dunstable.

42% of the two-part primary octave cadences are dipped. This is within the style of both composers but closer to the average for Dunstable.

A dip appears in voice I in 53% of three-part standard cadences. This is within the style of both composers.

There are no cadences containing delayed voice entry, octave leaps or falling fifths.

42% of phrases have miscellaneous endings and 35% finish on a close position chord. This is towards the upper limit for pieces by Dunstable, but within the style of both composers. There are no 5/1 endings.

Only one chord antepenultimate to a standard cadence is identical to that at the cadence point. This favours neither composer. There is one instance of an antepenultimate chord on the fourth degree, but it is prepared in the usual way.

There are 27.6 minims per cadence. This favours Dunstable.

In 22% of possible cases, the pitch of standard cadences

duplicates that of the previous one. This favours Dunstable over Leonel.

CONCLUSIONS

All those tests which give a definite result point to Dunstable as composer. This is in contrast to the views of Bukofzer and Hamm and, if accurate, reopens the question of whether ModB is reliable in its ascriptions.

STATISTICAL EVALUATION

The correlation coefficient for Dunstable is 0.963 and for Leonel 0.466.

The discriminant technique gives Dunstable as composer with a probability of 1.000.

SALVE MATER SALVATORIS

SOURCES AND ASCRIPTIONS

ModB	ff.116v-7		Dunstable
Tr92	no.1544	ff.193v-5	Leonel
Tr92	no.1562	ff.215-5v	

EDITIONS

MB8 no.62
 CMM50i no.17
 DT076 p.58

COMMENTS

Bukofzer thought that the treatment of dissonance and other (unspecified) features of style suggested Leonel as author (see MB8 commentary).

Hamm was doubtful about Leonel's authorship (see CMM50i p.XII).

The composition has been found in two quite different versions. That in Tr92 was thought by Hamm to be the original as it employs the older form of cadence. The differences concern mainly voice II. The material has obviously been reworked at some stage, though not necessarily by the original composer. It would be very convenient if the ModB version fitted Dunstable's style and was a reworking by him of a Leonel original, Dunstable being the younger of the two men.

VOICE RANGES

III C-e II C-a' I c-d'

The ranges are the same for both versions of the

composition. That of voice II, a thirteenth, is atypical of Leonel and therefore favours Dunstable as author. Similarly, a total composition range of over two octaves is unknown in Leonel.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.47 for both manuscript versions. This is within the extremes of Leonel's style but is more typical of Dunstable.

CHORD ANALYSIS

The ModB version is a little more dissonant overall than that in Tr92 (16.05% compared to 14.32%). The amount of accented dissonance is also higher and is outside the range expected of Dunstable, though just within that for Leonel. The Tr92 levels fit either composer, but Leonel more comfortably:

	Two-part	Three-part
ModB	9.09	4.92
Tr92	0.00	3.09

Most of the accented dissonance in ModB is non-functional and not associated with cadences. This must be the version that Bukofzer was referring to in stating that the treatment of dissonance suggested Leonel as author; that in Tr92 is also quite primitive but of too low a level to be significant. However, there seems to be confusion when he states that the ModB version attempts to eliminate some of the syncope dissonance as this is at odds with the above findings.

Chord difference:	ModB	-101.298
	Tr92	-6.575

The figure for the ModB version is rather high, even for Dunstable. The Tr92 version gives a quite different result, well within his style.

MELODIC INTERVALS

Ascending fifths voice I:	ModB	0.33%
	Tr92	0.67%

Both versions have a level more typical of Dunstable than Leonel, although Tr92 is the closer of the two to Leonel's style.

Interval difference:	ModB	-1.441
	Tr92	-0.245

(CMM50i swaps the positions of voices II and III as they appear in MB8. In this case the interval difference would be -1.729)

Both these values indicate Dunstable rather than Leonel, but that for the ModB version is quite extreme.

TEXT

There are 6.91 minims per syllable.

This is within the style of both composers.

CADENCES

In the two versions, phrase endings fall almost always in the same place, and must be a reflection of the composer of the original version only. The overall frequency of cadences is similar at 27.3 and 25.8 minims per cadence

for ModB and Tr92 respectively. This is within the style of both composers but a little more likely in Dunstable. There are many rests in the texture, so the number of phrases which cadence abnormally is high. There are 62% and 60% miscellaneous endings for ModB and Tr92 respectively, while 33% and 30% end on a chord in close position. These facts favour Leonel as composer. Two standard cadences are transformed by the octave leap progression in ModB (b.5 and b.78). At b.58 the (presumably) new voice II supplies a rising fifth at the bottom of the texture to produce a tonal-sounding progression.

CONCLUSIONS

In most of the features investigated, the ModB version is further from Leonel's style than that in Tr92. The discrepancy is in the direction of Dunstable's style and beyond. This confirms the cadential evidence that ModB is the more advanced, and therefore later, version. It seems very unlikely that Leonel could have been responsible for the music as it appears in ModB. Even Dunstable's authorship is unconvincing unless the unusual test results can be explained as being caused by the process of interfering with the original. This explanation is possible, taking, for example, the interval difference calculation for voice II: In making the music more 'up to date' by altering the middle voice alone, this part often has to cross voice III to effect a more tonal bass. This fact is confirmed by the increased proportion of chords

containing crossed voices - 15.14% for Tr92 and 23.73% for ModB. The angularity of voice II (its quality which most differs between Leonel and Dunstable) is therefore increased more than if the piece had been composed in one go. The increased crossing also widens the average chord span and so affects the chord difference calculation.

It is, therefore, conceivable that Dunstable was responsible for the emendations. The only serious evidence to the contrary is that of the treatment of accented dissonance. If Dunstable is accepted as being responsible, the only explanation for this must be manuscript error (which would, incidentally, also add to the unusual chord difference). The copying does not appear to have been particularly careless, although voice II is mostly written on a six-line staff to accommodate its wide range and this could possibly have led to confusion in the placing of notes. If the dissonance is taken at face value and the conclusion drawn that Dunstable is not responsible for the piece, the widely-held belief that ModB is generally accurate in its attributions could again be brought into question.

Who was originally responsible for the piece as it appears in Tr92 is not clear; on balance, the style points to Dunstable even though Leonel's name appears in the manuscript.

STATISTICAL EVALUATION

Correlation coefficients for the two composers are similar for the Tr92 version, though clearly in favour of

Dunstable for that in ModB:

	Dun	Leo
Tr92	0.768	0.817
ModB	0.919	0.246

Discriminant analysis gives Dunstable as composer of the ModB version rather than Leonel, with a probability of 1.000. For that in Tr92, the overall probability is only fractionally less at 0.999, though without the data on cadence types the probability drops to 0.599.

MASS CYCLE Rex seculorum

SOURCES AND ASCRIPTIONS

Kyrie

Emm f.1 (frag)

Gloria

Ao no.40	ff.39v-40	Dunstable (partly cut off) (Index Dunstable)
Ao no.65	ff.72v-4	Dunstapell (Index Dunstable)
Tr92 no.1397	ff.39-40	Leonellus
Tr90 no.901	ff.110v-112	
Tr93 no.1711	ff.140v-2	
MuEm no.241	ff.121v-3	

Credo

Tr92 no.1404 ff.46v-8 Leonellus

Sanctus

Tr92 no.1405	ff.48v-9	Leonellus
Tr90 no.984	ff.274v-5v	Leonell
Tr93 no.1816	ff.347v-8v	Leonell

Agnus

Tr92 no.1446 ff.94v-5 Leonelli

EDITIONS

MB8 nos.70, 19-22
CMM50ii no.22

COMMENTS

Ao is in general more accurate in its attributions than the Trent manuscripts, pointing to Dunstable as author. Bukofzer considered the attribution to Dunstable to be supported by (unspecified) stylistic considerations (see MB8 commentary).

The Kyrie survives only in fragmentary form and is unsuitable for analysis.

VOICE RANGES

Gloria	III C-d	II C-f	I b-d'
Credo	III C-f	II C-a'	I b-c'
Sanctus	III C-e	II C-a'	I a-c'
Agnus	III C-e	II C-g	I G-c'

The large ranges in voice II of a twelfth or thirteenth do not occur in Leonel. Also, he never uses an overall range of over two octaves as in the Gloria. These aspects point to Dunstable as the more likely composer.

The duetting voice ranges are in 60% of cases narrower, 20% of cases equal and 20% of cases wider than the corresponding full sections. This is close to the overall pattern for Dunstable.

AVERAGE CHORD LENGTH

	triple		duple	
	full	duet	full	duet
Gloria	1.44	1.55		
Credo	1.33	1.62	1.62	2.06
Sanctus	1.39	1.54	2.02	1.92
Agnus	1.63	1.39		

In four out of six cases, the duet sections have a longer average chord length than the corresponding full sections. Assuming a common author, these figures favour Dunstable.

RELATIVE VOICE SPEEDS

The ratios of voice III to voice I are as follows:

Gloria	0.46
Credo	0.34
Sanctus	0.44
Agnus	0.45
Overall	0.42

These values are within the range covered by Leonel's works, though he usually has a more active third voice.

They are more typical of Dunstable.

The comparatively low result for the Credo is due to a more active voice I, necessary because of the longer text, rather than a slower voice III. It is consistent with the shorter average chord length for this movement.

CHORD ANALYSIS

The percentage level of dissonance in accented chords is as follows:

	Two-part	Three-part
Gloria	0.00	1.08
Credo	2.40	1.82
Sanctus	3.56	1.51
Agnus	3.52	0.57

These figures must be viewed cautiously, for the version in Tr92, the manuscript which is the only source for the Credo and Agnus, is carelessly copied with many mistakes and erasures. One moment in the Credo which produces parallel sevenths seems particularly unlikely. Taken at face value, the three-part writing favours Dunstable and the two-part Leonel, with the exception of the Gloria. Any allowance made for mistakes in transmission leading to unintended dissonance would push the balance more in favour of Dunstable overall. Also, in general, this composer exhibits a greater difference between two- and three-part levels and this sample of music might be large enough for this to be significant here.

None of the features which could suggest Leonel is apparent: apart from simple passing notes, all the instances of accented dissonance in the Gloria and Sanctus, and most of those in the suspect movements, are

associated with cadence approaches. The level of bare fourths is not high. One instance of an appoggiatura not associated with a cadence in the Credo (b.169) could be a mistake due to the corrupt manuscript and in fact Bukofzer eliminated this dissonance in his transcription.

Chord differences:	Gloria	-45.285%
	Credo	101.72
	Sanctus	32.511
	Agnus	-7.402
	Overall	21.019

These figures are confusing. It is very interesting that the closest match for Dunstable, as for the levels of accented dissonance above, is in the only movement with an ascription to this composer.

The figure for the Sanctus suggests Leonel, that for the Agnus could be either composer and that for the Credo is rather high even for Leonel.

Assuming that the mass is by a single composer, the overall figure should give the most reliable guide to authorship. This indicates composition by Leonel.

MELODIC INTERVALS

Ascending fifths voice I:	Gloria	1.40%
	Credo	0.32%
	Sanctus	0.83%
	Agnus	0.82%
	Overall	0.79%

Overall, the result is in favour of Leonel, although the Credo and Gloria would individually fit the style of Dunstable.

Interval differences:	Gloria	-0.267
	Credo	-1.005
	Sanctus	-2.196
	Agnus	-1.477
	Overall	-1.037

None of these figures is typical of Leonel and that for the Sanctus is a little extreme even for Dunstable, though the overall figure for the whole mass is in his style.

TEXT

The number of minims per syllable for each movement is:

Gloria	4.43
Credo	3.48
Sanctus	17.49
Agnus	13.81

The figures for the Gloria, Credo and Sanctus are within the range that Dunstable uses in other examples of these particular movements, but larger than those used by Leonel. The Sanctus figure is actually larger than for any other known composition by Leonel. There are only single examples of attributed Agnus movements for each composer and this result is larger than both, so no firm conclusion can be drawn. However, as Dunstable consistently uses a larger spacing than Leonel for the same text, this must make the result slightly in his favour.

CADENCES

The percentage of secondary two-part cadences for each movement is as follows:

Gloria	33%
Credo *	41%
Sanctus	20%
Agnus	18%
Overall	32%

These figures are within the styles of both composers.

The sample size is large enough for the overall result to

be in favour of Dunstable.

For the whole mass, exactly a third of the two-part secondary cadences are on the unison. This is almost equidistant between the average results for the two composers and so is of no value in differentiating between them. There are too few instances to give meaningful results for individual movements.

The proportion of dipped primary two-part cadences for each movement is as follows:

Gloria	25%
Credo	27%
Sanctus	78%
Agnus	13%
Overall	35%

The overall figure is close to the average for Dunstable, despite the wide spread of results for the individual movements. There are six instances of a dipped unison cadence. This is unusual in Leonel.

The number of two-part cadences overlapping three-part phrases in each movement is:

Gloria	20%
Credo	29%
Sanctus	13%
Agnus	27%
Overall	24%

This would be slightly in favour of Leonel, but within the overall style of Dunstable.

In three instances, the added note at these junctions is on the third degree. This is more common in Leonel, but does occur in Dunstable's isorhythmic music.

In three-part cadences, the distribution of the dipped form in each movement is:

Gloria	36%
Credo	42%
Sanctus	57%
Agnus	67%
Overall	51%

None of the individual levels is above the maximum limit for Dunstable, and the overall high level must favour him slightly.

The Sanctus at bb.86-87 contains a cadence progression with delayed entry of voice II. This device is not found elsewhere in Leonel.

The Gloria at b.76 has a cadence with a falling fifth in voice III. Though the progression is partly hidden by the movement of voice II crossing over, it is more characteristic of Dunstable. There are no octave leap cadences.

The proportion of miscellaneous phrase endings in each movement is:

	All	Close Position
Gloria	39%	33%
Credo	33%	0%
Sanctus	25%	17%
Agnus	33%	33%
Overall	33%	23%

The figures for the mass overall are within the range of both composers, though it is unprecedented for Leonel to use no close position chord endings in a composition, as in the Credo.

In 14% of cases, the antepenultimate chord is identical to that on the cadence point - near to the average value for Dunstable. The first sections of the Credo and Agnus and the final section of the Sanctus end in this way. There are two instances of an antepenultimate on the fourth

degree, but both are prepared in the standard way.

The numbers of minims per cadence for each movement is as follows:

Gloria	27.7
Credo	26.9
Sanctus	31.0
Agnus	31.5
Overall	28.9

The Gloria and Credo give values just inside the range for Leonel's attributed works, but the other movements and the mass overall suggest Dunstable as composer.

In 20% of cases overall in the mass, adjacent three-part standard cadences are on the same pitch. This is more likely to be the case in Dunstable than Leonel.

CONCLUSIONS

The results of these tests are nearly all in favour of Dunstable as composer.

There does exist some inconsistency between movements, for example in the chord difference measurements. This might, in small part, be due to the corrupt nature of the main source, Tr92. However, it is indeed interesting that the Gloria shows the strongest match with Dunstable's style as this is the only movement with attributions to him. A scenario which would fit the inconsistency would be that the Gloria had been composed first and the other movements added at a later date. This would also conveniently fit the fact that the Gloria survives independently and in more sources. However, the theory can only be speculation.

STATISTICAL EVALUATION

The correlation calculations were disappointing in that different movements gave different results. This was largely due to the chord difference values which conflict with the idea of Dunstable's authorship in the Credo and Sanctus movements.

	Dun	Leo
Gloria	0.972	0.360
Credo	-0.500	0.545
Sanctus	0.125	0.817
Agnus	0.907	0.699

Because more test results were included in the discriminant analysis, it was thought that the effects of the anomalous chord differences would be diluted. However, the Credo was still allocated to Leonel in preference to Dunstable and the probability of the Sanctus being by Dunstable was a little reduced from a perfect score at 0.952. There are several possible explanations for the discrepancy. Collaboration between the composers cannot be ruled out, especially in the light of Bowers's speculation that they may have been employed in the same circles (see p.15). However, assuming a single composer, Dunstable is the more likely; the mass as a whole was allocated to him with a probability of 0.889. The Credo, in this case, could have been transmitted in a corrupt form. As mentioned above, the source was carelessly copied. It is also possible that some deliberate reworking of the movement had taken place, as in the previously discussed case, Salve Mater.

MASS CYCLE sine nomine

SOURCES AND ASCRIPTIONS

Kyrie

Emm ff.1v-2 (frag.)

Gloria

Ca ff.20v-2

Ao no.155 ff.208v-10 Bonnet (index Bennet)

Tr90 no.905 ff.118v-20

Tr93 no.1715 ff.148v-50

Credo

Tr87 no.26 ff.37v-9 Leonellus

Tr90 no.943 ff.193v-5

Tr93 no.1774 ff.263v-5

Sanctus

Ao no.145 ff.194v-5 (Index Bennet)

Tr87 no.78 ff.103v-4v

Tr90 no.971 ff.254v-6 Dumpstabl

Tr93 no.1802 ff.326v-8

MilB ff.74v- Leonel

Agnus

Ao no.154 ff.207v-8 (Index Bennet)

Tr87 no.80 ff.106-7

Tr92 no.1451 f.98 (frag.)

Tr90 no.972 ff.256v-7v

Tr93 no.1803 ff.328v-9v

MilB ff.7 -80

EDITIONS

MBB nos.71, 56-9

CMM50ii no.26

DT061 pp.119-125

COMMENTS

As the Trent manuscripts are inconsistent in their attribution, Bukofzer thought Benet the most likely composer. This is supported by the fact that Ao is in general more accurate in its attributions than the Trent manuscripts. Bukofzer also considered that rhythmic peculiarities and the treatment of dissonance suggest a

composer other than Dunstable (see M88 commentary).

Music by the composer Benet has not been analyzed as part of this thesis, so any similarity to his style cannot be assessed.

The Kyrie survives incomplete and is therefore unsuitable for analysis.

VOICE RANGES

Gloria	III C-e	II C-e	I G-b'
Credo	III C-e	II C-e	I G-b'
Sanctus	III C-d	II C-e	I G-b'
Agnus	III C-d	II C-e	I G-b'

These pitches are very similar and indicate that the movements were designed to be performed together. The ranges are unremarkable, being within the styles of both Dunstable and Leonel.

Seven out of ten duetting voice ranges are equal in range to the corresponding full sections. Two are smaller and one larger. This does not favour either composer over the other and is atypical of both.

AVERAGE CHORD LENGTH

	triple		duple	
	full	duet	full	duet
Gloria	1.35	1.30	2.26	1.92
Credo	1.42	1.29	2.03	1.98
Sanctus	1.24	1.26	2.21	2.43
Agnus	1.39	1.43		

In three out of seven cases, the duet sections have a longer average chord value than the corresponding full sections. This feature favours Dunstable over Leonel as composer (two of the cases are in the Sanctus which is

ascribed to Dunstable).

RELATIVE VOICE SPEEDS

The ratios of voice III to voice I are as follows:

Gloria	0.53
Credo	0.58
Sanctus	0.46
Agnus	0.52
Overall	0.52

The values could belong to either Dunstable or Leonel, though slightly favour the former.

CHORD ANALYSIS

The levels of dissonance and consonance in three-part chords for the various movements are:

	Dissonance	Imperfect Consonance	Perfect Consonance
Gloria	9.40	68.33	22.26
Credo	7.98	68.39	23.63
Sanctus	13.45	62.29	24.26
Agnus	10.39	67.47	22.14
Overall	10.12	66.76	23.11

The levels of dissonance vary considerably, especially when compared with those of the Mass Alma redemptoris, discussed later, which shows that a unified mass can have similar levels in each movement. The overall level is low compared to most of the mass music of both composers. Amongst accented chords the percentage levels of dissonance are:

	Two-part	Three-part
Gloria	0.40	0.47
Credo	0.30	1.58
Sanctus	0.24	2.55
Agnus	0.00	0.59

The figures do not rule out either composer, but again a discrepancy is shown between the movements. Most of the

instances occur in the preparation of cadences and this must favour Dunstable a little over Leonel, as does the fact that the three-part levels are higher than the two-part. No grounds can be found for Bukofzer's assertion that the treatment of dissonance suggests a composer other than Dunstable.

Chord differences:	Gloria	18.224
	Credo	-0.601
	Sanctus	-13.766
	Agnus	10.017
	Overall	4.556

These results vary considerably. They are not consistent with Dunstable or Leonel being sole author. It is possible that another single composer could produce such figures.

As with the mass cycle on Rex seculorum, the only movement producing a figure closely consistent with Dunstable's style is the only one with an attribution to this composer.

Assuming composition by a single composer, the overall result favours Leonel slightly.

MELODIC INTERVALS

Ascending fifths in voice I:	Gloria	0.80%
	Credo	0.23%
	Sanctus	0.23%
	Agnus	0.30%
	Overall	0.44%

These figures, apart from that for the Gloria alone, favour Dunstable as composer.

Interval differences:	Gloria	-0.134
	Credo	0.160
	Sanctus	-0.112
	Agnus	0.042
	Overall	-0.033

The Gloria and Sanctus figures are in the range most representative of Dunstable, whereas those for the Credo and Agnus suggest Leonel. Again, they are not consistent with either composer being sole author and could indicate composition by a third party. The overall figure for the whole mass is nearer to the style of Dunstable but is too borderline to be conclusive.

TEXT

The number of minims per syllable for each movement is as follows:

Gloria	5.76
Credo	4.56
Sanctus	16.33
Agnus	12.80

The figures are all much higher than any examples in the same categories by Leonel. That for the Sanctus is, in fact, higher than for any other known work of his. The Gloria, Sanctus and Agnus are all typical of Dunstable, though the figure for the Credo is a little high.

CADENCES

Four movements in combination give a large enough sample size for the proportion of two-part secondary cadences to give a meaningful result. At 30%, this is close to the average for Dunstable.

The proportion of two-part secondary cadences which are on the unison is very high, even for Dunstable; ten out of twelve examples (83%). The proportion in the primary category is also high at 39%.

Primary two-part dipped octave cadences appear as follows:

Gloria	50%
Credo	20%
Sanctus	0%
Agnus	0%
Overall	18%

The levels vary markedly between the individual movements, but that for the mass overall favours Leonel over Dunstable and is based on a large enough sample of music to be meaningful. There are no dipped unison types present.

The proportion of primary two-part cadences overlapping with three-part phrases varies between the movements because in the last two the duets are self-contained. The overall figure of 25% is within the styles of both composers. However, in two instances (Sanctus b.84 and Agnus b.18) the added voice provides a third below the cadence point. This is unknown in both styles.

Similar cadential patterns are sometimes found in different movements, providing evidence that they were composed at the same time. For example, that at b.25 of the Agnus is similar to those at bb.109 and 121 of the Sanctus.

In the three-part cadences, a dip occurs in the following cases:

Gloria	36%
Credo	36%
Sanctus	20%
Agnus*	30%
Overall	31%

These levels are a little nearer to the average for Dunstable but within the style of both composers.

There are no cases of delayed entry of voice II or of

octave leap cadences.

The Sanctus contains a descending fifth cadence. This favours Dunstable as composer. There is also a large number of descending fourth cadences - five examples in the mass as a whole. On average, even Dunstable would use only one or two in a mass of this size. The level of these modern tonal types here could simply be a consequence of the correlation between movements, or could imply composition by someone slightly younger than Dunstable.

The proportions of phrases with miscellaneous and close position chord endings are as follows:

	All	Close Position
Gloria	30%	25%
Credo	32%	27%
Sanctus	38%	31%
Agnus	29%	29%
Overall	32%	28%

These levels are within the style of both composers.

In one instance, at b.35 of the Agnus, the chord antepenultimate to the cadence is identical to that on the cadence point. This is an end-of-section position. This slightly favours Dunstable over Leonel. However, there are three places where an antepenultimate on the fourth degree is not prepared by a chord on the cadence pitch, which goes against Dunstable as composer.

The frequency of all cadence types for each movement in minims per cadence is:

Gloria	31.8
Credo	32.2
Sanctus	29.4
Agnus	30.9
Overall	31.1

The individual movements show an amazingly high correspondence. This shows evidence of composition by the same composer at the same time. The spacing is wider than in any known work by Leonel, and near the upper limit of compositions by Dunstable.

CONCLUSIONS

The results of testing show that the affinity of the movements is not strong. This is not unusual; most of the paired mass movements during this period are only loosely connected and even when unification has a structural basis the test results obtained in this study sometimes show variation between movements, as in the cycle on Rex seculorum, discussed previously.

However, in this case there is a pairing of the movements, Gloria/Credo and Sanctus/Agnus, in which the members of each pair are more closely related to one another than to the other pair. This disparity is seen not only in the obvious case of sectional structure, but also in the dissonance levels and cadence forms. It is possible that more than one composer has collaborated to produce the cycle but it must still be likely that it is the work of one man as some characteristics such as cadence frequency are consistent throughout.

Assuming a single author, in a comparison with the styles of Leonel and Dunstable alone, the music shows a greater affinity with the latter. However, many features have been discovered which are not typical of either of these composers. This makes Benet's authorship a

possibility, though it is not within the scope of this thesis to assess any similarity to his style.

STATISTICAL EVALUATION

The correlation coefficients between individual movements are reasonably high:

	Gloria	Credo	Sanctus
Credo	0.878		
Sanctus	0.718	0.958	
Agnus	0.976	0.960	0.846

In correlations with the composers' average styles, the result wavers between favouring Dunstable and Leonel for the different movements. This could mean that neither was responsible for the whole mass, or could be due simply to the unreliability of the technique.

	Dun	Leo
Gloria	0.493	0.900
Credo	0.842	0.767
Sanctus	0.925	0.664
Agnus	0.669	0.860

Discriminant analysis indicates that Dunstable is much more likely to be the composer rather Leonel (but not necessarily more likely than Benet). For the first three movements and the mass considered as a whole the probability is 1.000 in his favour. For the Agnus alone the probability is 0.847.

ALMA REDEMPTORIS MATER

SOURCES AND ASCRIPTIONS

BL no.192	ff.7v-8 (of a separate fascicle)	Binchois (cancelled) then Leonelle
Ap no.137	ff.187v-8	
ModB	ff.134v-5	Dunstable
Tr93 no.1828	ff.361v-3	
MilB	ff.71v-74	

EDITIONS

MB8 no.40
CMM501 no.16
DT076 p.51

COMMENTS

Bukofzer suggested that the attribution to Dunstable was more reliable due to the indecision of the scribe of BL (see MB8 commentary). Hamm considered that the piece was not in the style of Leonel's other motets (see CMM501 p.XII). In Ap and ModB the piece lies next to another composition attributed to Dunstable.

Any similarity to the style of Binchois cannot be assessed here.

VOICE RANGES

III E-a' II F-a' I c-d'

These individual ranges and that of the whole composition fit the style of both Dunstable and Leonel.

The tenor voice in the duets has a narrower range than in the full sections. This favours composition by Dunstable.

AVERAGE CHORD LENGTH

The figures obtained are within the range expected for either English composer. (duet 1.43, full 1.61).

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.64. This favours Leonel only slightly.

CHORD ANALYSIS

The level of accented dissonance is within the style of both composers:

Two-part 0.99% Three-part 1.11%

The type of dissonance included is not distinctive.

Chord difference: 8.193

This figure is in the expected range for a composition by Leonel.

MELODIC INTERVALS

Ascending fifths voice I: 0.91%

This figure is more typical of Leonel than of Dunstable.

Interval difference: -0.253

This suggests Dunstable as composer.

TEXT

There are 8.78 minims per syllable.

This is within the range of both composers.

CADENCES

30% of two-part cadences are of the secondary type. This

is closer to the average figure for Dunstable but within the style of both men. Two thirds of these are unison cadences. This favours Dunstable.

33% of two-part primary octave cadences are of the 'dipped' variety. This is exactly the average for Dunstable, although within the style of Leonel. More significant than this result is the presence of a dipped unison cadence at b.60. This favours Dunstable as composer.

30% of two-part cadences overlap with three-part phrases. This is just within the range of values for Dunstable, but more typical of Leonel. Also, there is an instance of an added third at the cadence point (b.96) which is more common in Leonel.

30% of three-part standard cadences are dipped. This is within the styles of both composers. There are none of the cadences characteristic of Dunstable, including delayed entry of voice II, octave leap and falling fifth types.

29% of phrases have miscellaneous endings, which is again within the style of both men, although only 7% end on close position chords, which favours Dunstable.

17% of chords antepenultimate to the cadence are identical to the cadence chord. This is more likely in Dunstable. However, the piece contains an antepenultimate on the fourth degree which is not preceded by the cadence chord. This is typical of Leonel.

There are 31.6 minims per cadence. This is higher than for any piece attributed to Leonel and therefore suggests

Dunstable as the more likely composer.

CONCLUSIONS

Many of the applied tests do not help in the decision concerning authorship. Those which do, on balance favour Dunstable slightly and the circumstantial manuscript evidence must strengthen his claim, although the evidence is not conclusive.

STATISTICAL EVALUATION

In a correlation test, the coefficient in respect of Leonel was 0.838 and in respect of Dunstable 0.708. Of all the pieces bearing contradictory attributions, this was the only one not to be assigned by discriminant analysis to either composer with absolute certainty. The overall result was 0.728 in favour of Dunstable. Without the inclusion of data on cadence types which could possibly bias the outcome, the result in favour of Dunstable increased to 0.942.

As the discriminant technique is superior to that of correlation, Dunstable must be a more likely composer than Leonel, though the inconclusive nature of the result could point to a third party, especially considering the original attribution to Binchois in BL.

BEATA DEI

SOURCES AND ASCRIPTIONS

BL no.289	ff.282v-3	Binchois (name possibly cancelled)
Ap 121	ff.167v-8	Bynchois (partly cut off)
ModB	ff.133v-4	Dunstable
MuEm no.8	ff.7v-8v	Dunstable
Tr90 no.1048	ff.335v-7	

EDITIONS

MB8 no.41
DT076 p.61

COMMENTS

Bukofzer states that the attribution to Binchois is incorrect (see MB8 commentary). This is probably based on the fact that the composition occurs in a group of English pieces in four of the five sources.

VOICE RANGES

III A-c II B-d I F-g

These are in all respects within the style of Dunstable, as is the overall range.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.41. This is within the typical range for Dunstable.

CHORD ANALYSIS

1.34% of three-part accented chords are dissonant. This level is very close to the average for Dunstable. All instances occur in the approach to cadences, as is also

the norm for this composer.

Chord difference: -15.475

This figure is well within the range expected for Dunstable, though the chord structure of compositions by Binchois has not been investigated.

MELODIC INTERVALS

Ascending fifths voice I: 0.91%

This result is a little unusual for Dunstable but lies within the extremes of values exhibited by his works.

Interval difference: -0.573

This is within the style of Dunstable.

TEXT

There are 9.97 minims per syllable.

This is within the style of Dunstable.

CADENCES

There is very little two-part writing in this piece and no true two-part cadences.

79% of standard three-part cadences have a dip in voice I.

This is similar to the highest level found in Dunstable but is unusual for him.

There are none of the cadence types sometimes used by Dunstable, such as those employing octave leaps, falling fifths in the bass or delayed voice entries. However, a lack of the more modern tonal-sounding types is probably much less characteristic of Binchois than of Dunstable.

36% of phrases have miscellaneous endings and 32% end on a

close position chord. This is within Dunstable's style. Two standard cadences are approached by a chord identical to that on the cadence point; this is 13% of possible cases, exactly the average for Dunstable. Both instances are at final cadences, as is also common in his music. There are 30.9 minims per cadence. This is within the style of Dunstable.

CONCLUSIONS

There is nothing in the style of this piece to suggest that it could not have been composed by Dunstable, so his authorship seems likely. Though the music of Binchois has not been investigated here in detail, there is every reason to assume that it would be slightly more advanced in style.

STATISTICAL EVALUATION

The correlation with Dunstable's average style gives a coefficient of 0.945.

Discriminant analysis gives a perfect score of 1.000 for Dunstable compared with Leonel, without taking into account Binchois' possible authorship.

BEATA MATER

SOURCES AND ASCRIPTIONS

OS f.6v	
ModB f.91	
Ab no.196 ff.278-9	
Tr87 no.131 ff.145-6	Jo. Dunstable (cancelled), Binchois
MuEm no.9 f.8v-9	Dunstable
Linc f.27	

EDITIONS

MB8 no.42
DT014-5 p.94

COMMENTS

The cancellation of Dunstable's name in Tr87 could be due to a confusion with the next one in the manuscript which is by Binchois.

The music of Binchois has not been examined as part of this study and so any similarity to his style cannot be discussed.

VOICE RANGES

III C-e II C-f I a-b'

These are within the style of Dunstable, as is the overall range.

The voices of the duet section are narrower in range, as is common in Dunstable.

AVERAGE CHORD LENGTH

The figures obtained are within the style of Dunstable (1.69 for duet sections, 1.58 for full).

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.42. This is in the typical range for Dunstable.

CHORD ANALYSIS

Only one (0.92%) of the three-part accented chords is dissonant and none of the two-part. This is quite typical for Dunstable. The dissonant combination is due to a simple passing note at a cadence approach.

Chord Difference: 7.176

This is just outside the expected range for Dunstable.

MELODIC INTERVALS

Ascending fifths voice I: 1.41%

Though high, this result is within the range for Dunstable.

Interval difference: 0.069

This value is possible for Dunstable though not typical.

TEXT

There are 14.97 minims per syllable.

This is within the range for Dunstable.

CADENCES

There is only a small amount of two-part writing in this composition and only four two-part cadences. This number is too small to enable a useful statistical analysis. One is a dipped unison cadence as is often used by Dunstable. In fact, three out of the four cadences are dipped - a

rather high proportion.

The high proportion of dipped cadences applies equally to three-part examples. Again, three quarters are of this type. This is not unprecedented in Dunstable, but a little high nevertheless. A glance through a few compositions by Binchois does show that he favoured this progression.

All the cadences are of the standard type and there are no miscellaneous phrase endings. Dunstable does err towards such uniformity but does not achieve it completely in his known works. However, there are none of the modern-sounding tonal cadences which would probably be expected in Binchois.

The cadence spacing, at 41 minims, is very wide, even for Dunstable.

The 'English figure' motif leading to a cadence at b.21 is suggestive of an insular composer, although Binchois is known to have often copied English characteristics.

CONCLUSIONS

The authorship of this motet does not seem to have attracted any debate. Its outward appearance resembles the style of Dunstable and Bukofzer seemed certain that the cancellation of his name in Tr87 was an error.

However, some of the above measurements would stretch the limits of the details of his style. Unfortunately, it is not possible within the confines of this thesis to say whether the measurements would be appropriate to music by Binchois.

STATISTICAL EVALUATION

The correlation with Dunstable's average style is low at 0.491, though even lower for Leonel at 0.214.

Discriminant analysis shows that Dunstable is more likely to be the composer than Leonel (probability 0.989).

ASCENDIT CHRISTUS

SOURCES AND ASCRIPTIONS

OH no.65 f.57 Fforest (frag.)
 ModB ff.96v-7 Dunstable

EDITIONS

MB8 no.61
 DT076 p.53
 CMM46 no.68

COMMENTS

In OH the piece follows another by Forest. DT076 (p.102) claims that the attribution in this manuscript was a later addition, although Bukofzer claims that it is contemporary with the music and states that it is plausible for (unspecified) reasons of style (see MB8 commentary).

This study has not investigated the music of Forest, so cannot assess the likelihood of his authorship.

OH, as an insular source, is more likely to be accurate in ascribing music by English composers than would be a Continental source.

VOICE RANGES

III E-g II F-a' I c-e'

These are in all respects within the style of Dunstable, as is the overall range.

Voices I and II have a wider range in the duet sections than in those which are fully scored. This is within the style of Dunstable, but is not typical.

AVERAGE CHORD LENGTH.

The average chord length of the full sections is not as long as in the duets (1.12 compared with 1.18 or 1.22 including the two long held chords at bb.9-10 and bb.63-4). This is consistent with Dunstable's style. However, the rate of movement is faster than in any other triple-time music by this composer.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.69. This is within Dunstable's style.

CHORD ANALYSIS

There is quite a discrepancy for overall rates of dissonance in two- and three-part chords:

Two-part 5.89% Three-part 12.00%

Whilst these levels commonly differ by two or three percent in Dunstable's other known pieces due to the greater complexity which an added voice produces, nowhere is the difference so great as here. A doubling of the dissonance implies a lack of skill in handling a three-voice texture and less refinement in compositional technique. This could point to an author other than Dunstable. In spite of this, the level of accented dissonance is low, there being only two instances in the piece, both in the preparation of a cadence.

Chord difference: 10.396

This figure is outside the range expected for Dunstable.

MELODIC INTERVALS

Ascending fifths voice I: 0.50%

This value is typical for Dunstable, as is the occurrence of large intervals and the amount of declamation.

Interval difference: -0.257

This is within the style of Dunstable.

TEXT

There are 9.97 minims per syllable.

This is within the style of Dunstable.

CADENCES

Only 20% of the secondary two-part cadences are on the unison. This is well below the average for Dunstable, though within his style.

None of the primary two-part octave cadences is dipped.

There are no dipped unison cadences.

One two-part cadence overlaps with a three-part phrase.

The added note is on the fifth degree. This is within Dunstable's style. However, the short duet section which concludes the piece finishes on a three-part cadence. No piece known to be by Dunstable ends in this way.

There are a few unusual moments in the duet sections. At b.18 and bb.31-32 the voices proceed to a cadence point in parallel octaves. This has never been observed in Dunstable. Twice the duetting voices cadence prominently on an interval of a third. Also, at b.6 the cadence is extended, the ensuing rest being delayed by a beat. All these instances point to a composer other than Dunstable.

No standard three-part cadences are dipped. This is unusual.

There are no instances of voice II having a delayed entry or forming an octave leap cadence.

One phrase ends with a falling fifth in the bottom part. This is possible in Dunstable. There are no other tonal-sounding cadences.

53% of phrases end with miscellaneous progressions, and 40% on close position chords. The first value is higher than in any piece firmly attributed to Dunstable and the second equals the highest level he achieves.

No chords antepenultimate to a standard cadence are identical to the cadence chord. Two are on the fourth degree but are prepared by a chord on the cadence pitch. There are 21.5 minims per cadence. This is within the style of Dunstable.

40% of standard cadences repeat the pitch of the previous one. This is a little high, even for Dunstable.

CONCLUSIONS

Several aspects of style indicate that Dunstable was not the author of this piece. In the light of the ascription to Forest, this composer is the logical alternative, although it would be necessary to explore the style of his other known compositions for confirmation.

ModB is generally believed to be accurate in its ascriptions to composers and any finding that this manuscript is in error must yet again have implications for many pieces thought to be by Dunstable (mainly his

isorhythmic motets) which are ascribed to him only in this source.

STATISTICAL EVALUATION

The style of this piece correlates more strongly with that of Leonel (coefficient 0.949) than that of Dunstable (coefficient 0.561).

Discriminant analysis also rejects composition by Dunstable in favour of Leonel (probability 1.000), making Forest's authorship a possibility.

SANCTUS

SOURCES AND ASCRPTIONS

Tr92 no.1560 ff.212-213

EDITIONS

MB8 no.68

COMMENTS

Trowell first noticed that this Sanctus bore a note indicating that it was linked to an Agnus copied six folios earlier in the manuscript (see his thesis p.179). The Agnus is attributed to Dunstable (MB8 no.14) and it is therefore possible that the Sanctus was also written by him. In Tr87 the Agnus is paired with a different Sanctus, attributed to Dunstable in its own right (MB8 no.13).

GENERAL STRUCTURE

There is no obvious thematic or structural link in either possible pairing.

The anonymous Sanctus has a high proportion of two-part writing for Dunstable.

KEY SIGNATURES

It is stated incorrectly in the commentary to MB8 (p.208) that the anonymous Sanctus and the Agnus no.14 share a common key signature. Actually, the anonymous Sanctus has a partial signature of one flat in the lower two

voices, as does Sanctus no.13. The Agnus matches neither, having one flat in the top voice and two in the lower ones.

CLEFS

None of the clef patterns match between the movements in question:

Anon Sanctus	Agnus no.14	Sanctus no.13
C1-C3-C3	C3-C5-C5	C2-C5-C5

VOICE RANGES

	III	II	I
Full	F-g	F-a'	c-e'
Duet	E-a'	F-a'	c-f'

The individual and total ranges are within the style of Dunstable, although it is more common for his duet writing to be over a narrower range than that in three parts.

The tessitura is much higher than that of the Agnus which has a total range of Bb-a'. Sanctus no.13 is a slightly better match at C-c'.

AVERAGE CHORD LENGTH

The average chord length is no longer for the duet section than for those in three parts, as is sometimes the case with Dunstable. Values match the Agnus a little better than do those of Sanctus no.13:

	triple a3	triple a2
Anon. Sanctus	1.46	1.39
Agnus no.14	1.38	1.37
Sanctus no.13	1.59	1.40

RELATIVE VOICE SPEEDS

As a proportion of the speed of voice I, those of the other voices are:

	Anon. Sanctus	Agnus no.14	Sanctus no.13
II	0.75	0.74	0.66
III	0.37	0.43	0.30

The anonymous Sanctus in this respect is quite similar to the Agnus.

CHORD ANALYSIS

The overall level of dissonance is within Dunstable's style but is higher than for the Agnus as is that for the alternative Sanctus. Percentages for the three-part chords are:

	Anon. Sanctus	Agnus no.14	Sanctus no.13
Dissonance	12.09	7.54	14.74
Imperfect consonance	51.31	58.43	56.37
Perfect consonance	36.61	34.02	28.88

The ratio of perfect consonance to imperfect consonance for the anonymous movement is 0.71 - a little higher than for any composition attributed to Dunstable.

The percentage levels of dissonant accented chords are within the correct range for Dunstable, though again not corresponding closely with the Agnus:

	Anon. Sanctus	Agnus no.14	Sanctus no.13
Two-part	2.34	0.00	1.12
Three-part	0.00	1.03	3.09

Chord Differences:

Anonymous Sanctus	-9.215
Agnus no.14	-7.149
Sanctus no.13	-36.027

The value is within the style of Dunstable and quite close

to that for the Agnus.

MELODIC INTERVALS

Ascending fifths voice I:

Anonymous Sanctus	0.70%
Agnus no.14	0.68%
Sanctus no.13	0.68%

The correspondence between these figures is close.

Interval difference for voice II:

Anonymous Sanctus	-1.500
Agnus no.14	-0.939
Sanctus no.13	-0.406

The figure for the anonymous Sanctus is a little large, but still within the range set by Dunstable's attributed works.

TEXT

The anonymous Sanctus has 10.96 minims per syllable. This is within Dunstable's general style, and is very similar to the 10.67 for his Sanctus MB8 no.6, though Sanctus no.13 has a much wider text spacing at 18.04 minims per syllable.

CADENCES

64% of the primary two-part cadences are dipped - a little more than in any other composition by Dunstable. However, there is a dipped unison cadence which he sometimes employs. There is one two-part cadence which overlaps with three-part writing. The added voice is at the unison, so is consistent with his style.

There are no tonal-sounding cadences or ones with delayed

voice entry or appoggiaturas.

In the number of miscellaneous phrase endings, the piece is again within the style of Dunstable:

Anonymous Sanctus	18%
Agnus No.14	8%
Sanctus No.13	26%

No chords antepenultimate to the cadence point are identical to those on the cadence point.

At bb.39-41 is a link between two phrases with figuration in voice II; similar occurrences are found in Dunstable. The number of minims per cadence is similar for all three movements:

Anonymous Sanctus	27.9
Agnus No.14	29.1
Sanctus No.13	28.0

In one out of ten cases, a standard cadence repeats the pitch of the previous one.

CONCLUSIONS

The lack of any strong evidence against this piece being by Dunstable and the presence of many features consistent with his style in combination with the scribal evidence must make his authorship a distinct possibility.

Some aspects correspond with the Agnus, but none is significant enough to suggest pairing on a stylistic basis.

STATISTICAL EVALUATION

The correlation between Dunstable's Agnus and this anonymous Sanctus is greater than between the Agnus and Sanctus no.13.

Agnus 14	Anon. Sanctus 0.952	Sanctus 13 0.812
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The correlation of the anonymous Sanctus with Dunstable's average style is high at 0.948 (coefficient for Leonel 0.501).

Without considering cadence types, a discriminant test allocates the piece to Dunstable in preference to Leonel with a probability of 0.999. Including the cadence data reduces the probability to 0.633.

KYRIE Lux et oriqo

SOURCES AND ASCRIPTIONS

Ao no.6 ff.11v-12 ?Leonel
Linc f.31v (frag)

EDITIONS

None known.
A transcription from Ao is included in this thesis
(p.393).

COMMENTS

The composer's name in Ao, which lies at the top of f.11v, has been cut through. However, Trowell noticed that the bottom of the attribution to Leonel on the immediately preceding piece, in the same hand, was similar to the cut name.⁸² Leonel must be seriously considered as composer. Voice I is based on a chant melody.

RHYTHM

Three sections in the pattern triple-duple-triple metre is common in Leonel, though is also a feature of much English music of the period. He is particularly fond of passages of coloration in voice I with resulting cross rhythms, as occurs in the middle section of this piece.

VOICE RANGES

	III	II	I
three-part	C-d	C-d	G-a'
two-part	C-d	C-e	a-a'

⁸² See Ann-Marie Seaman: 'The Music of Oxford, Bodleian Library, MS Lincoln College Latin 89: A Postscript' in RMA Research Chronicle, vol.14 (1978), p.139.

The individual ranges are within the style of Leonel, as is the overall range.

AVERAGE CHORD LENGTH

The piece moves slowly, but the rate is comparable with many of Leonel's early pieces.

The average chord length is shorter in the duet sections (2.00 minims) than in those which are fully scored (2.24 minims), so is unremarkable.

RELATIVE VOICE SPEEDS

The voices have similar rates of movement, as is usual in Leonel.

Voice II 0.86 Voice III 0.76

CHORD ANALYSIS

Chord difference: 6.997

This is within the style of Leonel.

The level of dissonant accented chords is within Leonel's style. Two of the incidents are appoggiaturas, of which Leonel is fond.

three-part 2.48% two-part 1.79%

MELODIC INTERVALS

There are no ascending fifths in voice I. This is a little unusual in Leonel's mid- and late-period works but not in his early plainsong harmonizations. Voice I follows the plainsong melody so closely here that the lack of large intervals is a characteristic of the chant rather

than of Leonel's choosing.

Interval difference in Voice II: 0.938

This is within the style of Leonel.

CADENCES

The presence of the 'English figure' indicates composition by an English composer.

There are only four primary two-part cadences. Two of these overlap with three-part phrases as is common in Leonel.

17% of standard three-part phrases have a dip in voice I. 22% of phrases do not cadence properly. There are 23.0 minims per cadence. All these values are within Leonel's style.

There are no tonal-sounding cadence progressions. In one case, an antepenultimate on the fourth degree is not preceded by a chord on the cadence pitch. 15% of consecutive standard cadences are on the same pitch.

CONCLUSIONS

There is nothing in the style of this Kyrie to suggest that it could not have been composed by Leonel, and much evidence to show that it is perfectly in his style. His authorship must be very likely, especially as the piece immediately follows another by him in the manuscript.

Though the music has not been chosen for inclusion in the collected edition of his works, there is more reason to suspect that it is by Leonel than many of those which are to be included.

If the piece is, in fact, by Leonel, it has an interesting mixture of features. Being a rather simple plainsong harmonization, it must be classed along with his Group I works. However, it contains more advanced features than his earliest descant settings, for example duet sections, alternating mensurations and particularly coloration. It must, therefore, be transitional between his early and mid-period styles. Though most of his early works are known only from insular sources, Ao does contain music which appears in the original layer of OH, so the inclusion of such a piece is not too surprising.

STATISTICAL EVALUATION

There is a high correlation with Leonel's average style (coefficient 0.848), though not a lot higher than with that of Dunstable (coefficient 0.702).

Discriminant analysis allocates the composition to Leonel with a probability of 1.000.

CREDO

SOURCES AND ASCRPTIONS

Tr92 no.1427 ff.71v-3
 Pemb f.2v (frag.)
 Tr90 no.947 ff.202v-4v
 Tr93 no.1778 ff.273v-5v

EDITIONS

MB8 no.10
 DT061 p.90

COMMENTS

This piece is placed in two manuscripts next to pieces attributed to Dunstable. In Tr92 it is next to Gloria MB8 no.9 and in Pemb next to Gloria MB8 no.2. Bukofzer found nothing in the style of the movement to contradict the assumption that it, also, was by Dunstable (see MB8 commentary).

VOICE RANGES

III F-a' II F-a' I c-f'

These ranges and the total composition range are almost ideal for the style of Dunstable.

Of the duetting voices, one is larger and one smaller in range than in the corresponding full sections. This is within Dunstable's style.

AVERAGE CHORD LENGTH

The duet section in triple time has a longer average chord length than the fully-scored sections, as often happens in Dunstable.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.59. This is a very typical figure for Dunstable.

CHORD ANALYSIS

The levels of dissonance amongst the accented chords are:

Two-part 1.03% Three-part 0.56%

These figures are both within Dunstable's style, as is the fact that all but one of the instances are associated with the approach to a cadence.

Chord difference: -34.081

This is close to the average figure for Dunstable, so is well within his style. It forms a good match with Gloria No.2 (chord difference -32.592), but a less good match with Gloria No.9 (chord difference 1.014).

MELODIC INTERVALS

Ascending fifths voice I: 0.23%

This would be typical for composition by Dunstable.

Interval difference: 1.217

This figure is not typical of Dunstable but does not rule him out as composer as two attributed works fall into this area.

TEXT

There are 3.41 minims per^v syllable.

This is within the style of Dunstable.

CADENCES

The English figure cadence motif at b.57 is often used by Dunstable.

29% of two-part cadences are of the secondary type and 6% overall overlap with three-part phrases. In the three-part writing, 36% of standard cadences dip in voice I and 21% of phrases have miscellaneous endings. These figures are all close to the average for Dunstable.

There are no examples of delayed entry of voice II or octave leap formulae.

There are quite a few tonal-sounding cadences with a descending fourth in voice II (the lowest voice at these points). There is even one in two parts at b.5.

Dunstable does occasionally use such formulae, but not so frequently and not in two parts.

The antepenultimate chord to two of the standard cadences is the same as on the cadence point, one of them being the final cadence of the composition, as is common in Dunstable. However, on two other occasions the antepenultimate is on the fourth degree and not prepared in the standard way. This is atypical of Dunstable.

There are 25 minims per cadence. This is close to the average for Dunstable.

18% of standard cadences repeat the pitch of the previous one. This is normal for Dunstable.

CONCLUSIONS

Most of the examined characteristics are well within the style of Dunstable. The high proportion of tonal-type

cadences and the unprepared antepenultimates on the fourth degree are the only evidence to the contrary. The tonal bias, however, could suggest a slightly more modern composer, though almost certainly English to judge from the manuscript positions and the presence of the 'English figure'.

STATISTICAL EVALUATION

The coefficient of correlation with Dunstable's average style, at 0.992, is the highest for any of the dubious works.

A correlation with the two Gloria movements shows a greater affinity with no.2 (coefficient 0.980) than with no.9 (coefficient 0.700), though there is no obvious structural pairing in either case.

The discriminant analysis technique shows a probability of 1.000 that composition was by Dunstable in preference to Leonel.

REGINA CELI

SOURCES AND ASCRPTIONS

OH no.44 f.36v

EDITIONS

CMM50i no.3
CMM46i no.44

COMMENTS

This motet was copied into OH after another composition attributed to Leonel - his Ave Regina (CMM50i no.2). The rhythmic styles of both pieces are similar.

Hamm considers it to be very much in Leonel's style (See CMM50i p.XIV).

VOICE RANGES

III F-e II b-a' I b-c'

These are within the style of Leonel.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.69. This is within the area most used by Leonel.

CHORD ANALYSIS

The overall level of dissonance is low (6.90%) and there is only one instance of accented dissonance. This matches Leonel's other descant pieces well.

The chord difference technique is not applicable to the descant style.

MELODIC INTERVALS

There are no large rare interval types in the upper voices, but this is normal in the descant style.

Ascending melodic fifths: 1.55%

This is within the style of Leonel.

The interval difference technique is not applicable to the descant style.

TEXT

Assuming that the text given in voice III is applicable to voice I, there are 10.65 minims per syllable.

This is within the style of Leonel.

CADENCES

In four cases, the middle voice remains stationary on the fifth degree during the cadence as is common in Leonel's descant pieces.

The number of miscellaneous cadence types is typical at 38% overall and 17% on close position chords, although there are no rests in the texture to indicate phrase endings.

There are 17.0 minims per cadence on average. This is in the typical range for Leonel.

Some of the standard cadences have atypical preparations without stepwise movement of the parts. This has been observed elsewhere in Leonel's descant music, though the proportion of instances in this piece is higher.

CONCLUSIONS

This piece fits Leonel's known early style well. Of all the anonymous pieces considered by Hamm, this is the most likely to be by him, although the testing here has not been so stringent as for the non-descant pieces.

Data on the descant compositions were not included in the correlation and discriminant analysis, so use of these techniques would not be valid in this case.

AVE MARIS

SOURCES AND ASCRPTIONS

Tr92 no.1450 f.97v

EDITIONS

CMM501 no.4
DT053 p.78

COMMENTS

This piece is attributed to Leonel in the index of Tr92 but possibly due to a misreading. If by Leonel, it is his only true descant piece with chant in the middle voice to appear in a Continental source.

The piece is short - only seventeen bars in modern transcription.

VOICE RANGES

III FF-a II A-d I C-f

The individual voice ranges are quite wide, especially considering the shortness of the piece. They are within the general style of Leonel, but all his known descant pieces have narrower ranges. However, voice II is based on a borrowed chant with a range of a ninth and this must have some effect on the range of the other parts.

The overall range is within his style.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.75. This is within the style of Leonel.

CHORD ANALYSIS

7.81% of all accented chords are dissonant. This is a much higher figure than met elsewhere in Leonel's work. However, the interpretation of the manuscript is uncertain and the two modern transcriptions are quite different. This figure is based on that in CMM50, the more recent version.

The chord difference technique is not applicable to the descant style.

TEXT

Assuming that the text given in voice II is applicable to voice I, there are 4.04 minims per syllable.

This is within the style of Leonel.

CADENCES

There are no miscellaneous phrase endings but two cadence progressions onto a 10/8 chord occur mid-phrase. The remaining cadences are all of the standard type, but considering the length of the piece this is not significant.

There are none of the cadences typical of Leonel's descant style in which voice II takes a fifth above the cadence pitch in the penultimate chord.

There are 14.6 minims per cadence which is within Leonel's style.

CONCLUSIONS

The shortness of the composition and the difficulties in

transcription make the results of analysis difficult to interpret. There is insufficient evidence to make any conclusions about authorship.

AVE REGINA

SOURCES AND ASCRPTIONS

OS ff.16v-7

EDITIONS

CMM50i no.6

COMMENTS

This piece was included by Hamm in the collected works as he considered it to be in the style of Leonel. There are no external clues as to the composer.

The motet resembles many plainsong harmonizations but it is freely composed. Chord difference and interval difference calculations have therefore been quoted though their validity in this case is not known.

VOICE RANGES

III F-f II G-a' I c-f'

This is within the style of Leonel.

Ranges in the duet passages are wider overall than in the full sections. This is typical of Leonel.

AVERAGE CHORD LENGTH

The triple section duet has a slightly longer average chord length than the corresponding fully-voiced section (0.83 compared with 0.81). This is possible in Leonel though not typical. Also, the values are smaller than for any piece attributed to Leonel.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.51. This is within Leonel's general style, but is lower than in any other group I piece.

CHORD ANALYSIS

There is no two-part accented dissonance and only two incidents in the three-part chords (1.20% of possible cases). This is within the style of Leonel.

Chord difference: -14.771

This is not in the range of Leonel's other works, though his group I pieces were not used in the formulation of the calculation.

MELODIC INTERVALS

Ascending fifths in voice I: 0.37

This is lower than average for Leonel.

Interval difference: -1.36

This does not support composition by Leonel, though again the calculation did not include his Group I pieces.

TEXT

Assuming that the text given to voice III is applicable to voice I, there are 6.31 minims per syllable.

This is within Leonel's style.

CADENCES

There are too few two-part cadences from which to draw any conclusions.

Only one in nine (11%) of the three-part phrases does not approach a true cadence. This is a little low for Leonel but just within his style.

One cadence contains the third of the chord in voice II. Otherwise they are all of the standard type.

There are 16.2 minims per cadence, which appears to be lower than the average for Leonel's style. However, the chord length is unusually short, so this figure is deceptive and the number of chords per cadence is higher than average at 17.5 (mean 14.9 for his attributed pieces). Both figures are within Leonel's style.

Many of the cadences are pitched on C and 31% of them repeat the previous pitch. This is a high level for Leonel.

CONCLUSIONS

This piece is just conceivably by Leonel but more likely to be by some other composer.

STATISTICAL EVALUATION

The motet correlates only weakly with Leonel's style and more strongly with that of Dunstable - coefficients 0.308 and 0.974 respectively.

The discriminant technique rejects the piece as being by Leonel and allocates it in preference to Dunstable with a probability of 1.000.

SANCTA MARIA

SOURCES AND ASCRPTIONS

Ad f.158v
 OS ff.3v-4

EDITIONS

CMM50i no.8

COMMENTS

This motet was included by Hamm in the collected works as he considered it to be in the style of Leonel. The music is copied into OS beside another composition (Ave Regina CMM50 no.7) attributed elsewhere to Leonel.

VOICE RANGES

III C-c II C-d I a-g

These ranges are within the style of Leonel.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.61. This is in the typical range for Leonel.

CHORD ANALYSIS

The overall level of dissonance is 9.42% - close to the average for Leonel's group I compositions. There is no accented dissonance and this is also typical.

The chord difference at -14.099 is not typical for Leonel, although the technique was not formulated using his group I pieces (those employing chant harmonization) and so

might not be relevant to the transitional style of this example.

MELODIC INTERVALS

There are no ascending fifths in voice I, though as this voice is based on chant the fact is probably not significant.

Interval difference: 0.709

This is within the range expected of Leonel.

TEXT

There are 8.33 minims per syllable.

This is within the style of Leonel.

CADENCES

42% of standard cadences are dipped, which is within Leonel's style, although every phrase ends with a standard progression and this is unknown in Leonel. There are no tonal-sounding cadences.

Nothing in the preparation of the cadences conflicts with Leonel's authorship and those which repeat the previous pitch are nearly ideal at 9%.

There are 16.2 minims per cadence and this is again within the style of Leonel.

CONCLUSIONS

It is just possible, though the evidence is not ideal in every respect, that this piece might be by Leonel as it does resemble other examples of his work. However, his

early style has not been investigated thoroughly enough here to give a definite opinion.

A statistical evaluation is not possible as Leonel's Group I works were not included in the calculations for his style.

SPES NOSTRA

SOURCES AND ASCRPTIONS

BL no.217b ff.204v-205

EDITIONS

CMM501 no.9

COMMENTS

This motet was included by Hamm in the collected works as he considered it to be in the style of Leonel. There is no manuscript evidence to support this.

VOICE RANGES

III C-d II C-e I a-b'

This is within the style of Leonel.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.74. This is within the style of Leonel.

CHORD ANALYSIS

There is no accented dissonance present. This is the case in two motets with uncontradicted ascription to Leonel, so is within his style.

Chord difference: 6.062^{*}

This is within the style of Leonel.

TEXT

There are 14.44 minims per syllable.

This is a larger figure than for any other work of Leonel.

CADENCES

There is no true duet writing but at b.38 the outer voices alone move towards a cadence where they are joined by the middle voice at a third below. This progression has not been observed elsewhere in Leonel.

There is a three-part cadence based on a falling fifth. This is uncommon in Leonel. There are no miscellaneous phrase endings.

The cadence spacing at a mean of 33.0 minims is much wider than for any known example by Leonel.

There is a lack in variety of cadence pitch, all examples being on C or F.

CONCLUSIONS

Though some tests give results within the style of Leonel, the cadence patterns and text distribution suggest some other composer.

STATISTICAL EVALUATION

The coefficient of correlation with Leonel's style is quite low at 0.496. With Dunstable's it is even lower at 0.207.

REGINA CELI

SOURCES AND ASCRIPTIONS

BL no.268 ff.242v-243

EDITIONS

CMM501 no.11

COMMENTS

This piece was included by Hamm in Leonel's complete works as he considered it to be in his style. In the manuscript it was copied immediately before a composition attributed to Leonel (Salve Regina CMM501 no.10).

VOICE RANGES

III C-d II C-e I a-a'

The ranges are within the style of Leonel.

AVERAGE CHORD LENGTH

The triple section has a duet with average chord length longer than that of the fully-voiced music. This is possible for Leonel but not typical.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.77. This is within the area most used by Leonel.

CHORD ANALYSIS

The use of accented dissonance is within Leonel's style.

The levels are: .

Two-part 2.80% Three-part 4.01%

There are three instances not associated with a cadence but no bare fourths.

Chord difference: -5.522

This figure does not strongly support the theory that the piece is by Leonel, but is within the limits of his style.

MELODIC INTERVALS

Ascending fifths voice I: 1.10%

This is within Leonel's style.

Interval difference: -0.451

This value is not typical of Leonel, though possible.

TEXT

There are 7.92 minims per syllable.

This is within the style of Leonel.

CADENCES

Both of the only secondary two-part cadences are on the unison. This is not typical of Leonel. Otherwise the two-part writing is unremarkable.

In three parts there are no non-cadencing phrases and all but one of the cadences are of the standard type. This is not typical of Leonel.

The cadence spacing at a mean of 30.1 minims is wider than any known example by Leonel.

CONCLUSIONS

Despite the circumstantial evidence of its manuscript position, there is no strong stylistic indication that the motet is by Leonel and the cadence evidence is to the contrary. However, uncertainty must remain until the work of other contemporary composers has been investigated in detail.

STATISTICAL EVALUATION

The correlation with Leonel's style is low at 0.114 - that for Dunstable's is higher at 0.725.

Discriminant analysis suggests that both Leonel and Dunstable are unlikely composers of the motet; it is allocated in preference to Leonel but with a probability of only 0.588.

DESCENDI IN ORTUM

SOURCES AND ASCRIPTIONS

Ac no.144 ff.193v-5

EDITIONS

CMM50i no.13

COMMENTS

Hamm considered this motet to be in the style of Leonel, so included it in his complete works. There is no external evidence to suggest a composer, though it lies within a group of English compositions containing pieces by both Leonel and Dunstable.

VOICE RANGES

III C-e II C-e I G-b'

These are within the style of Leonel.

AVERAGE CHORD LENGTH

In both triple and duple mensurations the duets have a shorter average chord length than the full sections. This is consistent with Leonel being the composer, though not specific to him.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.63. This is within Leonel's typical style.

CHORD ANALYSIS

The levels of accented dissonance are lower than average for Leonel but within his style. Only two instances are present, one being a bare fourth.

Chord difference: -24.231

This figure does not support the theory that the piece is by Leonel.

TEXT

There are 8.01 minims per syllable.

This is within the style of Leonel.

CADENCES

There are too few two-part cadences from which to draw any conclusions.

None of the three-part cadences has a miscellaneous ending, although there is one secondary cadence onto a 12/8 chord occurring mid-phrase (b.97).

At b.4 is an octave leap cadence which is quite rare in Leonel. All the other cadences are of the standard type.

There are more minims per cadence than in any attributed work (30.4).

CONCLUSIONS

Many of the features tested for are within Leonel's style, the exceptions being the chord difference calculation and the cadence spacing. These factors alone, however, put serious doubt on his authorship. Both would be consistent with composition by Dunstable.

STATISTICAL EVALUATION

The correlation with Leonel's style is very low at 0.004.

A figure of 0.877 suggests a better match with that of Dunstable.

Discriminant analysis indicates with a probability of 1.000 that the motet is more likely to be by Dunstable than by Leonel.

BENEDICTA ES

SOURCES AND ASCRIPTIONS

Tr92 no.1531	ff.177v-8	De Anglia
BL no.218	ff.205v-206	De Anglia
BU no.61	pp.83-83	ff.41v-42

EDITIONS

CMM501 no.15
DT076 p.81

COMMENTS

Hamm included this motet in the collected works as he considered it to be in the style of Leonel. There is no external evidence to suggest a composer.

VOICE RANGES

III C-e II E-e I G-a'

These are within the expected style of Leonel.

The ranges in the duets are larger than in the full sections as is often the case in Leonel.

AVERAGE CHORD LENGTH

That for duets in the triple mensuration sections is longer than for the fully-voiced music (1.54 as opposed to 1.48). This is possible for Leonel but not typical.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.62. This is in the typical range for Leonel.

CHORD ANALYSIS

There is no three-part accented dissonance. The level of dissonant accented two-part chords is 1.57%. These figures are within Leonel's style.

Chord difference: -9.187

This figure does not rule out Leonel as composer, but does not strongly support the idea.

Hamm has already pointed out that voice II proceeds for much of the time in fourths below voice I as in the Continental fauxbourdon technique. In fact, 59.7% of the piece is composed of such chords. Only one piece attributed to Leonel, Beata Viscera (CMM50i no.5), has a similarly high level at 60.2%, but as it is in the descant style the pieces are not directly comparable. His nearest non-descant piece has a level of 48.5% and most levels are much lower.

TEXT

There are 5.36 minims per syllable.

This is within the range of Leonel.

CADENCES

The most striking feature of the cadences is that there is little variation in their pitches. The majority of them, eight out of ten primary two-part and seven out of nine standard three-part cadences are on the pitch C.

Nothing in the distribution or form of the duet cadences conflicts with Leonel's style.

40% of three-part cadences are dipped in voice I. There

are no tonal-sounding examples. Again, this is within Leonel's style. However, only one phrase ends without a cadence (11%) and this is unusual for him.

Two chords antepenultimate to cadences are identical to those at the cadence point. This happens occasionally in Leonel but has been shown to be more common in Dunstable and could easily be a feature of the styles of other composers.

There are 24.9 minims per cadence, within the range expected of Leonel.

CONCLUSIONS

Although most of the tests give no concrete evidence either way, the lack of variety in cadence pitch is so atypical of Leonel that this alone is good reason to doubt his authorship. The use of fauxbourden-style chord progressions and the negative chord difference must add to this uncertainty.

STATISTICAL EVALUATION

The style of the piece correlates less strongly with that of Leonel (coefficient 0.400) than with that of Dunstable (coefficient 0.929).

Discriminant analysis likewise allocates it to Dunstable in preference to Leonel with a probability of 1.000.

ANGELORUM ESCA

SOURCES AND ASCRPTIONS

FM ff.22v-4

EDITIONS

CMM50i no.20

COMMENTS

This motet was thought by Hamm to be in the general style of Leonel. It is copied into the manuscript at the head of a group of English compositions containing pieces by both Leonel and Dunstable.

VOICE RANGES

	III	II	I
full	F-f	F-g	c-d'
duet	F-g		c-d'

The ranges are within the style of Leonel, as is the fact that voice III is wider in range in the duet sections.

AVERAGE CHORD LENGTH

The duet sections have a longer average chord length than those which are fully-scored (1.78 compared with 1.53). This is possible in Leonel but is not typical.

RELATIVE VOICE SPEEDS

The ratio of voice III to voice I is 0.46. This is less than for any of Leonel's known motets, though three attributed mass movements give a lower result.

CHORD ANALYSIS

The levels of dissonant accented chords are:

Two-part 1.66% Three-part 4.05%

These are within the range exhibited by Leonel's other pieces. Most of the incidents are associated with the preparation of cadences.

Chord difference: -8.174

Two attributed compositions do fall into this general area but a negative figure is not normal for Leonel.

MELODIC INTERVALS

The upper voices contain five of the rarer large intervals. This is within Leonel's style.

Ascending fifths voice I: 1.22%

This is within Leonel's style.

Interval difference: -1.064

This is most untypical for Leonel.

TEXT

There are 7.42 minims per syllable.

This is within the style of Leonel.

CADENCES

None of the two-part cadences conflicts with Leonel's style.

36% of the three-part standard cadences have a dip in voice I. This is within Leonel's style.

There are rather more tonal-sounding cadences than is usual for Leonel, including one of the octave leap

formula.

23% of phrases do not cadence properly and 12% end on a close position triad. These figures are towards the lower end of the range for Leonel but within his style.

36% of the standard cadences, rather a high proportion for Leonel, have an antepenultimate chord identical to that at the cadence point.

There are 23.9 minims per cadence. This is within Leonel's style.

CONCLUSIONS

The test results are not typical of Leonel. In particular, the negative chord and interval differences and presence of an octave leap cadence conflict with the idea of his being the author. These results are, in fact, very suggestive of Dunstable's style and an alternative attribution to him is also supported by the average chord length data and the slow-moving voice III. The group of compositions with which this piece is copied does contain two anonymous settings known from other sources to be by Dunstable. This composer should be seriously considered as a possible author of Angelorum esca.

STATISTICAL EVALUATION

The correlation coefficient with Leonel's style is 0.615 and with Dunstable's 0.948.

Discriminant analysis produces a probability of 1.000 in favour of Dunstable.

SUB TUAM PROTECTIONEM

SOURCES AND ASCRIPTIONS

BL no.290	ff.283v-4	Dunstable
Ap no.160	ff.217v-8v	
ModB	ff.115v-6	Dunstable
Tr92 no.1463	ff.108v-9	

Arrangements for organ:

Bux no.40	ff.17v-18v
Bux no.158	ff.86-86v

EDITIONS

MB8 nos.51, 51a and 51b
DT014-5 p.198

COMMENTS

The piece, as arranged for voices, survives in two different versions. In BL, unlike the other manuscripts which give the music in three parts throughout, the section from b.54 to b.78 is written as a duet for voices I and III. The middle voice at this point contains no rests but is marked 'duo Et propter'. Bukofzer, in his edition of Dunstable's works, suggests that this version for reduced forces is probably the original. His reasons include that the middle voice is responsible for an awkward moment in b.67 and that the two organ arrangements give the section essentially as a duet. The tests developed in this thesis should show whether this section is characteristic of Dunstable and whether its style is consistent with that of the remainder of the work.

SECTIONAL STRUCTURE.

Whilst Dunstable did write pieces with no duet sections, the variation in texture which these provide is a common feature of his music.

VOICE RANGES

The ranges for the fully scored version are:

	III	II	I
duet section	C-d	C-d	G-a'
rest of piece	C-d	C-e	G-c'

Some variation could be due to the small size of the duet section compared with the length of the piece, although the reduced range of voice I is consistent with Dunstable's style in that his duet sections often have narrower ranges than do his fully-voiced ones.

AVERAGE VOICE PITCHES

	III	II	I
duet section	9.09	8.64	12.73
rest of piece	8.76	9.71	14.29

The ranges discussed above do not give a full picture of the actual pitch of the voices. For example, it is quite obvious from a perusal of voice I that the average pitch of the would-be duet section is lower than for the voice as a whole. The average pitch values confirm this.

The lowering of voice I and the raising of voice III are consistent with the section being a duet; it is common for the voices involved to be brought closer together.

The lower pitch of voice II in the questionable portion is inconsistent with its having been composed at the same time as the remaining portion. Its length cannot be the

sole factor in the difference, as a section of similar length, from b.79 to b.101, gives a value of 9.69 - very similar to that in the rest of the three-part music.

AVERAGE CHORD LENGTH

The value for the possible duet as compared with the rest of the piece in C mensuration is larger (2.07 duet, 2.00 full). This is a common occurrence in Dunstable.

However, it must be considered that the removal of any voice from a texture is likely to increase the average chord length. In order to make allowances for this, more measurements and comparisons need to be made:

Duet section in three parts	1.69
Other C section in three parts	2.00
Duet section in two parts	2.07
Other C section without part II	2.13

If the duet section had been originally written in three parts, its activity would have been much greater than the rest of the piece. This seems unlikely. Also, if the middle voice had been removed at some stage, the result should have matched the speed of the preceding C section also with its middle voice removed, whereas it is a little more active.

RELATIVE VOICE SPEEDS

For the section under investigation, the ratio of the speeds of the bottom voices to that of voice I are:

Voice II	1.29	Voice III	0.94
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The value greater than one means that voice II is actually more active than voice I. Both ratios are higher than in

First, assuming that the outer parts were composed first, the cadence at b.68 was originally on the unison. It is not possible to construct a proper three-part cadence here and therefore the added part follows the same line as voice I. This progression would be strange if all the parts had been composed simultaneously.

Secondly, at b.70 is an octave leap cadence. As the outer voices are an octave apart at this point, it would have been possible to make the three-part version into a standard cadence. The use of a more advanced formula suggests that it might have been a late addition.

CONCLUSIONS

Almost all of the investigations performed on this piece strongly suggest that the section from b.54 to b.78 was, indeed, as Bukofzer suspected, originally written as a duet for voices I and III. The revision might have been the work of a second party, although there is nothing to suggest that the original composer could not have composed voice II. Any inconsistencies in style compared with the remainder of the piece could be entirely due to the difficulties of making an addition without disturbing the original voices. Two results consistent with a revision by Dunstable himself are the chord difference value which is within his style and the presence of an octave leap cadence which is reasonably common in his music.

ANIMA MEA

SOURCES AND ASCRIPTIONS

Two-part Version:

BU no.64 p.86 f.43v

Three-part Versions:

ModB ff.117v-8

Leonel

FM ff.32v-4

MuEm ff.150v-1

Leonellus

EDITIONS

CMM501 nos.18, 18bis

COMMENTS

The piece survives in three basic versions. BU gives it in two parts only, corresponding to voices I and III of the three-part version, with only small changes in the melodic detail. In MuEm, voice II takes the duet from b.56 to b.106, which is given in the other sources to voice III. Some of the tests developed in this thesis make it possible to comment on these different versions. Measurements quoted are taken from the three-part version.

SECTIONAL STRUCTURE

Music written entirely in two parts is unusual in this period and has no parallel in the surviving works of Leonel. An alternating two- and three-part structure is much more likely.

VOICE RANGES

	III	II	I
trio sections	E-g	F-a'	c-e'
duet sections	F-a'		c-e'

These ranges show a similar pattern to those of the average voice pitches discussed below.

AVERAGE VOICE PITCHES

	III	II	I
trio sections	10.70	12.81	16.51
duet section	12.65		17.01

The altered average pitches in the duet section are consistent with the piece having originally been written in three parts, but would be unusual if it had been intended as a duet. This reasoning is not as valid if MuEm is taken as transmitting the original form. The similarity in pitch of the lower part of the duet to voice II in this source is interesting, but does not necessarily mean that it is the more likely original three-part version; a raising of the pitch of the bottom part in a duet to make it closer to that of the top part is the norm in this corpus. More probably, the arrangement was changed here to make the duet more comfortable to perform by a particular group of singers.

AVERAGE CHORD LENGTH

Trio sections (O)	1.31
Duet section (O)	1.73
Trio sections without voice II (O)	1.58

The value for the duet section is not directly comparable with that for the rest of the piece as the sections are not in the same mensuration. However, despite the fact

that some variation would be expected between two- and three-part music, the values are almost in the ideal proportion of 1:1.33 for these mensurations (see pp.69-73). The proportion for the O and Q sections in two parts throughout would be less ideal at 1:1.09. These findings suggest that the two-part version is a reduction of that in three parts.

RELATIVE VOICE SPEEDS

The ratios of the speed of the bottom voice to that of voice I are:

Trio sections	0.44
Duet section	0.69

The two figures are quite different, this being inconsistent with the idea that the music was intended to be in two parts throughout. However, it would be more in keeping with the fact that it is normal in a duet for the bottom voice to increase in activity compared with the three-part sections to compensate for the thinner texture.

CHORD ANALYSIS

Dissonance (duet)	6.08%
Dissonance (three-part)	13.43%
Imp consonance "	30.09%
Perf consonance "	56.48%

These figures are all close to the average for Leone1.

The difference in dissonance level between two-part and three-part chords is almost ideal.

	duet	trio
Accented dissonance (%)	3.08	3.92

It is the norm for these levels to be closer than those for the overall dissonance. However, at 3.51%, that for the piece without voice II is also in the same area. The chord difference for the three-part sections is 68.140. This is within the range set by his other works, though a little high.

MELODIC INTERVALS

The interval difference for voice II of -0.562 is just within the limits of Leonel's style, but is not typical.

CADENCES

The three-part music contains several miscellaneous phrase endings formed by the addition of a fifth above what is, in the two-part version, a normal unison cadence. This is the only evidence to support the idea of voice II being added at a later date. The phenomenon could simply be a result of the process of successive composition of parts, as similar formulae do occur elsewhere in Leonel's music, though not in such concentration in one piece. A high proportion of miscellaneous endings is a characteristic of Leonel, though at 67%, that for this piece is very high.

CONCLUSIONS

The origins of this piece remain uncertain. Though the pitch and speed analyses initially point to a three-part original, it is difficult to invent a scenario which would reconcile this with the cadential evidence. The results of other investigations are also atypical of Leonel.

CREDO

SOURCES AND ASCRPTIONS

Ad no.94 ff.135v-8 Dunstapell

EDITIONS

MB8 no.5

COMMENTS

Though attributed without contradiction to Dunstable, in outward appearance this Credo seems a little more rambling than his other works and the application of discriminant analysis shows it to be atypical of his general style.

Without the data on cadence types, the piece is allocated to Leonel with a probability of 0.756. When this cadence information is included the allocation switches to

Dunstable but with a probability of only 0.842 - the lowest of any of his attributed pieces.

In the manuscript the piece lies at the head of a small group of English pieces.

VOICE RANGES

III	II	I
F-a'	F-a'	c-e'

These ranges are typical of Dunstable.

AVERAGE CHORD LENGTH

The average chord length of 1.29 minims is lower than average for Dunstable.

RELATIVE VOICE SPEEDS

The speed of voice III compared with voice I, at 0.48, is not unusual for Dunstable.

CHORD ANALYSIS

Overall consonance levels are within Dunstable's style.

dissonance	12.40%
perfect consonance	25.96%
imperfect consonance	61.64%

The level of three-part accented dissonance is very high at 9.09%, though the commentary to M88 does not mention that the piece was copied carelessly. None of the editorial emendations to the piece affects these chords.

Chord difference: -19.307

This is close to the average for Dunstable.

MELODIC INTERVALS

Voice I does not flow very freely, being quite declamatory in places. Declamation has been noted as a feature of Dunstable's style, though if Quam pulchra is rejected as his work (see the following discussion, pp.367-370), much of the evidence for this claim disappears.

There is a large number of ascending fifths in voice I for Dunstable - 1.14%.

The number of large rare intervals in the upper voices is higher than average for Dunstable at 0.55%.

The interval difference of $\bar{\nu}$ -0.399 is well within his style.

CADENCES

There are many more miscellaneous phrase endings than in any other piece attributed to Dunstable - 45%. This is due to all the voices being composed in short phrases with many interspersed rests, in contrast to the composer's usual style.

The average cadence spacing of 21.3 minims is low for this composer.

CONCLUSIONS

While many characteristics of this piece are within the style of Dunstable, the high level of accented dissonance and the fragmented phrase structure are both atypical of his music and therefore cast doubt on his authorship.

QUAM PULCHRA

SOURCES AND ASCRIPTIONS

BL no.291 ff.284v-5 Dunstable
 BU no.63 pp.84-5 ff.42v-3
 Pemb f.4
 MuEm no.122 ff.63v-4
 ModB ff.81v-2 Dunstable
 Ao no.138 ff.188v-9 Dunstapell (faded)
 Tr92 no.1465 ff.110v-1 Dunstable (cut off)

EDITIONS

MB8 no.44
 DTO14-15 p.190

COMMENTS

This piece is probably the most famous with an attribution to Dunstable. It has often been discussed, and is usually referred to in descriptions of this composer's work.

Though it has been used in the formulation of the database in Part One, investigations often show it to be atypical of his style.

VOICE RANGES AND AVERAGE PITCHES

	III	II	I
Range	Bb-bb'	C-e	a-bb'
Pitch	8.19	9.40	14.20

That these characteristics are within the style of Dunstable is not remarkable, as so are those for the majority of pieces composed in this period.

AVERAGE CHORD LENGTH

This is within the normal range for Dunstable. There are no duet sections for comparison with three-part speeds.

RELATIVE VOICE SPEEDS

The ratio of the speed of the bottom voice to that of voice I is 0.89. This is the highest value obtained for any piece by Dunstable and reflects the homorhythmic character of the voices.

CHORD ANALYSIS

The three-part chords can be classified as follows:

Dissonant	4.92%
Perfectly consonant	26.78%
Imperfectly consonant	68.31%

The piece is far less dissonant than any other attributed to Dunstable. In comparison, the dissonance amongst accented chords is high at 2.16%. A full third of the dissonant incidents fall on the beat.

MELODIC INTERVALS

0.58% of melodic intervals in voice I are ascending fifths. This is within Dunstable's style.

Interval difference voice II: 0.836

This figure is atypical of Dunstable.

CADENCES

The structure of the cadences is characteristic of Dunstable except for the one at b.20 which has an atypical preparation in voice II not met elsewhere in his music.

The proportion of miscellaneous phrase endings at 22% is within Dunstable's style.

There are 15.7 minims per cadence. This is a much closer spacing than in any other known piece by Dunstable, the

nearest being 21.0 minims per cadence.

CONCLUSIONS

Ascriptions in the original sources are, and must be, the primary evidence in defining the output of a composer. In view of the multiple attributions of this piece, it would indeed be a brave person who would state that it was not, after all, written by Dunstable. However, this writer would suggest cautiously that the possibility does exist and that, at the very least, the piece should not be held up to students as an example of Dunstable's work, if only for the reason that it is not representative of his general style.

Since the completion of this analysis, an article by Bent has come to my notice in which she claims that Dunstable's name in the Ao manuscript has been replaced by that of 'Egidius'.²³ This is indeed interesting in the light of the above findings.

STATISTICAL EVALUATION

Results for the piece correlate more strongly with Dunstable's style (coefficient 0.918) than with Leonel's (coefficient 0.649).

However, results of the more sensitive discriminant analysis varied during the input of data, possibly

²³ Margaret Bent: 'The Songs of Dufay. Some Questions of form and Authenticity' in EM, vol.8 (1980), p.459.

suggesting a composer other than these two. Without the information on cadence types, the music was allocated to Leonel with a probability of 0.731. With its inclusion, the result changed to be in favour of Dunstable (probability 0.989). The cadence types employed are not particularly unusual and could easily be the work of another composer of Dunstable's generation.

REGINA CELI

SOURCES AND ASCRIPTIONS

Tr90 no.1136 ff.458v-9 Leonell Anglicus
 Tr92 no.1507 ff.142v-3

EDITIONS

CMM50i no.19

COMMENTS

The authenticity of this motet as a work of Leonel was brought into doubt only by the results of discriminant analysis. The technique consistently rejected Leonel as composer, giving a final probability of 0.827 that the piece was more likely to be by Dunstable than by him. In Tr92 the piece lies amongst a group of English compositions which includes works by both Leonel and Dunstable.

VOICE RANGES

III	II	I
C-e	C-e	G-c'

The ranges are within the style of Leonel, though more typical of Dunstable.

AVERAGE CHORD LENGTH

The average chord length in the duet sections is shorter than in those which are fully scored (1.32 and 1.58 minims respectively) and so is unremarkable.

RELATIVE VOICE SPEEDS

Voice III moves at a relative speed of 0.54 to voice I. This is a little slow for Leonel, though not the slowest of his attributed pieces.

CHORD ANALYSIS

Nothing in the overall levels of consonance and dissonance contradicts Leonel's authorship:

dissonance	13.39%
perfect consonance	32.10%
imperfect consonance	54.52%

The level of dissonance in accented three-part chords is typical of him (2.67%), though that in the two-part chords is low at 0.54%, and more typical of Dunstable.

The chord difference is typical of Leonel at 18.129.

MELODIC INTERVALS

The level of ascending fifths in voice I, at 0.72%, is a little nearer to Leonel's average than Dunstable's.

The interval difference of 0.015 is closer to Leonel's average than Dunstable's.

The level of large rare intervals in the upper voices is near the middle of the range for both composers (0.26%).

CADENCES

There is a dipped unison two-part cadence at b.66 - the only occurrence among the pieces in Leonel's database.

There are very few phrases with miscellaneous endings for Leonel - 14%.

The cadence spacing is, on average, 28.5 minims. This is

the lowest recorded for Leonel.

CONCLUSIONS

The rejection of this piece from Leonel's database by the discriminant analysis programme was initially surprising, mainly because the chord difference test, which has been the most successful style marker, was consistent with his being composer. However, the statistical technique is very sophisticated and is not subject to bias; it takes into account the results of all tests and has determined that those which are atypical of Leonel outweigh this one result. Here is further proof that the outcome of single tests cannot be taken as a reliable indicator of authenticity.

It is possible, then, that this motet was wrongly attributed to Leonel, though Dunstable's authorship also seems unlikely in view of the low, inconclusive result.

MASS Alma redemptoris

SOURCES AND ASCRIPTIONS

Gloria

Tr87 no.3 ff.3v-4

Ao ff.219v-21 Leonell (index Leonel)

Tr93 ff.142v-4

Tr90 no.902 ff.

Credo

Tr87 no.4 ff.4v-6

Ao ff.221-3 (index Leonel)

Sanctus

Tr87 no.5 ff.6-7

Ao ff.223v-5

Agnus

Tr87 no.6 ff.7v-8v

Ao ff.224v-6

EDITIONS

ACM

CMM50ii no.18

COMMENTS

Ao is the only manuscript to ascribe the music, but only in two movements and one of these only in the index. Due to the consecutive positioning of the four movements in this source and Tr87, it is likely (though not certain) that the mass was composed as a unit and that the ascription was meant to apply to all the movements. Bent has commented that many of the technical and stylistic features of the music support Leonel's authorship,²⁴ such as the use of pseudo-augmentation, proportional passages and conflicting time signatures.

²⁴ Margaret Bent: 'Power, Leonel' in Grove, vol.15 (1980), p.175.

However, in the investigations of Part One, the two attributed movements often gave extreme results compared to Leonel's other works.

The mass will now be examined as a whole to test for correspondence between the movements and similarity to Leonel's general style.

SECTIONAL STRUCTURE

Part of the plainsong antiphon Alma redemptoris is stated in the tenor, this voice being identical in each movement except for interpolated duets. The treatment is somewhat like that in the isorhythmic technique and a similar texture featuring a marked inequality of the voices results, although the individual movements contain no internal repetition. This means of unification is not found elsewhere in Leonel.

All the movements have the same partial key signature of one flat in the lower two voices. Their mensural schemes are similar. All have a clef arrangement of C1-C3-C3, though voice II in the Agnus moves into C1 at b.58 to accommodate the high tessitura of the duet section.

VOICE RANGES

Gloria	III F-f	II F-a'	I G-e'
Credo	III F-f	II F-b'	I c-e'
Sanctus	III F-f	II F-a'	I c-e'
Agnus	III F-f	II F-e'	I a-e'

Some of these voice ranges are very wide; elsewhere Leonel never uses more than an eleventh. The large breadth in each case is due to the duet sections, without

which each movement would have identical ranges and none would be bigger than a tenth (F-a' voice II, c-e' voice I). It is typical for Leonel to use a wider range in his duet passages, but not to this extent. Curtis, in his modern transcription of the mass, allocates one of the voice II duets in the Agnus to a second triplex part. However, even if this solution is valid, the passage still covers a twelfth, as does the duetting voice I in the Gloria. The overall composition range is normal for Leonel.

AVERAGE CHORD LENGTH

	triple		duple	
	full	duet	full	duet
Gloria	1.38	1.00	1.40	1.33
Credo	1.27	1.35	1.24	1.50
Sanctus	1.49	1.15	1.73	1.68
Agnus	1.35	1.21	1.56	1.45

These figures show quite a lot of variation between the movements. The duet sections tend to be faster than the full sections, as is usual in Leonel's style, the Credo being an exception.

RELATIVE VOICE SPEEDS

The ratios of voice III to voice I are as follows:

Gloria	0.22
Credo	0.20
Sanctus	0.22
Agnus	0.24
Overall	0.22

These values are consistent and therefore could indicate composition by the same composer. However, the third voice is much less active than in any other work by

Leonel.

The slightly lower figure for the Credo is a reflection of the shorter average note length in the top voice (and therefore shorter average chord length) in order to accommodate a longer text.

CHORD ANALYSIS

The overall levels of dissonance and consonance match well for all the movements. This is consistent with the theory that they could have been composed at the same time.

These percentages are for the three-part chords:

	Gloria	Credo	Sanctus	Agnus
Diss.	15.17	15.60	14.27	14.23
Perf cons.	28.35	28.25	26.42	28.98
Imp cons.	56.49	56.16	59.32	56.79

The levels of dissonant accented chords for each movement are:

	Two-part	Three-part
Gloria	0.00	0.00
Credo	2.59	2.71
Sanctus	1.45	2.74
Agnus	0.58	0.76

The Gloria is unlike the other movements in having no accented dissonance and even the figure for the Agnus is a little low compared with most of Leonel's Mass music.

Chord Differences:

Gloria	32.992
Credo	50.711
Sanctus	2.959
Agnus	-12.421
Sanctus and Agnus	-5.082
Whole Mass *	18.765

The Gloria and Credo, which both bear attributions to Leonel, give figures appropriate to his style. The anonymous movements give quite different figures. The

Sanctus result is within the expected range for Leonel but that for the Agnus just outside. Taken together, the two still lie outside the normal range for Leonel. The whole Mass, assuming that it was written by one person, gives an overall figure within Leonel's style.

MELODIC INTERVALS

There are no rare large intervals in the top voices of the Gloria; this happens nowhere else in Leonel's non-descant compositions. The other movements are within his style.

Ascending fifths voice I:	Gloria	0.00%
	Credo	0.71%
	Sanctus	0.78%
	Agnus	1.08%
	Overall	0.66%

There are no other examples where Leonel's top voice contains no ascending fifths as happens in this Gloria.

The other movements are within his style.

Interval differences:	Gloria	0.179
	Credo	0.004
	Sanctus	0.164
	Agnus	-0.771
	Overall	-0.144

While the first three movements are within Leonel's style, the Agnus produces a figure which is extremely different to that for any of his other known compositions.

TEXT

The number of minims per syllable for each movement is as follows:

Gloria	3.31
Credo	3.44
Sanctus	13.33
Agnus	15.59

The Gloria and Credo both give a larger figure than any other of Leonel's pieces in the same category. The Sanctus gives a similar result to his other three settings. The Agnus figure is considerably higher than that for his only attributed Agnus (11.20 for CMM50ii no.7).

CADENCES

The proportion of secondary two-part cadences varies between the movements, but the sample of music is large enough overall for the level to be significant, and the result is a little higher than average for Leonel:

Gloria	33%
Credo	21%
Sanctus	53%
Agnus	28%
Overall	32%

The proportion of secondary cadences on the unison at 33% overall is only a little higher than the average for Leonel, as is the proportion of primary octave examples with a dip at 30%.

The numbers of two-part cadences overlapping with three-part phrases is ideal for Leonel at 16%. The overlapping note is in one case a third above (Agnus b.45) and in one case a fifth below (Credo b.57) the cadence point. Both are within this composer's style.

The proportion of standard three-part cadences with a dip is within Leonel's style for each individual movement, though is overall much higher than his average:

Gloria	43%
Credo	33%
Sanctus	60%
Agnus	100%

The falling fifth cadence appears in three out of the four movements (twice in the Sanctus), yet this progression is not seen elsewhere in Leonel's attributed work.

The percentage of phrases which do not cadence properly is high, even for Leonel. The level for the Credo is higher than for any other piece attributed to him, though the overall value for the mass is just inside that for the range of his works.

	Misc. endings	Close pos. endings
Gloria	67	44
Credo	79	57
Sanctus	40	40
Agnus	62	54
Overall	64	49

The preparation of cadences in voice III is quite conventional and does not provide any evidence against Leonel's authorship.

Overall for the mass, the cadence spacing is just within the range set by Leonel's other known works, though quite wide. That for the Sanctus alone, however, is wider than for any attributed work. In minims per cadence the values are:

Gloria	23.9
Credo	25.8
Sanctus	29.6
Agnus	25.9
Overall	26.1

CONCLUSIONS

Bearing in mind that a quarter of all uncontradicted attributions may be inaccurate, and that only one of four manuscripts suggests a composer for this mass, there is a possibility that it was written by someone other than

Leonel. The inconsistencies with his general style must make the ascription more suspect than most.

The Gloria in a few tests gives results quite unlike the other movements. This is similar to the case of the Mass Rex seculorum.

The results of investigations suggest that the two other mass cycles with attributions to Leonel are not, in fact, by him. If true, his claim to authorship of this cycle is also diminished as he cannot be credited with employing any strong unification techniques elsewhere in his mass music.

STATISTICAL EVALUATION

There is a high correlation between the Gloria and Credo on the one hand and the Sanctus and Agnus on the other, but the two pairs are not so closely connected. The coefficients are as follows:

	Gloria	Credo	Sanctus
Credo	0.987		
Sanctus	0.815	0.719	
Agnus	0.760	0.648	0.941

Comparisons with the average style of Leonel, interestingly, show a strong affinity only in the two movements which bear attributions to the composer (Gloria and Credo). The correlation coefficients are:

	Leo	Dun
Gloria	0.986	0.265
Credo	0.962	0.110
Sanctus	0.865	0.763
Agnus	0.773	0.786

Discriminant analysis actually rejects him as the composer of the Sanctus.

	Composer	Probability
Gloria	Leo	1.000
Credo	Leo	1.000
Sanctus	Dun	1.000
Agnus	Leo	0.955
Overall	Leo	0.990

SECULAR SONGS

Secular music has so far not been considered in this study, mainly because no examples by Leonel are known to have survived, so the genre does not figure in the comparison of his and Dunstable's styles. However, nearly all of those few examples which bear the latter composer's name are dubious works and so warrant a mention, at least.

The only song to which no contradictory evidence applies, Puisque m'amour (MB8, no.55), is attributed to Dunstable in two of the three surviving sources. If it is assumed, as seems likely, that this piece is correctly ascribed, then it is the only firm model available on which to judge the composer's secular style. It is unlikely to have been composed in isolation as Dunstable's only non-sacred work.

Probably the most well-known piece to bear his name, O rosa bella (MB8 no.54), is known from an amazing thirteen manuscripts and yet more arrangements, though in only one source is it attributed to Dunstable. Another gives Bedingham as author, though it is possible that he was responsible only for writing extra voices, or concordantiae, as mentioned in Tr89. Bukofzer thought that Dunstable's authorship was certain in view of the fact that the manuscript which names him contains the music of composers active before Bedingham (see MB8 commentary). The style of the piece with its pervasive imitation is strikingly different to that of any of Dunstable's known sacred works.

Another conflicting attribution to Bedingham, this time of the chanson Durer ne puis (MB8 no.64), was regarded by Bukofzer as more likely to be correct. He considered the piece to be slightly more advanced than Dunstable's style. Also, in one manuscript it is a late addition, suggesting a date contemporary with Bedingham.

Margaret Bent has pointed out that the ascription to Dufay of the song Je languis (CMM1vi p.33) replaces an erased ascription to 'Dumstabl'.²⁵ She believes that some of its features are atypical of Dufay and suggestive of the English school: its wide range; old-style partial key signature; movement in sixths and thirds and drive to the cadence.

It is not possible to know, without further investigation, how far the findings of Part One can be applied to the secular genre. No detailed analysis or statistical evaluation will therefore be attempted, though the following test results are of interest.

VOICE RANGES

	III	II	I
Puisque m'amour	C-d	C-e	G-b'
O rosa bella	C-d	C-f	G-c'
Durer ne puis	G-a'	G-g	b-e'
Je languis	C-e	A-d	G-c'

All the individual voice ranges are within the style of Dunstable.

²⁵ Margaret Bent: 'The Songs of Dufay: Some Questions of Form and Authenticity' in EM, vol.8 (1980), p.459.

Puisque m'amour has a total range which matches well with those of Dunstable's sacred works.

In Je languis, the overall range of a seventeenth which Bent mentioned as being too wide for Dufay is also a little wide for Dunstable; five of his pieces span a sixteenth and one, the short textless piece MB8 no.34, spans a nineteenth, though this may have been constructed as an exercise and does not represent his general style. The large width is due to the contratenor crossing under and lower than the tenor - a Continental rather than an insular trait.

CHORD ANALYSIS

The percentage level of dissonance in Durer ne puis is a little high for Dunstable. Also, its level of perfect consonance is low which is suggestive of a late dating (though one of Dunstable's motets, MB8 no.47, has an even lower level). O rosa bella has a similar ratio of perfect to imperfect consonance. It is possible that secular music could have been designed to be less austere in this respect than sacred, though the levels of consonance and dissonance in Puisque m'amour are typical of Dunstable's sacred style.

	dissonance	perfect consonance	imperfect consonance
Puisque m'amour	12.17	30.24	57.59
O rosa bella	10.68	22.64	66.67
Durer ne puis	16.06	20.73	63.21
Je languis	14.25	29.02	56.74

The result of chord difference calculations on Puisque m'amour is ideal for composition by Dunstable, in contrast

to those for O rosa bella and especially Durer ne puis.

Puisque m'amour	-10.076
O rosa bella	14.249
Durer ne puis	56.695
Je languis	-74.397

MELODIC INTERVALS

The interval difference calculation on Puisque m'amour does not produce a result typical of Dunstable's sacred music, therefore the test might not be applicable to the secular genre. This would be understandable because in chanson style the main function of the lower voices is to provide a harmonic support for the much more melodic top line. For this reason they often have an unvocal angularity which affects the pattern of melodic intervals.

CADENCES

In Puisque m'amour a large proportion of the cadences are tonal-sounding, so the distribution of cadence types in sacred music cannot be used as a style model for the secular field.

The average number of minims per cadence differs markedly for the four pieces. In Puisque m'amour the spacing is close for Dunstable, whereas in O rosa bella it is wider than in any of his known compositions.

Puisque m'amour	20.4
O rosa bella	35.2
Durer ne puis	26.7
Je languis	29.6

CONCLUSIONS

Because some of the characteristics of Puisque m'amour match with Dunstable's sacred style, they might also be

valid as markers in his secular music. However, none of the other three songs resembles this piece, so doubt must remain as to their authenticity.

SUGGESTIONS FOR FURTHER RESEARCH

This investigation has shown the value of a scientific, statistical approach in the study of early music. In particular, employment of the technique of discriminant analysis has been very profitable. The project has been so successful that it could be used as a starting point for a much more comprehensive study of all the music of the period. The MINITAB programme has the potential to consider many databases simultaneously and could, therefore, still be employed if the analysis were extended to include data on other composers.

The logical next step is the building up of a much broader information base. First, the analysis of melodic and harmonic patterns needs to be extended. The success of a limited study of cadence patterns has shown that such an approach could be very useful. During the course of the present study, a computer programme was written to catalogue in detail all melodic and rhythmic repetitions in a piece of music and to look for similarities between different pieces. The project was abandoned because the small capacity of the computer in use meant that the programme ran far too slowly for it to be completed. Recent developments in computer technology mean that the task could be undertaken much more easily using different, more up-to-date, equipment.

Secondly, the attributed music of other English composers contemporary with Dunstable and Leonel needs to be analysed. Of immediate value would be a study of the

works of Benet and Forest in order to complete the investigations of several works discussed in Part Two which bear conflicting attributions to these men. It is likely that tests other than those developed for Dunstable and Leonel will be necessary to identify other composers. For example, it is conceivable that rhythmic peculiarities or pitch organization could play a larger part in distinguishing some styles.

Nearly forty different English composers have been identified as having worked in the first half of the fifteenth century.⁵⁴ However, the definition of personal compositional styles might only be possible where a substantial proportion of their music survives in attributed sources. The wide variety of techniques employed by Dunstable and Leonel has been made amply evident and it is likely that a similar diversity would exist in the styles of other composers. The study of single pieces is, therefore, likely to be of only limited value.

Ultimately, it might be possible to identify the writers of much anonymous music of the period. A starting point for this could be the anonymous music in OH and other insular manuscripts, followed by the listings of seemingly English compositions in Continental sources by

⁵⁴ Trowell and Hughes have listed and discussed many of them. See Brian Trowell: 'Music under the Later Plantagenets' (diss. University of Cambridge, 1960), pp.222-316; 'Some English Contemporaries of Dunstable' in *PRMA*, vol.81 (1955), pp.77-92 and Andrew Hughes: 'English Sacred Music (Excluding Carols) in Insular Sources, 1400-ca.1450' (diss. University of Oxford, 1963), vol.2 pp.45-55.

Trowell and Hamm.³⁷ Another repertory worthy of investigation would be that of the English carol. Bent believes that on statistical and stylistic grounds Dunstable may have written some of these.³⁸

It would also be interesting to apply statistical methods to the broader subject of English style in general by performing a comparison with that of Continental composers. Many English compositions probably still remain unrecognized as such, buried in foreign manuscripts. As Curtis has pointed out, the main criteria for suspecting English authorship have hitherto been non-musical (such as the use of English chant variants, telescoping of text and certain notational procedures) or at best based only on superficial elements of style (such as mensural schemes and melodic clichés).³⁹ There have even been suggestions that certain works ascribed in the sources solely to Continental composers may, in fact, be of English origin.⁴⁰ It would be interesting to compare

³⁷ Brian Trowell: *Diss.*, *op.cit.*, pp.194-196,204-221; Charles Hamm: 'A Group of Anonymous English Pieces in Trent 87' in *M&L*, vol.41 (1960), pp.211-215 and 'A Catalogue of Anonymous English Music in Fifteenth-Century Continental Manuscripts' in *M.Disc*, vol.22 (1968), pp.47-76.

³⁸ Margaret Bent: 'Dunstable, John' in *Grove*, vol.5 (1980), pp.721.

³⁹ Gareth R.K. Curtis: 'Stylistic Layers in the English Mass Repertory c1400-1450' in *PRMA*, vol.109 (1982-3), p.23.

⁴⁰ See, for example, Thomas Walker: 'A Severed Head: Notes on a lost English Caput Mass' in *Abstracts of Papers read at the thirty-fifth Annual Meeting of the American Musicological Society*, (1969), pp.14-15; Gareth R.K. Curtis: 'Jean Pullois and the Cyclic Mass - or a Case of Mistaken Identity?' in *M&L*, vol.62 (1981), pp.41-59; and Margaret Bent: 'The Songs of Dufay: Some Questions of Form and Authenticity' in *EM*, vol.8 (1980), pp.454-459.

such music with the styles of individual composers.

Several other topics suitable for study also suggest themselves. Using the same database, historical trends in music could be investigated. The evolution of style could be traced between different generations of composers. Once such trends have been identified, they could be employed within a single composer's works as an aid to dating and chronology. The techniques developed in this thesis could also be adapted to fit the music of other repertoires and historical periods.

Though the tasks outlined above seem large, they could easily be accomplished by cooperation between workers. In this present study, the setting up of the computer system and writing of the necessary software was the most time-consuming part of the work, taking many tens of times longer than the assimilation of the results once they had been obtained. The same, no doubt, is true of every computer-assisted project which is begun from scratch; time and funds run out before the full potential is ever realized. Now that the present system, for instance, is up and running, it could be employed on a larger capacity computer to continue the work, leaving future researchers free to study the music itself instead of computer programming manuals. What is needed, it seems, is agreement upon a standard method of encoding and then the compilation of a library of music and software which can be made available to all workers. No doubt the time will come, hopefully in the not too distant future, when all music is stored on a standard, internationally-

available computer network and any analysis can be performed with only the minimum of effort and an appropriate command. The necessary technology is already in existence and just a few dedicated workers could make the dream a reality.

APPENDICES

TO

PART TWO

KYRIE Lux et origo

EDITORIAL NOTES

SOURCE *Ap* no.6 ff.11v-12

Overleaf is the photographic reproduction of these folios upon which the transcription is based.

Voice I also survives in an insular manuscript, *Linc*, f.31v.

The name of the composer at the top of the first folio has been cut through, presumably by the binder of the manuscript. Though not clear from the photograph, the remaining portion of the inscription resembles the lower half of the attribution 'Leone1' which is present on the preceding folio in the same scribal hand.

The plainsong lies in voice I transposed up a fourth with only light ornamentation.

Note values have been quartered.

The upper right corner of f.11v and left corner of f.12 are damaged, though most of the original notation can be deciphered.

b.74 voice II: bottom of ligature a erased to give b.

b.91 voice II: bottom of ligature c erased to give d.

b.160 voice III: MS breve emended to a long editorially.

Handwritten musical score on a single page, featuring ten staves of music. The notation is dense and includes various rhythmic values and clefs. The word "Cantabile" is written in the left margin. The paper shows signs of age and wear.

Handwritten musical score on a single page, featuring ten staves of music. The notation is dense and includes various rhythmic values and clefs. The word "Cantabile" is written in the left margin. The paper shows signs of age and wear.

KYRIE Lux et origo

?Leonel

[o]

Contratenor

Tenor

Lux et origo Lu-

cis sum-me de-us e - le - i - son.

cui - us

Musical score for measures 18-21. The vocal line begins with a rest in measure 18, then enters in measure 19 with the lyrics "e - le". The accompaniment consists of two staves of piano accompaniment.

Musical score for measures 22-25. The vocal line continues with the lyrics "son. Qui so-lus po - tes". The accompaniment continues with two staves.

Musical score for measures 26-30. The vocal line begins with the word "et" in measure 26. The accompaniment continues with two staves.

Musical score for measures 31-35. The vocal line continues with the lyrics "Re - dem - ptor om - ni - um". The accompaniment continues with two staves.

et so - lus e - o - rum be - ni - gne e -

- le - y - son. per cru -

- cem re - dem - pti a mor - te

pe - ren - ni te ex - o - ra mus e - le - y -

C

- son. Qui

es ver - bum pa -

- tris sa - tor pi - e - ta - tis

lux ve - ri - ta -

90

f

His e - le -

100

- son. Spi - ri

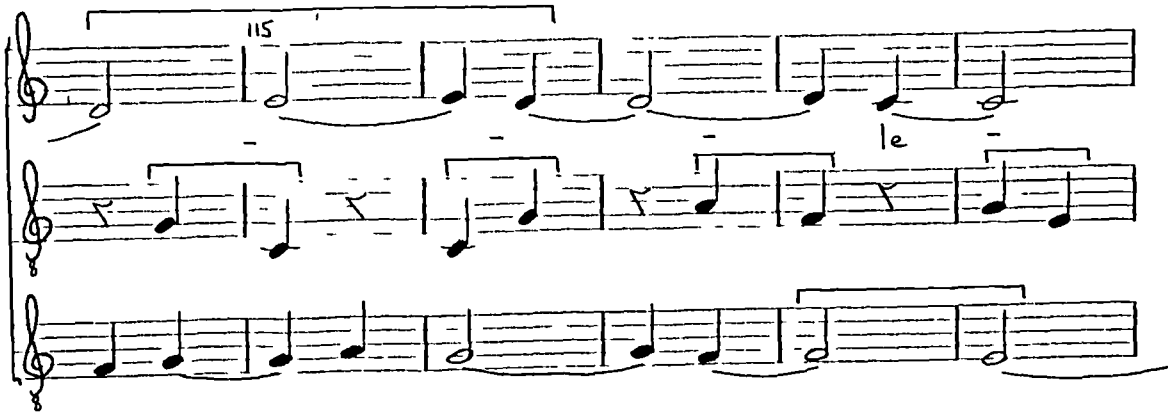
3

105

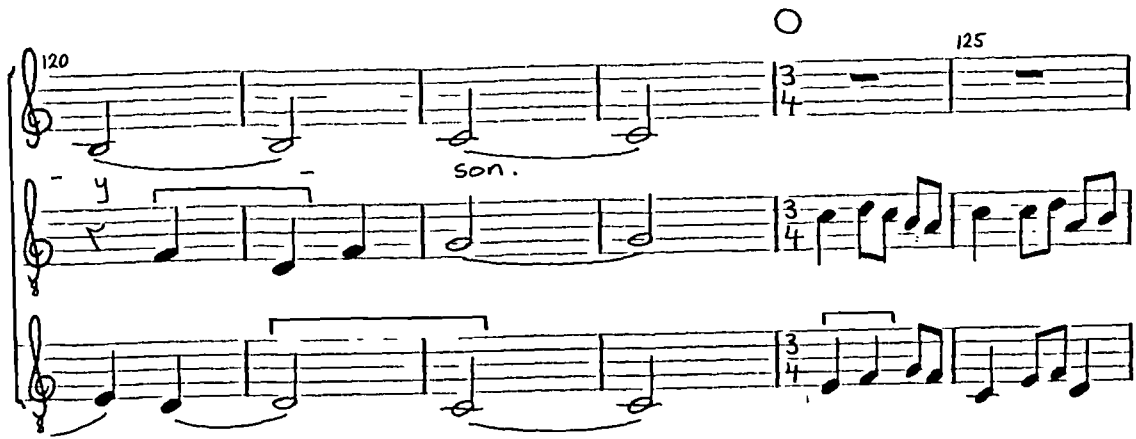
- tus Sanc - te de - us

110

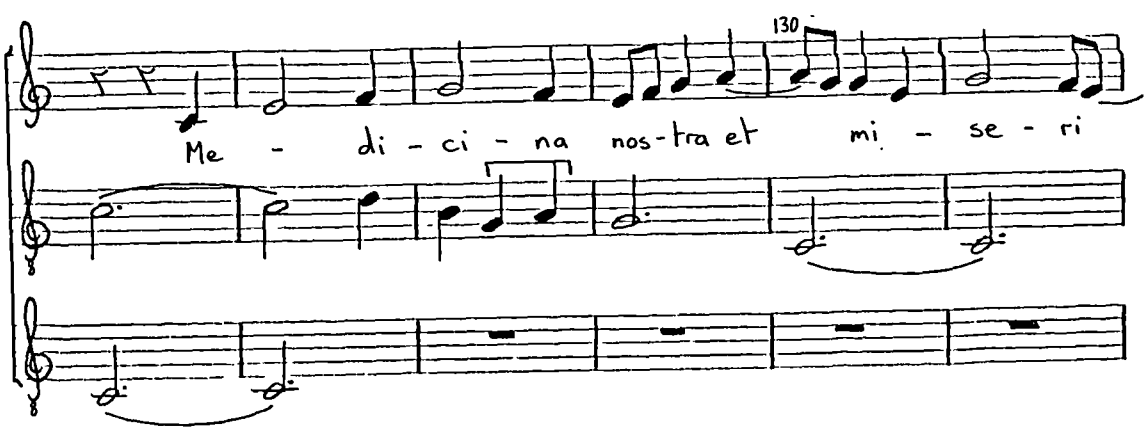
no - bis e -



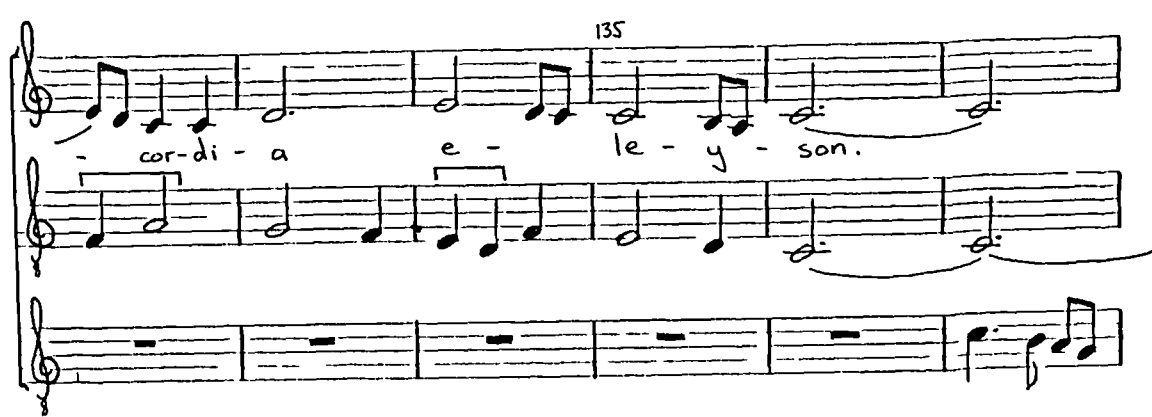
Musical score system 1, measures 115-119. It consists of three staves. The top staff has a treble clef and a key signature of one flat. The middle and bottom staves have bass clefs. The music features a melodic line in the top staff and accompaniment in the lower staves. A bracket above the first measure of the top staff is labeled '115'. The word 'le' is written below the top staff in measure 118.



Musical score system 2, measures 120-124. It consists of three staves. The top staff has a treble clef and a key signature of one flat. The middle and bottom staves have bass clefs. The music features a melodic line in the top staff and accompaniment in the lower staves. A bracket above the first measure of the top staff is labeled '120'. The word 'son.' is written below the top staff in measure 122. A circle containing the number '3' is positioned above the top staff in measure 124, and a '4' is written below the staff. A bracket above the last measure of the top staff is labeled '125'.



Musical score system 3, measures 130-134. It consists of three staves. The top staff has a treble clef and a key signature of one flat. The middle and bottom staves have bass clefs. The music features a melodic line in the top staff and accompaniment in the lower staves. A bracket above the first measure of the top staff is labeled '130'. The lyrics 'Me - di - ci - na nos - tra et mi - se - ri' are written below the top staff across measures 130-134.



Musical score system 4, measures 135-139. It consists of three staves. The top staff has a treble clef and a key signature of one flat. The middle and bottom staves have bass clefs. The music features a melodic line in the top staff and accompaniment in the lower staves. A bracket above the first measure of the top staff is labeled '135'. The lyrics 'cor - di - a e - na le - y - son.' are written below the top staff across measures 135-139.

Tri - ni - tas et v -

- ni - tas san - cta no - bis

sem - per e -

- le - y - son .

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