

A NEW ASPECT OF THE EVOLUTION OF THE TRIMETER IN EURIPIDES

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In the formulation of his famous law, Porson himself briefly indicated the nature of the word boundaries permitted to stand between a long third anceps and the final cretic segment of the trimeter. Porson's formulation has been refined by subsequent research, and today scholars recognize a class of grammatical function words known as "prepositives" (the article, prepositions, *οὐ*, *μή*, etc.) and "postpositives" (enclitics, indefinite pronouns, conjunctions such as *μέν*, *δέ*, *γάρ*, etc.), or, collectively, "appositives." However, appositives are not simply free to occur at Porson's Bridge without any constraint. If we investigate their incidence in Euripides, we find that they are, in fact, strongly avoided in his earliest plays at Porson's Bridge, and that the constraint is progressively relaxed in the later plays.¹ This fact² has been very generally ignored, both in the standard metrical handbooks and in modern research work on Greek metre. In none of the major discussions of the metrical evidence for the dating of the plays of Euripides has any attempt been made to exploit the evidence of the appositives for the chronology of the plays, nor to compare the growth of appositives at Porson's Bridge with the previously available evidence for the growth of resolution in both the trimeter and the tetrameter. Furthermore, this general neglect of the appositives has deprived scholars of a crucial cue to the understanding of the stylistic development of the Euripidean trimeter. For, as we shall see, the growth of appositives at Porson's Bridge is so closely correlated both with the growth of resolution overall and with the various manifestations of its fine structure, that the phenomena can hardly be separate and independently motivated variables. Once this formal unity is recognized, it is a relatively simple

¹ For a full discussion of the linguistic interpretation of this and similar facts and of their significance for metrical theory see our article "Semantics, syntax and phonological organization in Greek: Evidence from the trimeter," to appear in *CP*.

² The developmental trend was discerned already in J. Descroix, *Le trimètre grecque* (Macon 1931) 236.

matter to proceed from it to an explanation of Euripides' stylistic evolution in substantive linguistic and metrical terms.

1. *The appositive criterion and overall resolution*

In Table 1 we present the rates for appositives³ at Porson's Bridge in each extant play; the figures are the rate per thousand trimeters. The next two columns give the rates of resolution per thousand lines for the trimeter and tetrameter respectively.⁴

TABLE 1
Rate per thousand lines of appositives at Porson's Bridge,
trimeter resolution and tetrameter resolution

Play	Date	Rate of Appositives at Porson's Bridge	Rate of Trimeter Resolution	Rate of Tetrameter Resolution
<i>Cyclops</i>	—	61.50 ± 9.92	350.42 ± 24.47	—
<i>Rhesus</i>	—	20.53 ± 5.42	80.64 ± 10.87	200.00 ± 141.42
<i>Alcestis</i>	438	29.92 ± 6.01	62.34 ± 8.81	—
<i>Medea</i>	431	0.96 ± 0.95	65.57 ± 7.94	—
<i>Heracleidae</i>	—	11.26 ± 3.56	57.43 ± 8.04	—
<i>Hippolytus</i>	428	5.06 ± 2.24	42.55 ± 6.56	—
<i>Andromache</i>	—	26.70 ± 5.34	113.24 ± 11.00	—
<i>Hecuba</i>	c.424	16.30 ± 4.17	127.17 ± 11.75	—
<i>Supplices</i>	—	9.83 ± 3.27	135.51 ± 12.17	—
<i>Electra</i>	—	25.00 ± 5.10	168.75 ± 13.25	—
<i>H.F.</i>	—	28.45 ± 5.37	215.44 ± 14.79	315.78 ± 128.92
<i>Troades</i>	415	20.15 ± 4.81	211.58 ± 16.32	166.66 ± 96.22
<i>I.T.</i>	—	23.27 ± 4.65	233.70 ± 14.74	258.06 ± 91.24
<i>Ion</i>	—	34.45 ± 5.74	258.37 ± 15.72	285.71 ± 58.32
<i>Helen</i>	412	23.94 ± 4.31	275.33 ± 14.82	285.71 ± 116.64
<i>Phoenissae</i>	c.410	22.37 ± 4.87	257.73 ± 14.87	365.07 ± 76.12
<i>Orestes</i>	408	37.03 ± 5.60	394.18 ± 18.64	421.05 ± 60.77
<i>Bacchae</i>	406	33.76 ± 5.95	375.81 ± 20.23	421.05 ± 105.26
<i>I.A.</i>	406	51.47 ± 7.72	383.04 ± 20.61	557.14 ± 51.50

³ We have based our count on the Oxford texts. Individual textual decisions are unlikely to produce significant alterations to any trend emerging from such a large scale statistical analysis.

⁴ The data on the line rates for resolution in the trimeter are taken from E. B. Ceadel, "Resolved feet in the trimeter of Euripides and the chronology of the plays," *CQ* 35 (1941) 66–89. In our tables we have followed the order of presentation of the plays adopted by Ceadel to preserve comparability of format. The data on the line rates for resolution in the tetrameter are taken from J. Kanz, *De tetrametro trochaico* (Darmstadt 1913) 29 ff. In order for us to obtain the best estimate of the actual growth trend, the two trimeter passages in the *I.A.* (49–114 and 1532–77) which have anomalously low resolution rates have been excluded here and in Table 2 below (see Ceadel 80–81), and, for the sake of consistency, also from the appositive count.

As we compare the respective rates for one play with those for another, we must remember that part of the difference can be due to sampling error: we need to have some idea of the statistical significance of the difference between the individual rates, before we can conclude that they actually differ. This is why each figure in the table is followed by its standard deviation. For instance, the figures for the *I.T.* mean the following: a play in which the lines have the same probability of showing an appositive at Porson's Bridge or a resolution as they do in the *I.T.* will, slightly more than two times out of three ($\pm \sigma$), show an appositive rate falling between 18.62 and 27.92 per thousand trimeters, and a trimeter resolution rate falling between 218.95 and 248.45. When these intervals overlap for any two plays, we cannot even be 68% confident that there is a real difference in the probability of occurrence. Since, for resolution in the trimeter, the intervals overlap for the *I.T.* and the *H.F.* on the one hand and for the *I.T.* and the *Ion* on the other, the *I.T.* is not significantly different from either of the other two plays, even at the 68% confidence level. Thus any conclusions drawn from the difference in their rates of trimeter resolution regarding style or chronology would rest on a considerable degree of uncertainty: in point of fact, there is approximately a 38% chance of a difference arising purely from sampling variation that is as big or bigger than the difference between the trimeter resolution rates of the *I.T.* and the *H.F.* Or take the three plays of the *semiseverus*⁵ group: the confidence intervals for resolution in each of these plays overlap with those of the remaining two plays, so that we cannot establish the rank order of these plays with a satisfying degree of confidence on the basis of trimeter resolution (although of course the observed rates remain the best estimates available to us for further analysis).

There is a quite astonishing degree of agreement between the rank orders of the plays as indicated by the resolution criterion and by the appositive criterion, even in cases in which there is a conflict between the rank ordering and the chronological dating—*Alcestis*, *Phoenissae*, *Bacchae*. In the case of the *Phoenissae* vis-à-vis the *Helen*, and more clearly in that of the *Bacchae* vis-à-vis the *Orestes*, the appositive criterion lends a degree of confirmation to differences in resolution rates that overlap at the 68% confidence level: for, although it is possible, it is considerably less

⁵ For convenience of presentation, we have maintained Zieliński's grouping of the tragedies into four sets: *stilus severior* (*Rhesus*, *Alcestis*, *Medea*, *Heracleidae*, *Hippolytus*), *stilus semiseverus* (*Andromache*, *Hecuba*, *Supplices*), *stilus liber* (*Electra*, *Hercules Furens*, *Troades*, *Iphigenia Taurica*, *Ion*, *Helen*, *Phoenissae*), and *stilus liberrimus* (*Orestes*, *Bacchae*, *Iphigenia Aulidenensis*) (T. Zieliński, *Tragodoumenon Libri Tres* [Krakow 1925] 141). For a ternary classification see K. Matthiessen, "Euripides: Die Tragödien," in *Das griechische Drama* (Darmstadt 1979) 110. Such groupings should not, of course, be interpreted as implying absence of stylistic development within any particular group nor discontinuities in the growth curves *through time* of the criteria discussed in this paper.

likely that the one play should be ranked higher than the other on both the trimeter resolution and the appositive criterion purely due to random variation.⁶ One would then conclude that the discrepancy between chronological order and rank order (on both the resolution criterion and the appositive criterion) was due to literary and stylistic factors and not merely to sampling variation. In the case of the *Alcestis*, the appositive criterion strikingly confirms the rank order based on the resolution rate, which is significant at the 68% confidence level: resolution ranks the *Alcestis* lower than the *Hippolytus*, despite the fact that it was written ten years earlier. On the other hand, the appositive criterion underlines the importance of not disregarding the confidence intervals in the case of the *semiseverus* plays, which it ranks in precisely the reverse order. But, apart from its particular applications, the appositive criterion provides a valuable general confirmation of the proposition that the trimeter resolution rates evidence an organic and consistent stylistic evolution through time.

Because of the relatively small number of tetrameters in those plays which have any at all, the confidence intervals are very wide in the last column of Table 1. Nevertheless, the actual rates increase very consistently in time, again with the significant exception of the *Bacchae*. The correlation between resolution in the trimeter and resolution in the tetrameter, as measured by the correlation coefficient, is quite considerable ($r = .81$): this means that 61% of the variation between the plays in tetrameter and trimeter resolution is common to both.⁷ For the correlation of the

⁶ Later on in our discussion we shall introduce another criterion. Consistent agreement of all four or of three against a fourth further increases the likelihood of a systematic motivation despite the overlapping confidence intervals on any one criterion. The standard deviations (from which the confidence intervals are calculated) are useful only for pair-wise comparison of plays on a single variable; when more than one variable is involved, multivariate techniques must be used. See, e.g., P. E. Green, *Analyzing Multivariate Data* (Hinsdale, Ill., 1978). When we are interested in the tendency for one variable to increase as one or more others increase, i.e., in the strength of the association between variables, we must use the theory of correlation and regression. See further notes 7, 8, and 9.

⁷ Resolution, in both the trimeter and the tetrameter, grows exponentially in time, i.e., time, t , appears as an exponent of the constant e (≈ 2.71828 ...) in the equation relating the resolution rates to time: $R = ae^{bt}$. In exponential growth the rate of increase is not constant, but itself continuously increases in proportion to the magnitude already attained: the larger the rate of resolution, the faster it increases. Since the correlation co-efficient measures the linear association between variables (see A. M. Mood, F. A. Graybill, and D. C. Boes, *Introduction to the Theory of Statistics* [New York 1974] 155–57, and M. G. Bulmer, *Principles of Statistics* [New York 1979] 222–27), it is necessary to use the logarithm of the resolution rates to calculate the correlation coefficients.

appositive rate⁸ with the resolution rate in trimeters, this percentage is even higher (c. 90%: $r = .95$).

2. Dating of the plays

In the preceding section, we have discussed the appositive and resolution criteria in the light of establishing a rank order of plays along the parameter of stylistic evolution in Euripides. However, before we attempt an interpretation of this stylistic evolution, let us first exploit the criteria to provide a numerical prediction of the dates of composition of the individual undated plays, purely on the basis of the internal metrical evidence, i.e., without having recourse to non-metrical evidence such as historical allusions and so forth. This is best done by performing a regression analysis on the dated plays and using the resulting equations to predict the dates of the undated plays on the basis of the various criteria used.⁹ Since we have seen that, of the dated plays, the *Alcestis* and the *Bacchae* appear to show systematic deviation from the actual chronology, these two plays should not be used in the regression analysis.

Resolution grows exponentially with time;¹⁰ consequently the regression analysis will find the straight line that best fits the growth of the logarithm of the resolution rate in time. In the case of appositives at Porson's Bridge, for mathematical reasons it is necessary to operate with the arcsine of the square root of the rate rather than with the logarithm. Regression analysis will find the straight line that fits the growth of this function in time.¹¹ The dates predicted by regression analysis on the basis of our

⁸ The statistical theory underlying correlation and regression requires that the variance of a random variable be independent of its mean; since the rate of appositives at Porson's Bridge is binomially distributed, we must use the transformation $2\sqrt{n_i} \arcsin \sqrt{P_i}$ for the appositive rates P_i , where n_i is the number of trimeters in the i^{th} play.

⁹ The regression of a random variable Y on X is defined as the expected (or average) value of Y given a fixed value of X ; Y is therefore a random variable once the value of X is given and therefore has a standard deviation and associated confidence interval, but the value of X is considered fixed and so confidence intervals have no application to it. The regression model assumes a linear relation between the conditional expected value of Y given X and the value of X : $E(Y|X=x) = a + \beta x$. See Mood, Graybill, and Boes (above, note 7) 482-503 and Green (above, note 6) 35-93.

¹⁰ The actual regression equation for trimeter resolution is

$$t_i = 11.2283 \ln R_i + 33.9202$$

where t_i is the date (in years from the *Medea*) predicted for the play with trimeter resolution rate R_i (per line). For tetrameter resolution the regression equation is

$$t_i = 7.5728 \ln R_i + 13.1346$$

where time is now measured in years from the *Troades*.

¹¹ The regression equation is

$$t_i = 2.3243(2\sqrt{n_i} \arcsin \sqrt{P_i}) - 5.9481.$$

where time is measured in years from the *Medea* and the angles in radians.

three criteria are presented in Table 2, together with the actual dates on which the analysis was based.

TABLE 2
Predicted dates

Play	Date Predicted by Porson's Bridge Criterion	Date Predicted by Trimeter Resolution	Date Predicted by Tetrameter Resolution	Actual Date
<i>Cyclops</i>	—	—	—	
<i>Rhesus</i>	—	—	—	
<i>Alcestis</i>	—	—	—	438
<i>Medea</i>	432.3	427.5	—	431
<i>Heraclidae</i>	422.2 ± 3.4	429.2 ± 3.5	—	
<i>Hippolytus</i>	426.5	432.4	—	428
<i>Andromache</i>	413.6 ± 3.3	421.5 ± 3.4	—	
<i>Hecuba</i>	418.8	420.2	—	c.424
<i>Supplices</i>	423.0 ± 3.4	419.4 ± 3.2	—	
<i>Electra</i>	414.0 ± 3.3	417.0 ± 3.2	—	
<i>H.F.</i>	412.2 ± 3.3	414.3 ± 3.2	410.5 ± 0.7	
<i>Troades</i>	418.2	414.4	414.5	415
<i>I.T.</i>	413.6 ± 3.3	413.3 ± 3.2	412.1 ± 0.7	
<i>Ion</i>	408.9 ± 3.4	412.2 ± 3.2	411.3 ± 0.7	
<i>Helen</i>	411.4	411.5	411.3	412
<i>Phoenissae</i>	413.1	412.2	409.4	c.410
<i>Orestes</i>	406.6	407.5	408.4	408
<i>Bacchae</i>	—	—	—	406
<i>I.A.</i>	406.5	407.8	406.2	406

For each criterion, the regression equation fits the actual relationship between date and criterion astonishingly closely. Fully 91% of the variation in dates between the (dated) plays can be predicted on the basis of the rate of appositives at Porson's Bridge ($r = .96$), 91% also on the basis of the rate of resolution in the trimeter ($r = .96$), and 97% on the basis of the rate of resolution in the tetrameter ($r = .99$). The combined effect of literary factors particular to the dated plays used in the analysis and other statistical disturbance accounts for less than 10% for each criterion. The equations established by the regression analysis for the dated plays have been used to yield the dates predicted in Table 2 for the undated plays. Each predicted date is accompanied by a confidence interval at the 68% confidence level (one standard deviation). Let us take, as an illustration, a play with a predicted date of 417 ± 3 on the basis of trimeter resolution. What does this mean? It means that if we had, let us say, 100 plays with the same trimeter resolution rate as that on which the prediction is based, then the average of the real dates would be the predicted date; and that almost 70 of the 100 plays will have real dates lying between 420 and 414 and 95% of them between 423 and 411

(confidence interval approximately ± 6 at 95% confidence level). The predictions and their confidence levels are founded on the assumption that play-particular literary factors and other statistical noise will have the same chance of disturbing any particular prediction as they had in the case of the dated plays. This is why no predictions have been entered in the table for the *Cyclops* and the *Rhesus*.

There are a few specific points of interest. The resolution criterion is a misleading predictor in that it reverses the dates of the *Medea* and the *Hippolytus*, which are very accurately predicted by the appositive criterion. It is worth noting that both criteria agree in dating the *Heracidae* later than the *Hippolytus* (see also Table 3 below). The predictions for the *semiseverus* group present an anomalous but suggestive picture. Both criteria probably predict too late a date for the *Hecuba*; for the *Supplices*, the appositive criterion offers new support for Zuntz's date of 423,¹² but is badly out of line on the *Andromache*, while the resolution criterion tends to late predictions for both plays. The *semiseverus* thus emerges as a transitional period, which deviates from the general trend of growth for both criteria in the other periods. Both resolution and appositives at Porson's Bridge have been allowed to increase steeply, the latter to such an extent that some later plays seem to represent a more conservative approach, even when due account is taken of the confidence intervals within which the predictions are made.

The *Electra* is, tantalizingly, dated at 414 by the appositive criterion. The tetrameter resolution criterion agrees with the appositive criterion in predicting a slightly later date than that predicted by trimeter resolution for the *H.F.* All three criteria strikingly agree in their dating of the *Helen*, and all the predictions are very close to the actual date. Unlike the appositive criterion and the trimeter resolution criterion, tetrameter resolution correctly predicts that the *Phoenissae* is later than the *Helen*. The close agreement of the dates predicted for the *I.A.* by the appositive and tetrameter criteria (in agreement with the actual date) as against the somewhat deviant date predicted by the trimeter resolution criterion will be discussed below.

In the above discussion, we have analyzed the growth in time of resolution in the trimeter and the tetrameter and of appositives at Porson's Bridge with a view to establishing the nature of the growth in the three

¹² Strictly speaking the prediction is 423 plus or minus 3.4 years at the 68% confidence level; however, 423 constitutes the most probable date (since it is the center of the confidence interval) for a play with the appositive rate of the *Supplices*; the farther away from the central point or expected value, the more unlikely the date. This is why, informally, we can just refer to the central point of the confidence interval.

criteria and finding out what dates could be predicted solely on this basis. We have drawn attention to the fact that rates of occurrence are relatively uninformative unless accompanied by confidence intervals. We decided to perform a regression analysis, because such a procedure has the advantage of leading to an objective quantification of growth and to objectively defined confidence intervals. It is only through a regression analysis that one can identify periods in which there has been more (or less) than regular growth (in the case of the dated plays), and (in the case of the undated plays) that one can know just how accurate a predicted date really is. In the next section we shall be discussing the minor resolution criteria, and there are, of course, all kinds of multivariate statistical techniques that could be applied to incorporate them into the prediction of dates. Furthermore, whatever statistical procedures are adopted, the objectively calculated dates (of the undated plays) must always be integrated with non-metrical evidence. We feel that to pursue the analysis of metrical statistics for dating much further would involve increasingly complex statistical calculations and increasingly diminished returns. Rather, the principal value of the minor resolution criteria lies in the insights they afford into the possible stylistic explanations for discrepancies within the metrical criteria themselves and between the metrical criteria and known chronology.

3. *Minor resolution criteria*

As is well known, it is not only the overall rate of resolution that changes through Euripides' career: the relatively strict constraints that apply in the earlier plays to word-shapes yielding resolution and to their location in the line are progressively relaxed through time. These minor resolution criteria can also be exploited for the purpose of ranking the plays. However, it is essential to ensure that these criteria are properly analyzed and measured. The point bears emphasizing, because the standard modern textbook discussion is confused.¹³ It is not sufficient to demonstrate that the incidence of any particular type of resolution increases through time: *all* types of resolution increase through time, and any particular type is merely a subsample of resolution in general, until proved otherwise. What we are looking for from a minor resolution criterion is additional and independent evidence for ranking the plays, not for a duplication of something that has already been counted in the primary criterion of the overall rate. Failure to appreciate this has resulted in the adoption of fallacious minor criteria. For instance, it is perfectly true that the incidence of anapaest-shaped words located before the penthemimeral

¹³ A. M. Dale, *Euripides: Helen* (Oxford 1967) xxiv ff., cited, e.g., by A. Lesky, *Die tragische Dichtung der Hellenen* (Göttingen 1972) 511.

caesura increases through time: but this criterion will be a vacuous duplication of the overall rate unless it can be shown that the *proportion* of anapaest-shaped words so located increases through time. In point of fact, it does not increase, but remains relatively stable at between 40 and 50 per cent of all anapaest-shaped words used in the trimeter. So in this case, significance has been attributed to a criterion that has none.¹⁴ In other cases, the criterion cited is a real one, but its independent information is buried in the overall growth when the data are not presented in terms of proportions—this is true for the growth of 4th-paeon-shaped words located before penthemimeral caesura.¹⁵ Use of proportions does not completely isolate the independent information (because other factors may affect the class on the basis of which the proportion is taken): nevertheless, it is the simplest practical means of avoiding the fallacy just discussed.

We have established a set of six minor resolution criteria.¹⁶ They are as follows:

1. Anapaest-shaped words in line initial position having their final syllable lengthened by position as a percentage of all anapaest-shaped words in line initial position;
2. Pyrrhic-shaped words implementing 2nd, 3rd, 4th and 5th *longa* as a percentage of all resolutions;
3. The proportion of words of the shape 4th-paeon and ionic *a minore* located with resolution of the 3rd or 4th *longum* that belong to the following morphological categories: (a) words with prepositional prefixes (type ἀπολαβών), (b) other compounds (type νεόγαμος), (c) medio-passive participles in -μενος;
4. 4th-paeon-shaped words located before penthemimeral caesura as a percentage of all 4th-paeon-shaped words;
5. Words of the shape ionic *a minore* located with resolution of 4th *longum* as a percentage of all resolutions;
6. Dactyl-shaped words in line initial position as a percentage of all resolutions.¹⁷

¹⁴ Dale xxvi.

¹⁵ Dale xxvii.

¹⁶ For the omission of T. Zieliński's laws numbers 1, 6, 7, and 9 (Zieliński [above, note 5] 132–98), which are to be rejected, see our article "Rules for Resolution: The Zielińskian Canon," *TAPA* 110 (1980) 63–79.

¹⁷ The percentages for each criterion (based on our counts) are given in the following table:

CRITERION	1	2	3	4	5	6
<i>Alcestis</i>	14.29	6.00	100.00	0.00	0.00	0.00
<i>Medea</i>	0.00	2.94	31.25	0.00	1.47	0.00
<i>Heraclidae</i>	0.00	3.92	41.67	0.00	1.96	0.00
<i>Hippolytus</i>	—	4.76	42.86	0.00	0.00	0.00
<i>Andromache</i>	16.67	16.98	69.23	0.00	0.00	0.00
<i>Hecuba</i>	0.00	11.11	38.89	0.00	0.85	0.00

In Table 3,¹⁸ columns 1-6 give the rank orders of the plays on each criterion; column 7 is the composite ranking derived by adding the different¹⁹ ranks and expressing the result as a rank order; column 8 gives the rank ordering on the overall rate of resolution; and column 9 gives the mean difference between the ranking on resolution and the ranking on each of the six minor criteria.

TABLE 3
Rank order of plays on minor resolution criteria

Criterion	1	2	3	4	5	6	Composite Rank	Overall Resolution	$\Sigma\Delta_i/n$
<i>Alcestis</i>	8	4	17	—	—	—	7	3	+6.67
<i>Medea</i>	2.3	1	2	—	8	—	2	4	-0.67
<i>Heracleidae</i>	2.3	2	4	—	11	—	4	2	+2.83
<i>Hippolytus</i>	[1]	3	5	—	—	—	1	1	+2.00
<i>Andromache</i>	9.5	15	15	—	—	—	14	5	+8.17
<i>Hecuba</i>	2.3	5	3	—	6	—	3	6	-1.92
<i>Supplices</i>	6	8	8	—	—	7	5	7	+0.25
<i>Electra</i>	16.5	11	1	—	9	15	9	8	+2.50
<i>H.F.</i>	13.5	13	6	11	10	9	8	10	+0.42
<i>Troades</i>	9.5	16	10	13	—	12	12	9	+3.10
<i>I.T.</i>	5	9	13	—	12	16	10	11	0.00
<i>Ion</i>	7	6	7	12	7	8	6	13	-5.17
<i>Helen</i>	12	10	14	14	15.5	14	15	14	-0.75
<i>Phoenissae</i>	13.5	14	9	10	17	11	13	12	+0.42
<i>Orestes</i>	15	12	11	16	14	13	16	17	-3.50
<i>Bacchae</i>	11	7	12	15	15.5	10	11	16	-4.25
<i>I.A.</i>	16.5	17	16	17	13	17	17	15	+1.08

The rankings on each of these minor criteria are often obtained from a small number of instances. This is why one finds considerable variation in the rankings of any given play. Nevertheless, the overall agreement between the six rankings (even when the numerous ties at zero occurrences

<i>Supplices</i>	12.50	12.10	60.00	0.00	0.00	0.81
<i>Electra</i>	25.00	14.81	30.30	0.00	1.85	3.09
<i>H.F.</i>	23.08	15.57	51.16	6.52	1.89	1.42
<i>Troades</i>	16.67	20.24	62.50	7.41	0.00	2.38
<i>I.T.</i>	5.00	13.55	68.29	0.00	2.79	3.19
<i>Ion</i>	13.33	11.48	52.50	6.98	1.11	1.11
<i>Helen</i>	21.05	14.49	68.63	10.00	3.77	2.90
<i>Phoenissae</i>	23.08	16.00	61.40	5.66	5.00	2.00
<i>Orestes</i>	23.53	14.99	64.38	20.51	3.56	2.68
<i>Bacchae</i>	17.65	11.59	65.96	19.64	3.77	1.44
<i>I.A.</i>	25.00	20.49	75.00	26.00	2.83	3.89

¹⁸ In Table 2, which was concerned with the dating of the plays, there were no entries for the *Alcestis* and the *Bacchae*, and lines 49-114 and 1532-77 were excluded from the *I.A.* for the regression dates. Table 3, however, is designed to reveal systematic deviations of any origin and consequently includes the *Alcestis*, the *Bacchae* and the two anomalous passages from the *I.A.*

¹⁹ Criteria 4, 5, and 6 do not provide rankings for plays in which there are zero occurrences of the category in question; therefore, to prevent distortion, they have not been entered into the mean figures on which columns 7 and 9 are based.

of criteria 4, 5, and 6 are taken into account) is quite strong, as measured by the coefficient of concordance ($W = .71$) and is highly significant statistically ($\chi^2 = 68.78$, $d.f. = 16$). Under these circumstances, the most reliable ranking can be obtained by combining the evidence of the individual criteria into a composite rank order, as in Table 3, column 7. There is a very high correlation, as measured by the Spearman rank order correlation coefficient, between the composite ranking on the minor resolution criteria and the actual dates of the eight dated plays used in the regression analysis. There is also a substantial correlation with the overall resolution rate $r_s = .69$ and with the appositive criterion ($r_s = .66$) for all 17 plays. (The coefficient of concordance for all three rankings is $W = .80$, $\chi^2 = 38.50$.) It is also important to discover whether there is any systematic tendency for these minor criteria to rank a play noticeably higher or lower than the overall resolution criterion. Large mean deviations in column 9 are evidence that disagreements between the minor criteria and resolution are less likely to be due to random variation and more likely to arise from substantive causes.

It will be remembered that both the overall resolution criterion and the appositive criterion located the *Phoenissae* before the *Helen* and the *Bacchae* before the *Orestes*. The composite ranking on the minor criteria follows the same pattern, likewise conflicting with the chronology in both cases, and thus tending to substantiate the evidence of the two major criteria. Furthermore, the minor resolution criteria also tend to confirm the evidence of the appositive criterion, when it deviates substantially from the indications of overall resolution. Although the latter places the *Alcestis* substantially later than its known date, the minor criteria agree with the appositive criterion in assigning it an even lower ranking among the plays (note the large mean difference in column 9). Likewise, in the case of the *Andromache*, the extremely low ranking on the basis of the appositive criterion is in striking agreement with the very large mean difference in column 9 in the same direction for this play. It is unlikely to be a coincidence that the two plays that deviate the most from the overall resolution criterion on the minor resolution criteria are just those that also deviate the most on the appositive criterion, namely the *Alcestis* and the *Andromache*.

4. Interpretation and explanation

The preoccupation of previous scholarship with the value of metrical statistics for the dating of plays has tended to obscure the fact that, quite apart from any applications they may have to incidental problems such as dating, these statistics have implications of the most basic kind for Euripides' stylistic evolution and therefore demand for themselves a substantive interpretation and explanation.

Let us look again at the regression analysis just presented. For the purposes of an investigation of the growth of resolution and appositives at Porson's Bridge, it is appropriate to present the results of the analysis in reverse form, that is, to predict the rate of the two phenomena on the basis of the (known) dates of the plays, rather than vice versa as above. This reversed regression analysis is presented in graphical form in Figures 1 and 2: the straight line represents the regression line (growth trend), the circled points represent the actual (transformed) rates in the dated plays.

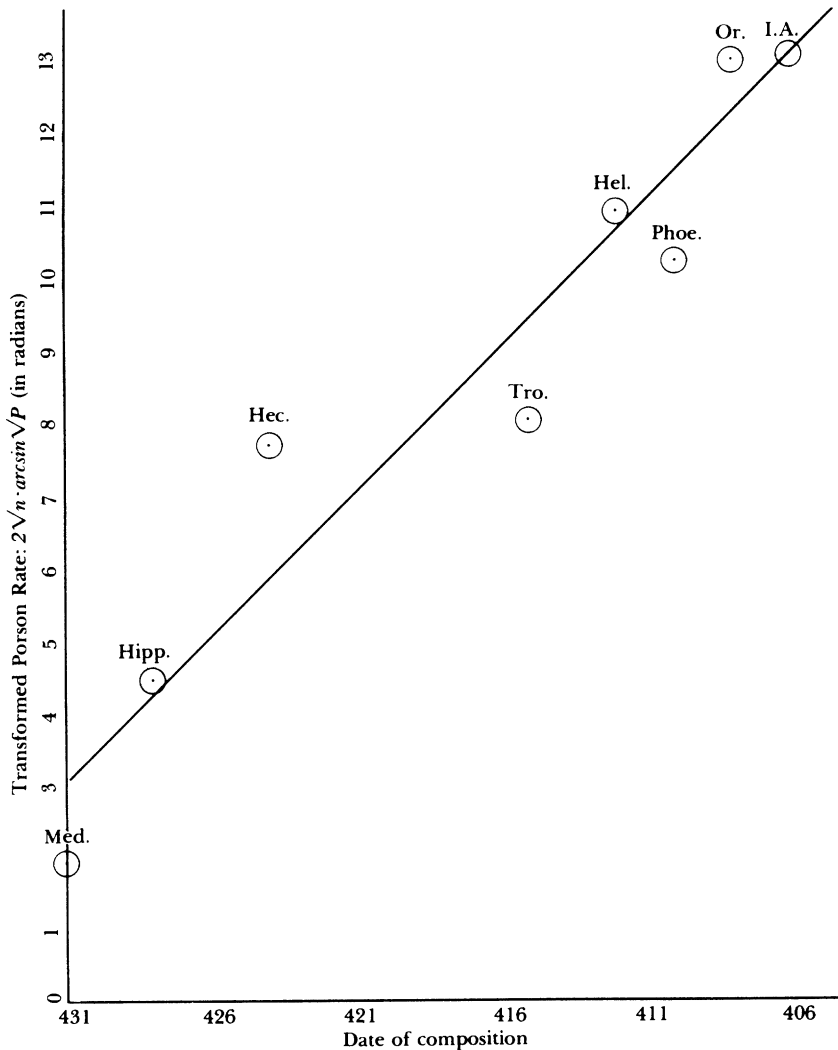


Figure 1
Growth of the Rate of Appositives at Porson's Bridge

$$2\sqrt{n} \cdot \arcsin \sqrt{P} = 0.3948t + 3.0642 \quad (t \text{ measured in years after the } Medea)$$

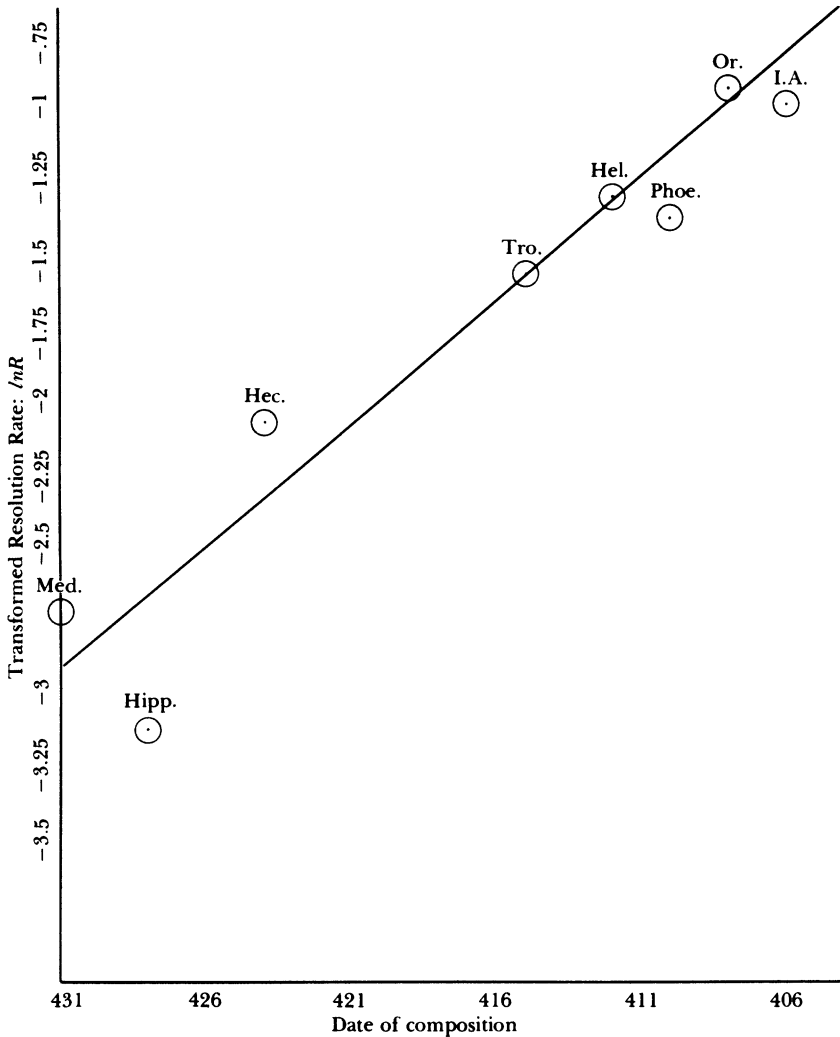


Figure 2
Growth of Resolution Rate

$$\ln R = 0.0816t - 2.9140 \quad (t \text{ measured in years after the } Medea)$$

The closeness of fit between the regression line and the actual rates once again illustrates the regularity of the developments. We naturally wish to know first of all what are the properties of resolution and appositives that would make them (as opposed to other categories) liable to change, and secondly why Euripides caused them to change in the way they do. Furthermore, an explanation will have to be given for the anomalous

position of the *Bacchae* and particularly of the *Alcestis* which, on the basis of the regression equations, would have had a date of 428.2 predicted for it on the overall resolution criterion (nearly ten years too late), an even later date on the minor resolution criteria ($\Sigma\Delta_i/n=+6.67$), and a date of 413.9 on the appositive criterion (about 24 years too late).

The traditional account of the growth in resolution has generally been a restatement of the statistics in terms of increasing metrical laxity: thus A. M. Dale writes, "The process of trimeter-loosening went on apace."²⁰ The possibility of a linguistic component in the growth of resolution has been largely ignored.²¹ Yet the identification of a motivating linguistic factor would lead to a more powerful theory that provides independent empirical motivation for the growth of resolution (something not available in an explanation dealing exclusively in terms of the progressive erosion of initially rigorous metrical constraints). Let us briefly characterize what we understand to be the linguistic basis of resolution.

Traditional descriptions of word-shapes (tribrach, cretic /○○○, -○○, etc.) provide only linear sequences of heavy and light syllables. But any sensitive observation of speech at normal conversational tempi in any number of languages will lead to the conclusion that concrete speech production, as opposed to the abstractions of metrical and grammatical description, is highly patterned and rhythmical, a conclusion now corroborated by instrumental phonetic investigation of the temporal organization of speech in a variety of languages. In the study of the temporal organization of speech production, it is typically found that the syllable sequence within a word is organized by a complex of rules into a rhythmicized structure suitable for phonetic implementation.²² Such an organization is consonant with what is known about human motor

²⁰ Dale (above, note 13) xxviii.

²¹ It has sometimes been suggested (most recently by C. Prato, *et al.*, *Ricerche sul trimetro dei tragici greci: metro e verso* [Rome 1975]) that Euripides increases the rate of resolution because he comes increasingly to require words whose shapes necessitate resolution if they are to be used at all in the trimeter (or tetrameter). (The reasons for the appearance of new vocabulary are irrelevant here.) It is quite easy to show that such a theory is inadequate to explain the increase in resolution. If it were merely the pressure to use new words that was responsible for the increase in resolution, there is no reason why words such as *δακρύοις* which occur as cretic shapes in the earlier plays should in later plays be employed as anapaestic shapes, i.e., giving a resolution. It is clear that resolution is growing in all kinds of words, though not necessarily at the same rates, including those used in the earliest plays; thus the increase in resolution is not limited to any sub-class of the lexicon.

²² See the discussion and literature cited in our article "The Phonological Definition of Boundaries," *Juncture*, edd. M. Aronoff and M.-L. Kean (Saratoga, Cal., 1980). Note, however, that much of the experimental evidence still comes from stress-timed languages.

activity in general, and conversely seems to provide the temporally coherent structures that are necessary for speech perception.²³

The way temporal organization rules affect a particular syllable critically depends on the syllables contiguous to it in the word. We assume that under certain circumstances (and after the application of morpho-phonemic and sandhi rules, of course) two contiguous light syllables in a word are subject to some form of coarticulatory plan for their phonetic production: the two light syllables are reduced in duration so as to function as the rhythmical equivalent of a single heavy syllable in the same phonological environment. They are not pronounced as independent light syllables but a single durational template is assigned for their articulation, as a result of which both their overall duration is decreased and their individual durations rendered less independent of each other. Thus the result of this temporal organization of the contiguous light syllables is the formation of a disyllabic matrix.

Whether or not two contiguous light syllables in word-shapes such as tribrachs and first and fourth paeons are processed to form a matrix depends not only on their environment in the word²⁴ but also on the speech tempo adopted in the discourse situation. The salient characteristic of rapid, informal speech in any language is that it generates reduced and compact structures. On the other hand, slow, formal speech is more likely to follow a type of speech production which guarantees the rhythmic autonomy of each syllable. Slow speech is more inclined to employ an additive strategy,²⁵ fast speech a subtractive strategy. Instead of slightly lengthening a single light syllable to produce two units of temporal organization from a sequence of two light syllables, non-deliberate speech will prefer to reduce the two light syllables into a disyllabic matrix, thereby producing only one unit. Thus we are suggesting that, in a tribrach-shaped word such as *δνομα*, in slow speech each syllable would remain an autonomous unit, but in non-deliberate speech the syllabic sequence would be organized to result in a temporal structure of trochaic²⁶ character: the three light syllables ŠŠŠ are processed as ŠŠ. This is not a revolutionary idea, but was proposed fifty years ago by the Cambridge metrist

²³ S. G. Nootboom and A. Cohen, "Anticipation in Speech Production and its Implications for Perception," *Structure and Process in Speech Perception*, edd. S. G. Nootboom and A. Cohen (Berlin 1975) 124–45.

²⁴ It is not unreasonable to suspect also segmental conditioning, but no firm evidence has been found for it in metre: see our article "Tribrach-Shaped Words in the Tragic Trimeter," *Phoenix* 35 (1981) 22–41.

²⁵ That this, as opposed to strict syllable-timing, was the strategy for the organization of sequences of two light syllables in Greek is suggested by the rule for the formation of the comparative and superlative according to which a short stem vowel was lengthened after a light but not after a heavy syllable: thus *σοφώτερος* but *λεπτότερος* and *ωμότερος*.

²⁶ See J. Irigoin, "Lois et règles dans le trimètre iambique et le tétramètre trochaïque," *REG* 72 (1959) 67–80; W. Sidney Allen, *Accent and Rhythm* (Cambridge 1973) 318 ff.

E. Harrison.²⁷ On this view, the formation of a disyllabic matrix in the language is both a precondition and an explanation for the metrical phenomenon of resolution.²⁸

There exist some instructive typological parallels for the linguistic situation that has just been assumed. For instance, a parallel from a language with syllable quantity is furnished by secondary stress assignment in Estonian, where *usaldavamale* may be stressed *usald¹av²am³ale* [ˈxlˈxlˈxl] or *usaldav²amale* [ˈxxlˈxxl]. Or again, in Fijian, where temporal organization of speech centers on foot-like syllable groups, in slow deliberate speech it is dipodic [*mera*] [*ica*] “in order to see it,” but at normal conversational tempo it is monopodic [*merâica*]. Such evidence strongly suggests that in speech production the syllables of a word are mapped onto a patterned template with solutions to the mapping problem varying according to speech tempo.

The theory just outlined would provide the linguistic component in an explanation for the growth of resolution through time in Euripides, once the further assumption is made that one aspect of the evolution of Euripides’ style was the increasing acceptance of phonological structures other than those of slow and deliberate speech.

The general lines of this linguistic approach to resolution are corroborated by the new data on appositives presented above. For, in the case of the appositives, we know with complete certainty, on the basis of independent data from Greek phonology and of general linguistic and typological evidence, that there indeed *was* variation in the language.²⁹ It follows that, for the growth of appositives, the most direct explanation will have a linguistic (prosodic) component incorporating the fact of this variation. As the tempo of speech becomes less deliberate and the style less formal, appositives become phonetically more comparable to parts of words than to whole or independent words. Examples of this may be found in almost any language. In Madurese (Java), proclitics “are . . . independent words or, in fast speech, part of a larger word.”³⁰ In English, the sentence *There are some books* may be spoken with a stress on the first or the second syllable (depending on emphasis) or on both in slow

²⁷ E. Harrison, “Τριβραχυλογικά,” *Proc. Camb. Phil. Soc.* (1932) 4–5.

²⁸ It emerges from the evidence of the minor criteria that some word shapes allow a disyllabic matrix to be formed more easily (i.e., in less rapid, informal speech) than others. This explains minor criteria numbers 2, 5, and 6 (pyrrhic, ionic *a minore*, and dactyl-shaped words respectively). Minor criterion number 4 involves variation in the location of the matrix within fourth-paeon-shaped words. Criteria 1 and 3 arise from the compositional principle whereby the easier a form is to avoid in resolution or substitution, the smaller the proportion of resolutions or substitutions it will constitute in those plays in which resolution and substitution are highly constrained.

²⁹ This evidence is further explored in our article above, note 1.

³⁰ A. M. Stevens, *Madurese Phonology and Morphology* (New Haven 1968) 69.

speech: in fast speech, both the first and the second syllables are reduced and only the non-appositive lexical item *books* receives stress and retains an unreduced vowel [ðeresmbUks]. That appositives could combine with another word in Greek is demonstrated, *inter alia*, by the fact that inscriptions punctuating word boundaries with any degree of consistency do not usually punctuate after prepositives or before postpositives. This variation in the pronunciation of appositives explains why a prepositive such as elided τῶνδε can stand both before a diaeresis (e.g., τῶνδ' || ἐξίοντι *Ion* 535) and before Porson's Bridge (e.g., τῶνδ' ἐκπεσεῖν *Andr.* 875); likewise σῆς || συγγόνου (*Hel.* 1656) at the caesura and σῶ συγγόνῳ (*Hel.* 978) across Porson's Bridge. The slow speech variant (two phonological words) provides a satisfactory caesura, the more compact variant (one phonological word) satisfies the requirement of the bridge. The increase in the incidence of appositives at Porson's Bridge, documented and analyzed in §§1 and 2 of this paper, can be interpreted as basically due to the increased admissibility in later Euripides of variants from less deliberate speech. By establishing the existence in the language of variants satisfying and contravening respectively the requirements of Porson's Bridge, we can directly motivate the growth in the appositive criterion. If we symbolize phonetically signalled word boundary by # and its absence by Ø, then we can construct the following schema for the pronunciation of the syntagm σῶ συγγόνῳ, which spans Porson's Bridge at *Hel.* 978:

slow speech	σῶ # συγγόνῳ	(violates Porson's Bridge)
other speech tempi	σῶ Ø συγγόνῳ	(does not violate Porson's Bridge)

The above description rests on a direct and immediate deduction from two premises, one metrical and one linguistic. The metrical premise is that bridges require the absence of phonologically marked word boundary; this premise is definitional. The linguistic premise is that appositive boundaries are deleted except in deliberate speech; this premise is proved by general linguistic and specifically Greek evidence. From these two premises it follows that, if appositives increase at bridges, then at least in this case³¹ non-deliberate speech forms are being admitted more freely by the poet. This in turn makes it more likely that other non-deliberate speech forms are also increasing and thus serves to corroborate our assumptions regarding resolution.

³¹ The interpretation of appositives at bridges as "minor violations" is even here a *theoretically* possible alternative. But, given that perfect implementations of the bridge (i.e., structures with boundary deletion) actually exist as variants in the language, it seems uneconomical and almost perverse to deny them relevance. The question is fully discussed in our article above, note 1.

The linguistic account we have just given for resolution answers two questions:

1. Why is resolution allowed at all? Because the language has a phonetic process forming a matrix from certain sequences of two light syllables.
2. What is the principal reason for the increase in the rate of resolution? Disyllabic matrices are formed more readily in less deliberate speech, and later plays allow themselves greater access to less deliberate speech structures.

The linguistic account we have just given for appositives at Porson's Bridge likewise answers two questions:

1. Why are appositives allowed at Porson's Bridge at all? Because there is a phonetic process deleting appositive boundaries in certain environments.
2. What is the principal reason for the increase in the rate of appositives at Porson's Bridge? Boundaries are deleted more readily in less deliberate speech, and later plays allow themselves greater access to less deliberate speech structures.

The evident parallelism of the answers to the second question in each case affords a ready answer to the third question:

3. Why are the growth of resolution and the growth of appositives at Porson's Bridge correlated? Because the phonetic processes underlying the two phenomena, although formally very different, are both conditioned in the same way by speech tempo.

Thus, the correlated behavior of resolution and appositives at Porson's Bridge can be interpreted as the reflex of a single stylistic development, namely the increasing admissibility of everyday pronunciations in the language of later Euripidean verse.³²

Of course, that everyday pronunciations in general are less constrained in later Euripides is simply a hypothesis, but it is a hypothesis which permits us to derive a coherent and descriptively adequate account of the data which is consistent with well established linguistic principles. The hypothesis would be further strengthened, if it were possible to provide

³² We have been careful to speak of "non-deliberate" rather than merely "rapid" speech because Euripides limits himself to a far lower point on the phonostylistic parameter than that which underlies the use of resolution and anapaestic substitution in comedy. Of all Euripides' plays, the *Cyclops* makes the most extensive use of conversational pronunciations: it has a very high rate of appositives at Porson's Bridge and even admits structures not permitted in tragedy (e.g., *πρὸς αὐτῇ τῇ πέτρα* 682), but it has far fewer anapaestic substitutions than comedy.

independent confirmation. In the absence of precise and truly reliable diachronic analyses, the best we can do is to call attention to a long tradition of intuitive critical comments which lend credibility, if not specifically to the assumption of change from early to late Euripides, at least to the proposition that everyday speech is a special characteristic of Euripides' style. (It seems a perfectly reasonable assumption that, as for most authors, his "typical" style did not come fully formed but developed progressively through time.) This feature of Euripides was observed already in antiquity: see Aristotle *Rhet.* 3.2.5, *ἐάν τις ἐκ τῆς εἰωθυίας διαλέκτου ἐκλέγων συντιθῇ· ὅπερ Εὐριπίδης ποιεῖ καὶ ὑπέδειξε πρῶτος*. The famous literary contest in Aristophanes' *Frogs* is full of references to the everyday nature of Euripides' language and subject matter: *τὸ βάρος ἀφείλον* (941), *ἐπυλλίους* (942), *οἰκέα πράγματ' εἰσάγων* (959), cf. also 1059.³³

The assumption that phonostylistic variation can be reflected in metrical statistics is fairly easy to substantiate with modern parallels. Consider, for instance, Kyd's *Spanish Tragedy*, which is notorious for its *ὄγκος*, and Webster's *Duchess of Malfi*, the language of which is in general less elevated and approximates more closely to conversational English. Now syncope of vowel before a resonant in trisyllabic words such as *flatt(e)rer*³⁴ is presumably associated with everyday speech, and thus we should expect the disyllabic variant to be more common in the *Duchess of Malfi*. And indeed, the reduced variant represents 46% of all instances potentially subject to such syncope in the iambic pentameters of the latter work, whereas it represents only 7% of all instances in those of the *Spanish Tragedy*.

It is generally recognized that the style of satyric drama is considerably less elevated than that of tragedy. On the basis of our theory we should therefore predict that both resolution and appositives at Porson's Bridge will occur at comparatively high rates in the *Cyclops* (just as colloquialisms do, according to Stevens):³⁵ in fact, the resolution rate is that of a tragedy of *stilus liberrimus*, and the appositive rate (61.50 per thousand trimeters) is far above even that of the *I.A.* and almost twice that of the *Bacchae*. These data confirm the correlation of literary style and genre with the admissibility of everyday speech variants. We thus have an explanation for the anomalous position of the *Alcestis* on the overall

³³ See also the discussion of *ληκύθιον ἀπώλεσεν* (1208) by J. H. Quincey, *CQ* 43 (1949) 32–44, where it is suggested that *ληκύθιον* means "bombast" (*ampulla*).

³⁴ Note trisyllabic *flatterer* at Marlowe, *Edward II* xi, 195

Yonder is Edward with his flatterers,
but the disyllabic form at *ibid.*, 200

No, Edward, no; thy flatt(e)rers faint and fly.

³⁵ P. T. Stevens, *Colloquial Expressions in Euripides* (Wiesbaden 1976) 65.

resolution, appositive, and minor resolution criteria, namely that it is a pro-satyr play; further evidence for this interpretation is the fact that the proportion of *correptio Attica* in the *Alcestis* is significantly higher than in the other plays of the *stilus severior*, i.e., the language of the *Alcestis* is closer to the local spoken dialect on this point. In the case of the *Bacchae*, on the other hand, a conservative trend in various aspects of this play including the language has been discerned by the Oxford edition³⁶ (which cites Smereka's claim that there are more archaic forms and fewer colloquial ones than in any play written after 415). On the basis of our theory, we should therefore predict a lower rate of resolution and of appositives at Porson's Bridge than in approximately contemporary tragedies of Euripides. And indeed, the data in Table 1 show that the *Bacchae* has the lowest rates of the plays of the *stilus liberrimus* on both criteria; and it may be seen from Table 3, column 7, that the *Bacchae* is ranked roughly in the center of the *stilus liber* (*sic*) by the minor resolution criteria (note also the high negative $\Sigma\Delta_i/n$ in column 9). We thus have a simple explanation of why the regression analysis would have predicted erroneous dates in Table 2 and erroneous rates in Figures 1 and 2. The behavior of our criteria in the *Cyclops*, *Alcestis*, and probably also the *Bacchae*, establishes that they can reflect factors other than the general chronological development.

There are some other plays in which the four metrical criteria are mutually contradictory or misleading when interpreted in purely chronological terms; it is worth considering whether these discrepancies may be due to stylistic characteristics of the individual plays, although what we shall have to say must remain largely speculative.

In the *Rhesus*, the overall rate of resolution is lower than that of any *semiseverus* play, but the rate of appositives at Porson's Bridge is comparable to that of a *liber* play such as the *Troades*. (Note also that the rate of *correptio Attica* in the *Rhesus* is very close to that in the *Alcestis*.) We have already seen in the case of the *Alcestis* and of the *Cyclops* that the appositive criterion is more sensitive than the overall resolution criterion to differences in style or genre. Thus, it might be possible to connect the discrepantly high rate of appositives at Porson's Bridge in the *Rhesus* with the judgement of certain critics that the *Rhesus* (whoever wrote it) is not purely tragic in character.³⁷

In the *Andromache* we again find a remarkable discrepancy in the same direction between the resolution and appositive criteria; in this play, moreover, the minor criteria, by pointing to a significantly lower ranking than that suggested by the overall resolution rate, support the assumption

³⁶ E. R. Dodds, *Euripides: Bacchae* (Oxford 1960²).

³⁷ See the discussion and literature cited in W. Ritchie, *The Authenticity of the Rhesus of Euripides* (Cambridge 1964) 350 ff.

that the discrepancy is not simply due to random variation. It would be interesting to see if this metrical evidence could be related to the judgement of literary critics about the general stylistic level of the *Andromache*.

The *Helen*³⁸ is interesting because, out of our four metrical criteria, three agree in ranking it lower than the *Phoenissae* (which is known to be a later play), and only the tetrameter resolution criterion ranks it higher. It is again worth speculating whether this discrepancy between the trimeter evidence and the chronology might correlate with some difference in stylistic level between the *Helen* and the *Phoenissae*.

In the *I.A.*, it is the trimeter resolution rate that goes against the known chronology and predicts a date marginally earlier than that of the *Orestes*, even with the exclusion of the two passages at the beginning (lines 49–114) and end (lines 1532–77) of the play in which the rate of resolution is anomalously low. (If the two passages are included, of course, the date assigned on the criterion of overall resolution in the trimeter would be even earlier.) By contrast, the minor resolution criteria and the tetrameter criterion both rank the *I.A.* last of the tragedies, and the rate of appositives at Porson's Bridge is so much higher in the *I.A.* than in the *Orestes* that the confidence intervals do not overlap at the 68% level. An attempt might usefully be made to link this discrepancy with the problems of authorship and interpolation in the *I.A.* If, even with the above exclusion, the interpolations are concentrated in trimeters and the overall rate of trimeter resolution is consequently decreased (because of the rarity of resolution in the interpolations), then it would follow that (a) the tetrameter rate should be less affected, and (b) the minor criteria (which do not reflect the line rate but rather distributions within the body of actually occurring resolutions) will suffer less distortion and be more representative of the properly Euripidean component. Furthermore, as the rate of appositives at Porson's Bridge is not depressed below what would be predicted for a play of 406 by the regression analysis in Figure 1, it would be the case that the interpolated lines had a different correlation between the appositive and resolution rates than that obtaining in the Euripidean component.

Scholars have long been aware that philological data in metrics characteristically vary through time and from style to style and genre to genre. Such variation is a major *explanandum* in metrics. For the most part, variation in metrical data has been explained in terms of varying metrical

³⁸ For use of the expected value (central point of the confidence interval) and the significance of multiple criteria see notes 6 and 12.

strictness; the possibilities of an explanation in terms of the language tended to be neglected. The reason for this neglect is very simple. Metrists regarded language as a monolithic and unvarying structure, and as such it could not be invoked to explain variation in metrical data, for the obvious reason that variation cannot be explained by a constant, but only by a variable. The disadvantage of these purely metrical explanations was that (quite apart from their frequent moralizing overtones) they were little more than restatements of the *explanandum* in terms of abstractions that could not be connected with independent, i.e., non-metrical, data. On the other hand, by definition, a linguistic account uses independent data (i.e., language), and directly motivates the attested variations in a non-circular manner. To the extent that metrists are aware of the high degree of patterned variability inherent in language, they are in a position to take account of both language variability and metrical variability, therefore constructing far more explicit and adequate explanatory models.³⁹

³⁹ We wish to thank Marsh McCall for his generous help and valuable suggestions.