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RULES FOR RESOLUTION: THE ZIELINSKIAN CANON

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In the half century since the appearance of T. Zieliński's *Tragodumenon Libri Tres*, the *Liber secundus* ("De trimetri Euripidei evolutione")[1] has established itself as the fundamental reference work not only for the chronology and course of stylistic evolution in Euripides, but also for the philological formulation of the complex of rules governing resolution in Euripidean tragedy. Subsequent scholarship has taken two directions. On the one hand, the work of Ceadel[2] concentrated on producing more accurate counts than those of Zieliński and his predecessors Zirndorfer,[3] Rumpel[4] and C. F. Mueller;[5] the object of Ceadel's work was the dating of plays, and factors central to other considerations— particularly data on word-shapes—are disregarded. On the other hand, attempts have been made (notably by Irigoin[6] and Sidney Allen[7]) to establish a small set of general metrical and linguistic principles that would lead to an explanatory reformulation of the Zielińskian canon. What has been conspicuously lacking so

[1] T. Zieliński, *Tragodumenon Libri Tres* (Cracow 1925).

[2] E. Ceadel, "Resolved feet in the trimeters of Euripides and the chronology of the plays," *CQ* 35 (1941) 66–89.

[3] H. Zirndorfer, *De chronologia fabularum Euripidearum disputationes* (Marburg 1839).

[4] J. Rumpel, "Die Auflösungen im Trimeter des Euripides," *Philologus* 24 (1866) 407–21.

[5] C. F. Mueller, *De pedibus solutis in dialogorum senariis Aeschyli, Sophoclis, Euripidis* (Berlin 1866).

[6] J. Irigoin, "Lois et règles dans le trimètre iambique et le tétramètre trochaïque," *REG* 72 (1959) 67–80.

[7] W. Sidney Allen, *Accent and Rhythm* (Cambridge 1973).

far is an investigation of the middle ground between these two levels of analysis. Metrical and linguistic explanations of the philological generalizations that constitute the rules should be preceded by a careful evaluation of the independent significance of those generalizations. This paper is devoted to that end.

Our reassessment of the Zielińskian canon leads to three types of revision. A rule may be refined by the addition of a philological fine structure. A rule may be extended and generalized to cover new data not considered by Zieliński. Finally, a rule, or part of a rule, may be eliminated on the grounds that it is not an independent, autonomous rule but vacuous and purely a reflex phenomenon, a numerical constatation of no theoretical significance for the understanding of the metrical and linguistic bases of resolution.

1. *Lex de solutionibus cumulatis*. Two or more resolutions in the same line are avoided; this constraint is progressively relaxed through time.

The substantive content of the 1st law is that the poet finds double resolution artistically objectionable and goes out of his way to avoid it. But we can only accept this important claim about poetic technique, if it has first been demonstrated that the incidence of double resolution is not purely random. It is perfectly true that multiple resolutions are, in absolute numbers, very rare in the *severior* style: Zieliński finds two in every thousand trimeters. However, such a figure, taken by itself, is meaningless: single resolution is comparatively infrequent in the *severior* plays, so that, even on a purely random basis, double resolution is likely to be rarer still.

Our task, therefore, is to calculate how rare double resolution would be on a purely random basis: if the observed incidence (2 per thousand trimeters) is ever less than the incidence so predicted, then the law holds; if not, then the rarity of double resolution is automatic and no special explanatory aesthetic factors need be assumed.

The simplest statistical hypothesis for the calculation of the random incidence of double resolution is the Poisson distribution, what is often referred to as the "law of rare events": $P(k) = e^{-\lambda} \frac{\lambda^k}{k!}$, where P means probability, k is the number of resolutions, and λ is the average number of resolutions per line. Using Zieliński's own data, we therefore calculate that the probability of double resolution is 1.8 per thousand trimeters. In fact, we find an incidence of 2 per thousand. The difference between the predicted random rate of occurrence and the observed rate is not statistically significant. Nor is the absence of triple resolution surprising, since the Poisson distribution predicts a random occurrence of only 3.7 in every *hundred*

thousand lines. Thus in the *severior* style there is no evidence for any avoidance of double or triple resolution.

Similar considerations apply to Zieliński's second assertion, that the supposed constraint against multiple resolution is progressively relaxed in later styles. It is quite true that the incidence of double resolution does increase in absolute terms from a minimum of 2 per thousand for the *severior* to a maximum of 39 per thousand for the *liberrimus* style. But again, the non-random character of these frequencies remains to be demonstrated, before any conclusions about stylistic evolution may be drawn. It will be recalled that resolution in general increases from the earlier to the later styles, and if resolution becomes more frequent, then, purely on a random basis, the likelihood of multiple resolution must also increase—this presumably explains the situation in lyric trimeters also. We have calculated that the Poisson distribution predicts random rates of multiple resolution that fit quite satisfactorily with the observed incidences in all three later styles. Thus, in each style taken independently, any slight evidence there is for the 1st law is statistically not significant.

However, when the data for the three later styles are studied as a whole, an interesting fact emerges: there is a weak tendency for the predicted incidence to exceed the observed incidence. This finding is evidence that the hypothesis of a Poisson distribution was too simple, a null hypothesis; for the Poisson distribution makes the simplifying assumption that all locations for resolution are equally acceptable (an assumption which biases the test towards confirming the 1st law). In fact, as is well known, in many locations resolution is avoided to a greater or lesser degree: there is only one really favored location, which is the third *longum*. Consequently, if a line is to have more than one resolution, the additional resolutions will have to go into the relatively disfavored locations in a majority of instances. A random model incorporating such locational constraints will predict even fewer multiple resolutions than the simple Poisson hypothesis, thereby eliminating the underpredicting trend in the simpler model (and of course further strengthening the null hypothesis in the case of the *severior* style, for which the simple hypothesis was, by itself, fully adequate). Therefore, we must reject the 1st law.

A similar constraint against multiple resolution was proposed for the trochaic tetrameter of tragedy by Rubenbauer,[8] and it is not

[8] H. Rubenbauer, "Der Bau des trochäischen Tetrameters in der neueren Komödie," *Philologus* (1913) 206–24, referring to J. Rumpel, "Der trochäische Tetrameter bei den

surprising that in the tetrameter too the law is vacuous and the incidence of multiple resolution turns out to be purely random. For double resolution the Poisson model predicts 31 tetrameters and we find 37: the occurring number of double resolutions is actually greater than the number predicted, which hardly suggests active avoidance; for triple resolution the predicted random occurrence is 3.56, the observed number is 4.

2. *Lex de tertii pedis solutionum praevalentia*. The third *longum* is resolved more often than any other, and the earlier the play, the stronger this tendency.

Both the synchronic and the diachronic claims are obviously true, but the rule would be better reformulated in terms of its directly motivating general principle. In his discussion of the 2nd law, Zieliński invokes the caesura as the motivating environment (we need not be concerned here with his particular beliefs about ictus). This implies that, at least to some extent, there should also be a correlation between hephthemimeral caesura and resolution. We have tested this implication and have found that in Aeschylus fully 81% of 4th paeon-shaped words beginning with the 4th *longum* are preceded by a metrically defined[9] hephthemimeral caesura, in Sophocles 67%, in Euripides *severior* 54%. The high strength of the correlation obtaining in Euripides *severior* is revealed by comparison with the hephthemimeral caesura before the corresponding unresolved shapes, cretic- and molossus-shaped words: the proportion is 26%, i.e., less than half, in the control environment. In the later styles, the correlation becomes extremely weak.

After post-caesural position, the next most common location of tribrach-shaped words is line initially: this latter location is about a fifth as common as the former in the trimeter, but in the tetrameter tribrach-shaped words are distributed nearly equally at the beginning of each hemistich, so that the ratio of post-diaeresis to line initial location is only 1.08 : 1. It seems likely that the smaller relative frequency of line initial location in the trimeter is due either to the preference for locating tribrach-shaped words in a trochaic slot (cf. the 8th law) or to the fact that the resolved syllables are not in absolute line initial position in iambic meter.

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griechischen Lyrikern und Dramatikern," *Philologus* 28 (1869) 425.

[9] In order to avoid potentially ambiguous cases, we accepted as having hephthemimeral caesura only those lines without full word boundary at the penthemimeral position.

A hypothesis that can account for both locational preferences by a single principle will *ceteris paribus* be superior to one that invokes different principles for each location. The property common to the two locations is that they are both contiguous to a metrical boundary, i.e., to potential pause metrically defined (which may or may not coincide with a linguistically defined syntactic boundary). We assume that in the position following a metrical boundary the complication of resolution is less damaging to the underlying metrical structure, i.e., less liable to render it opaque and difficult to analyze for the audience. This also seems to be the reason for the restriction to line initial location of major departures from the basic pattern (anapaestic substitution, choriambic inversion). In the English iambic pentameter the strictest poets only allow "trochaic inversion" post-pausally, although here pause is defined both in metrical terms (end of line) and in linguistic terms (end of syntactic constituent).

If the interpretation just presented is correct, then it would follow that the tendency to post-pausal location should be stronger, the more disfavored or "difficult" a word-shape is in resolution, and this is precisely the case. Pyrrhic- (see the 10th law) and proceleusmatic-shaped words are evidently difficult, since in Euripides *severior* the former are very rare in resolution and the latter do not occur at all. For these two word-shapes, the post-pausal requirement is overwhelming: lexical pyrrhics in resolution are excluded from all locations except 1st and 3rd *longum*, and proceleusmatic-shaped words (which of course do not scan beginning in 3rd *longum*) are first admitted line initially and always more common there than in any other location.

3. *Lex de primo pede*. A resolved 1st *longum* is implemented only by a line initial tribrach-shaped word; this constraint is relaxed in later styles.

Much of the philological data relevant to this rule emerges in the subsequent reformulations specific to later styles.[10] However, significant aspects of the fine structure are missing: a more revealing analysis can be obtained by refining Zieliński's classification of the different types of line initial dactyls. The following is an exhaustive classification: (1) the syntagm heavy prepositive monosyllable followed by tribrach-shaped word (type πρὸς πατέρα); (2) the 1st paeon-shaped word (type νηφάλια); (3) the dactyl-shaped word (type

[10] Zieliński (above, note 1) 155–57; 167–69; 187–90.

μητέρα); (4) the syntagm heavy prepositive monosyllable followed by lexical pyrrhic-shaped word (type τὸν πόδα); (5) the syntagm heavy prepositive monosyllable followed by 4th paeon-shaped word (type τῶν γενομένων); (6) the syntagm heavy lexical monosyllable plus tribrach-shaped word (type γραῦς ἄπολις). Of these six categories, the last two are rare in all styles, but the others show interesting trends, which are represented in table 1 showing the rank orders of incidence.

Table 1

	πρὸς πατέρα	νηφάλια	μητέρα	τὸν πόδα
Soph.	1st	2nd	3rd	4th
Eur. *Severior* & *Semiseverus*	1st	2nd	3rd	4th
Eur. *Liber*	1st	3rd	2nd	4th
Eur. *Liberrimus*	3rd	4th	1st	2nd
Trend	decreasing	decreasing	increasing	increasing

It will be seen that the two least common categories in Sophocles and the two earlier styles of Euripides have become the two most common categories in Euripides *Liberrimus*, and that Euripides *Liber* represents a transitional stage at which the dactyl-shaped word has progressed but the syntagm prepositive plus pyrrhic-shaped word is still constrained. This reversal in rank order will have to be accounted for in any integrated explanatory theory of resolution. Suffice it here to say that the difficulty noted above in grouping the two syllables of a pyrrhic-shaped word in a resolution matrix is evidently also characteristic of the final two syllables of a dactylic-shaped word. The transitional rank order in the *stilus liber* indicates that the presence of the appositive word boundary in the type τὸν πόδα is an additional complication.

4. *Lex de quinto pede*. The 5th *longum* is not resolved in the *severior* style (Zieliński reads ἀμβαλοῦ in *Alc.* 526); in later styles the 5th *longum* is infrequently resolved, and only (i) in a four-syllable word or appositive word group, and (ii) not after long third anceps; also (iii) neither of the two short vowels of the syllables implementing the resolution may be followed by *muta cum liquida*.

Each of three constraints requires special comment. The second constraint excludes "fifth-foot dactyls," but it is not needed in Euripides since in the 5th *longum* resolutions are always the first two syllables of the word (see law 8), so that long anceps is already

eliminated by Porson's bridge. In Aeschylus and Sophocles, however, the second constraint is non-vacuous, and the first constraint does not hold: for in these two authors about half of all occurrences of 1st paeon-shaped words are located so that their two final syllables implement resolved 5th *longum* (νη|ѕφάλια|). (It is significant that such a location of 1st paeon-shaped words is never found in Euripides, not even in the *stilus liberrimus*.)

Finally, the third constraint, against *muta cum liquida*, is completely unfounded. In all styles taken together, the proportion of line final 4th paeon-shaped words (the vast majority of words in resolved 5th *longum* are 4th paeon-shaped words) having *muta cum liquida* in one of the two proscribed positions is 6.67%; the proportion for all 4th paeon-shaped words in Euripides located outside resolved 5th *longum* is 5.1%: thus, it is clearly not the case that *muta cum liquida* is avoided more in resolved 5th *longum* than elsewhere (in fact, as we shall argue under law 9, it is never demonstrably the object of active avoidance by the poet in any word-shape in any location).

5. *Lex de quarto pede*. The 4th *longum* is not resolved before a long third anceps, whether there is an (appositive) word boundary after the resolution or not. This constraint is relaxed in later styles.

Most of the data are given by Zieliński in his discussions.[11] The theoretically significant points emerge much more clearly and directly in a formulation based on the relevant word-shapes, to which we must add a comparison with the distribution of those word-shapes in resolved 2nd *longum*.

(a) In resolved 4th *longum* in the two stricter styles of Euripides (as also in Aeschylus and Sophocles) there is, on the average, about one word of the shape ionic *a minore* for every ten 4th paeon-shaped words. But by the time we get to Euripides *Liberrimus*, the two word-shapes are equally common. This trend through time proves a constraint against the ionic type in the earlier styles.

(b) The structure pyrrhic-shaped appositive plus spondee-shaped headword (syntagmatic ionic *a minore*) is completely excluded in Euripides, *stilus severior*, as it is in Aeschylus and Sophocles. This constraint is progressively relaxed, but never so far as to approach the normal frequency of word initial long anceps after unresolved 4th *longum* (which is approximately 50%). The ratio of syntagmatic ionic *a minore* to syntagmatic 4th paeon-shaped word is in all styles even

[11] Zieliński (above, note 1) 172–75; 192–93.

smaller than the ratio of simple ionic *a minore* words to simple 4th paeon-shaped words. This effect seems to derive from a *compounding* of the difficulties of the word-shape ionic *a minore* with the difficulties of the appositive boundary (cf. above on the syntagm τὸν πόδα in line initial position), resulting in a structure that is even more objectionable than it would be on a simple linear combination of the two constraints.

(c) In resolved 2nd *longum*, words of the shape ionic *a minore* and 4th paeon are both much rarer than in resolved 4th *longum*, but here, by contrast, it is the ionic type that is relatively more frequent. The contradiction is only apparent. The ionic is the inherently more difficult shape, hence the ratios in the 4th *longum*. Both shapes are avoided in the 2nd *longum*, but the paeon is easier to place elsewhere and for this simple reason finds its way into resolved 2nd *longum* less frequently than the ionic *a minore*.

6. *Lex de secundo pede*. When the 2nd *longum* is resolved, the second anceps is preferably long. This requirement is actually intensified in the *stilus liberrimus*.[12]

This law is an example of one of the prime fallacies in Greek metrics, the automatic assumption that what is more frequent must be actively preferred by the poet (whereas, in fact, numerical superiority can result from any number of often interacting metrical, linguistic and compositional factors). It is immediately suspicious on various counts. In the first place in a stratified sample of *severior* palys we found that the frequency of long second anceps after unresolved 2nd *longum* before penthemimeral caesura was 75% (sample size N = 320): but the percentage of long anceps after resolved 2nd *longum* in all tribrach- and anapaest-shaped words excluding proper names in the *stilus severior* is also 75% (N = 20). This comparison hardly establishes a *prima facie* case for the law. Or again, the ratio of anapaest- to tribrach-shaped word in prose[13] is approximately the same as the ratio of anapaest- to tribrach-shaped word in resolved 2nd *longum* in Euripides as a whole (about two to one). However, when we realize that the *overall* ratio of anapaest- to tribrach-shaped word (i.e., in all locations) is the reverse of prose and ranges from

[12] A second clause in this law emphasizes the very high correlation of penthemimeral caesura with resolved second *longum*.

[13] Calculated on the basis of figures from a small sample from Plato given by B. Newton, "Metre and Stress in Greek," *Phoenix* 23 (1967) 369.

1 : 3 in the *stilus severior* to 1 : 2 in the *stilus liberrimus*, we can appreciate that the simple ratios on which Zieliński based his 6th law can only be the result of a complex of interacting factors involving the two word-shapes and the various constraints on their different possible locations.

Table 2 displays how the percentages of long and short anceps after resolution are the result of the per thousand line frequencies of the main contributing word-shapes (proper names excluded).

Table 2

	⏑⏑|$_3$–	⏑⏑ – overall	⏑⏑|$_3$⏑	⏑⏑⏑ overall	⏑⏑|$_3$–
Severior	3.375	7.42	1.125	25.00	75.00
Semiseverus	6.399	15.99	5.688	51.9	52.94
Liber	12.876	27.24	6.235	64.78	67.38
Liberrimus	17.782	35.569	9.414	68.34	65.38

The figures in the first four columns represent the frequencies per thousand lines of the word-shape in question in the 2nd *longum* and overall; the last column gives the percentage of anapaest-shaped words out of the total of anapaest- + tribrach-shaped words in resolved 2nd *longum*.

The reader will note that both overall and in the 2nd *longum* both word-shapes increase exponentially through time;[14] the tribrach-shaped word, although less frequent in prose, begins at a higher rate and increases less rapidly than the anapaest-shaped word. In resolved 2nd *longum*, as compared with Aeschylus who admits practically no resolution in this location, Euripides' *stilus severior* admits the anapaest-shaped word but still tends to exclude the tribrach-shaped word. This difference need not be interpreted as evidence that the anapaest-shaped word made a better resolution of the 2nd *longum* (either phonologically or in the sense of contributing more "gravitas" [so Zieliński]); rather it seems merely the result of there being fewer alternative locations for the anapaest-shaped word than for the tribrach-shaped word. Thus the simplest explanation rests on the common-sense compositional principle that, *ceteris paribus*, the relaxation of locational constraints on resolution is sensitive to the availability of alternative locations.

[14] For this reason the remarks of A. M. Dale, *Euripides: Helen* (Oxford 1967) xxv–xxvii, are without value. Since all word-shapes in resolution increase through time, and the proportion occupying the second *longum* also steadily increases through time, only comparative evaluation can establish that increase in frequency is evidence for preference for any particular word-shape in any particular location.

At the next stage, the *stilus semiseverus*, the overall incidence of both shapes doubles; but in resolved 2nd *longum*, while the anapaest-shaped word doubles, the tribrach-shaped word quadruples. The substantive interpretation of these growth figures is that the locational constraint has now been relaxed for the tribrach-shaped word too.[15] In the later styles we find both a general increase in the incidence of the two word-shapes and a further relaxation of the locational constraint against resolution of the 2nd *longum*. In the *stilus liber* in resolved 2nd *longum* tribrach-shaped words grow at a slightly higher rate than overall, thus accounting for the 15% difference in the resulting percentage of long anceps. Finally, in the *stilus liberrimus*, both shapes grow faster in resolved 2nd *longum* than overall, but the difference is much more marked in the case of the tribrach-shaped word. Thus we can recognize two cycles of the same growth pattern: the locational constraints limiting resolution in resolved 2nd *longum* are relaxed first for the anapaest-shaped word and in the subsequent style for the tribrach-shaped word, and the difference is both times explained by the above invoked compositional principle.

The 6th law thus rests on two methodological shortcomings. Zieliński implicitly assumed that, if it were not directly sensitive to resolution, the ratio of long to short anceps would be fifty-fifty, whereas in fact the assumption of equal distribution under such conditions is unwarranted since the distribution will still reflect pre-existing conditions of language and its use in meter, such as prose frequency of the relevant word-shapes, available metrical locations, and changing levels of constraint on their use in verse. Secondly, Zieliński presented the data in terms of a single dimension, namely the ratio of long to short anceps, which led him to look for a single explanatory property ("gravitas"). But, as we have seen, this ratio is simply an artifact of the truly autonomous and independently constrained growth patterns of the tribrach- and anapaest-shaped word.

7. *Lex de tertio pede*. When the 3rd *longum* is resolved, the preceding anceps is preferentially long.[16]

The 7th law proceeds from the same prime fallacy as the 6th law: it rests on the implicit assumption that a distribution of long and short

[15] Sophocles, somewhat idiosyncratically, allows both tribrach-shaped and anapaest-shaped words in resolved second *longum*, while at the same time retaining a relatively high incidence of both shapes in line initial position.

[16] A second clause in this law emphasizes the very high correlation of penthemimeral caesura with resolved third *longum*.

anceps in a ratio other than fifty-fifty can only signify that the incidence of long and short anceps is directly sensitive to the presence of resolution. In all styles except the *severior* the incidence of short anceps before resolved 3rd *longum* ranges from 25.7–26.8%. It is easy to see how this relatively low incidence could have suggested the 7th law to Zieliński, given the above false premise. However, direct sensitivity to resolution cannot be established simply by reference to an abstract standard of equidistribution, but only by comparison with the distribution when resolution is absent. In a sample (N = 314) from the *stilus liberrimus*, we found that of all ancipitia preceding penthemimeral caesura with *un*resolved 3rd *longum*, 24.9% only were light. It is immediately evident that there is no significant difference between the frequency of short second anceps before resolved and unresolved 3rd *longum* in lines with penthemimeral caesura. Whatever the reasons for the higher incidence of long anceps, resolution cannot be one of them, and the 7th law is vacuous.

The situation in the *stilus severior* is slightly more complicated. Here the proportion of short ancipitia before resolution is only 20%, whereas without a following resolution the 25% proportion still obtains (based on a sample N = 320). The significance of this difference is not established by our small unresolved sample; but, as the proportion for the *liberrimus* sample indicates, the ancipitia rates before unresolved 3rd *longum* are pretty stable and it is likely that the 5% difference would, with a considerably larger unresolved sample, turn out to be statistically significant. It is our contention that this tendency to lower frequency of short 2nd anceps before resolution in the *stilus severior* is in fact a wholly automatic reflex phenomenon, having nothing to do with any striving for "gravitas" (or for durational balance) on the part of the poet. The lower frequency correlates with a peculiarity of the phonological structure of tribrach- and 4th paeon-shaped words in the *severior* style: these word-shapes begin with consonants considerably more frequently than the unresolved word-shapes that occur after the penthemimeral caesura. Let us examine these word-shapes in locations other than the post-caesural location in question. Of all the tribrach-shaped words in the *stilus severior*, excluding those after the penthemimeral caesura and the lexical item πότερον,[17] fully 85% begin with consonants. Of all 4th

[17] πότερον was excluded in order to eliminate any bias from this high frequency grammar word: see Devine and Stephens, "Tribrach-shaped Words in the Tragic Trimeter," forthcoming in *Phoenix*.

paeon-shaped words in the *stilus severior*, excluding those after the penthemimeral caesura, fully 84.21% begin with consonants. (These astonishing figures are not repeated in later styles, and are due to the restriction of resolution to core vocabulary in the *stilus severior*). On the other hand, of all unresolved shapes located after the penthemimeral caesura, only *c.* 65% begin with consonants. We would therefore expect to find a greater incidence of positional lengthening of second anceps before resolved 3rd *longum* than before unresolved 3rd *longum*, as a simple reflex of the higher incidence of initial consonants in the resolved word shapes. In fact, 9.37% of the ancipitia before unresolved 3rd *longum* are implemented by -V̆C# without positional lengthening as compared with only 5.3% before resolved 3rd *longum*: a difference which *ceteris paribus* accounts for nearly all of the 5% reduction in the frequency of short ancipitia that is the basis for the 7th law in the *stilus severior*.

8. *Lex de solutione initiali*. Except at the beginning of the line, the syllables implementing a resolution tend to be the first two syllables of a word. This constraint is somewhat relaxed in later styles.

The consistency with which in all styles a tribrach-shaped word is preponderantly located in a trochaic slot rather than in an iambic slot is striking and has been emphasized by Irigoin.[18] However, for the tribrach-shaped word it is difficult to find an unambiguous test location, in which factors other than the 8th law can be ruled out with absolute confidence. A clearly unassailable demonstration of the validity of the principle of initiality invoked by Zieliński is afforded by the 4th paeon-shaped word. This word-shape is not allowed in resolved 2nd *longum* in the two earlier styles; it begins to appear so located in the *stilus liber* and by the time of the *stilus liberrimus* over 20% of all 4th paeon-shaped words occupy this position. The only factor, it seems to us, that could explain this is a requirement in the earlier styles that in the 4th paeon-shaped word, resolution be implemented by the initial syllables of the word, a requirement that is progressively relaxed.

However, there are a couple of seemingly isolated but crucial details that cast suspicion on a formulation of the 8th law in terms of word initial position. We shall argue that (as in practice already recognized

[18] Irigoin (above, note 6) 70 ff. uses the term "coupe" for the requirement of the eighth law. He presents the data in terms of the correlation between word boundary and resolution rather than in terms of the different word-shapes.

by Sidney Allen) word initial position is not the directly motivating factor but merely one of several environments in which we may identify the operation of a more far-reaching principle of phonological organization. There are three instances (all in Sophocles) of a tribrach-shaped word ending with resolved 5th *longum*. In all three cases a heavy prepositive monosyllable precedes,[19] so that there results a larger unitary word-group: it is hard to see how a violation of the requirement of the 8th law that resolution start with a word initial syllable can be remedied by the prefixing of yet another syllable, thus further removing the resolution syllables from the environment required. Moreover, the 8th law is unable to account in any way for the fact that in Aeschylus 1st paeon-shaped words are without exception located so that the *last* two syllables implement the resolution (-⏑⏑); Aeschylus evidently had a rule additional to the 8th law which contrasts with that of Euripides who preferentially organized 1st paeon-shaped words as -⏑⏑ . It is clear that only a dynamic theory founded on the syllable structure of the entire word can provide a general explanatory basis for the complete data.

9. *Lex de positione debili*. *Muta cum liquida* may not follow either of the vowels of the syllables implementing a resolution. This constraint is progressively relaxed until the *stilus liber*. In so far as exceptions occur, they preferentially involve the structure *tenuis* or *tenuis aspirata* + *r*.

As with some of the earlier rules, Zieliński has based his 9th law on a subjective and *a priori* standard of rarity: in resolution *positio debilis* is rare in absolute terms and what is rare is, Zieliński implies, actively avoided by the poet. The only meaningful procedure, of course, is to compare the incidence of *positio debilis* in resolution with its incidence in ordinary *brevia* (i.e., outside resolution). A comparative test that controls for all possible confounding effects would have to take into account not only the prose text frequency of *muta cum liquida* in all word-shapes that can be used to produce resolutions on the one hand

[19] *O.T.* 719 is emended by some, and in *O.T.* 1496 the preceding monosyllable is unavoidable given the hephthemimeral caesura, but as Elmsley saw, the examples corroborate each other. A monosyllabic prepositive also always precedes a tribrach-shaped word ending with resolved fourth *longum* (with the single exception of the *adnominatio* χάριν ἄχαριν *I.T.* 566), but in this case the high incidence of preceding prepositives could be merely a reflex of the comparative rarity of lexical monosyllables (combined, of course, with the caesura requirement). This fact seems to have been overlooked by Sidney Allen (above, note 7) 326.

and ordinary *brevia* on the other, but also the relative facility with which each relevant word shape could be located with the heavy syllabic variant. The second factor, in particular, would be almost impossible to quantify with any degree of certainty. Thus there are good grounds for making do with the simpler comparative test[20] that directly compares the incidence of *positio debilis* in resolution with its incidence elsewhere. This test involves the assumption that, when all the relevant word-shapes are combined into two major categories, the overall effect of the complicating individual word-shape factors will be random and not skew the figures in opposite directions.

The results of this simple test are presented in table 3. The figures represent the percentage of vowels in *positio debilis* out of all vowels in resolution and out of all ordinary *brevia* respectively, based on Zieliński's counts, except that the frequency for the *stilus severior* is higher than that given by Zieliński, who (followed by Snell[21] and Irigoin[22]) omits 4 instances.[23]

Table 3

	Resolution	*Elsewhere*
Severior	1.99	2.53
Semiseverus	2.65	2.89
Liber	3.41	3.35
Liberrimus	2.60	2.51

It is clear from table 3 that the incidence of *positio debilis* in resolution is to all intents and purposes identical with its incidence outside resolution.[24] Even in the *stilus severior*, where the difference is somewhat larger, it is not statistically significant ($\chi^2 = 0.620$). Thus, for resolution in general the 9th law is counterfactual for all styles. However, it is revealing that the slightly larger (if statistically non-significant) difference in the *stilus severior* arises from a real

[20] As presented in an earlier discussion of the law by L. Stephens, "The Myth of the *Lex de Positione Debili* and a Fundamental Question in Metrical Theory," *Phoenix* 29 (1975) 171–80.

[21] B. Snell, *Griechische Metrik* (Goettingen 1962³) 11, 13.

[22] Irigoin (above, note 6) 75.

[23] *Heracl.* 211 θυγατρός, *Med.* 481 πολυπλόκοις, *Alc.* 641 διαπρέπεις, *Alc.* 687 πολυπλέθρους.

[24] Euripides' use of *correptio attica*, in both resolutions and *brevia*, together and separately, varies significantly from style to style. This represents an encroachment of the Attic dialect upon the *Dichtersprache* and then a slight reversal of this tendency in the *stilus liberrimus*.

difference in one word-shape, namely the tribrach-shaped word. In the *stilus severior*, the incidence of *positio debilis* in the resolved syllables of tribrach-shaped words is 1.35%, whereas in later styles it is far greater: *stilus semiseverus* 5.17%, *stilus liber* 6.07%, *stilus liberrimus* 4.08%. In this single word-shape in this single style, the 9th law *does* apply, and the explanatory principle invoked by Zieliński, based on compositional strategy, is clearly correct: resolution is easier to avoid when there is an alternative scansion for the word-shape: "sequitur propter voces, quae etiam in insolutum versum recipi possint, solvi arsin non oportere."[25] It is unfortunate that most later scholars[26] have disregarded Zieliński's explanation and sought to use the 9th law as a justification for ascribing metrical relevance to their own phonological hypotheses. The restriction of the 9th law to one word-shape in one style clearly points to some kind of compositional strategy rather than to a broad phonological principle. *Muta cum liquida* is not avoided in resolution in this word-shape in the *stilus severior*: it is used to avoid resolution.

The second claim of the 9th law (taken up recently by Sidney Allen[27]) is that among those instances of *positio debilis* that do occur, the structure voiceless stop + *r* is less objectionable. However, voiceless stop + *r* is simply the most frequent class of medial clusters in the Greek language (as it is in Latin). (It is probably true that *r* is "liquidarum liquidissima," as Zieliński says, and this may contribute to the high linguistic frequency of these clusters; but that of course is irrelevant for the meter.) There can be, therefore, no question of a metrical "restriction" or "desire to ensure" minimal duration: we have simply an immediate, automatic result of the obvious fact that Greek verses were written in the Greek language. Only if such clusters were not by far the most frequent in the language might there be an indication of some metrical restriction.

10. *Lex de polysyllabis*. Resolution is avoided in words of less than three syllables.

[25] For instance, δάκρυα is quite frequent in resolution in later styles, but never occurs in the *severior*, where, however, other case forms of this word with heterosyllabic *muta cum liquida* (i.e., cretic-shaped) are not uncommon.

[26] For example, L. Parker, "Greek metric 1957–1970," *Lustrum* 15 (1971) 68–69; M. West, "A new approach to Greek prosody," *Glotta* 48 (1970) 186–87; B. Snell (above, note 21); Irigoin (above, note 6) 75; G.-P. Ancher, "Coupe morphologique et coupe syllabique en attique," *RPh* 52 (1978) 66–86.

[27] Allen (above, note 7) 317, 331.

This rule is probably not formulated in terms of its directly motivating properties. It amounts to a combination of the split resolution rule as it applies to monosyllables and elided disyllables with a particular constraint against pyrrhic-shaped words in resolution. However, this latter constraint could also be interpreted as part of a more general constraint affecting other (longer) word-shapes also, such as the dactyl-shaped word (as compared with tribrach-shaped word) and the proceleusmatic-shaped word (as compared with the 4th paeon-shaped word). This generality is not captured by the alternative approach, which has to invoke disparate metrical factors. One attempt to reformulate the 10th law in terms of a more general principle is Irigoin's zeugma rule,[28] that the syllables implementing a resolution should not be the two final syllables of a word. This seems to us still not entirely satisfactory. In Aeschylus 1st paeon-shaped words are without exception located in such a way as to violate the zeugma rule (- ⏑ ⏑̄): zeugma cannot be a basic law of resolution if, under conditions that present a free choice, it is violated 100% in one particular word-shape in one author. Rather, in our view, each word-shape has its own particular properties of phonological organization, which govern its distribution in resolution.

Zieliński's explanation of the comparative rarity of pyrrhic-shaped words in resolution in the stricter styles is that it is a result of the fact that they could also be located without resolution (line finally and as iambs with positional lengthening). In our view (and presumably in that of Irigoin) this explanation can only be a partial explanation; an additional factor of a phonological order is also required, as will be clear from the following consideration. Lexical[29] pyrrhic-shaped words (unlike other word-shapes) are, even in the *stilus liberrimus*, excluded from resolved 2nd, 4th and 5th *longum*; this extremely strict *locational* constraint, which significantly does not apply to appositive pyrrhic-shaped words, cannot be explained simply on the basis of avoidability: if avoidability were the only factor, those lexical pyrrhic-shaped words that were allowed to stand in resolution would hardly be excluded from most locations in the line. That this locational constraint does not apply to appositives is not merely a reflex of the incidence of anastrophe, but indicates, as has long been realized, that there is some phonological difference between two lexical words and appositive plus headword.

[28] Irigoin (above, note 6) 71 ff.

[29] By "lexical" we mean nouns, adjectives, and non-appositive adverbs and verbs.

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It is difficult to give an even-handed evaluation of the Zielińskian canon. It represents a combination of the extraordinarily insightful with the quite valueless and almost naive. About half of the canon must in our opinion be discarded outright as at the best vacuous and at the worst gravely misleading. This does not result so much from the absence of particular mathematical-statistical procedures such as the $\chi 2$-test, Poisson distribution, regression analysis, etc.; useful as such devices unarguably are, they remain merely technical adjuncts in statistical metrics. At a far more basic level, it must be realized that raw statistical data are always by definition meaningless, and that the first step in the interpretation of raw statistical data is to find out whether it requires any new factor for its explanation or can simply be interpreted as the result of what we already know. An awareness of the need for a null hypothesis is thus the logical prerequisite to statistical metrics, and it is just this crucial point that Zieliński has failed to appreciate adequately. Nevertheless, the regrettable methodological shortcomings cannot obscure the fact that it is to Zieliński, above all others, that we owe the basic conception of the overall framework within which resolution can most effectively be studied.