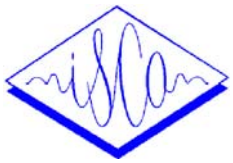
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An Acoustic-Analytic Role for the Deviation Between the Scansion and Reading of Poems

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Abstract

This research aimed 1) to compare the results of scansion with those of an acoustic analysis, 2) to classify the problematic feet of cadence, which is identical to the foot types in casual speech, and 3) to clarify the relation of scansion to acoustic analyses. Additionally, it tried to establish the necessity and clarify what benefits of acoustic analyses will provide readers of poems with problematic scansions. For the research, lines were sporadically chosen from by 12 poets and readings of their own poems in the tape titled, *THE POET SPEAKS*. All seemingly problematic mismatches between the results of scansion and acoustic scalar values were analyzed and discussed. Among suprasegmentals and acoustic scalar values of stress intensity, foot duration, and pitch height, the first values proved to be the best guide and play a greater role in scansion and reading poems.

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1. Opening

Scansion before reading poems is indispensable to reading and appreciating poetry; however, cadences in the fixed meter, or various types of feet in spoken language in famous poems, exasperate readers and teachers as well over scansion about the feet in lines of casual speech type. For the clarification of cadences, the present research aims to analyze acoustically poet reading of their own works, disclose distinct acoustic factors, and ascertain how their acoustic scalar values provide more credential aids to readers' scansion and to the reading of poems in the fixed meter.

The theoretical theories applied to scansion here are based on metrical, prosodic, and phonological studies by P. Kiparsky (1977), Kiparsky & Youmans (1989), Nespor & Vogel (1986), D. Attridge (1982), E. Selkirk (1984), B. Hayes (1983, 1989), and on post-lexical phonology and studies on causal speech by E. M. Kaisse (1985) and L. Shockey (2003). Furthermore, the program <wave> and <praat> were used for measuring scalar values such as duration, energy, and frequency of peaks in the strong positions of lines in fixed meter.

Lines which seem to embody problematic feet at first glance were sporadically chosen from 13 poems by 12 poets and read by poets, themselves. Poets analyzed here are as follows: T.S. Eliot (1888-1965), W.H. Auden (1907-1973), J. Betjeman (1906-1984), R. Graves (1895-1985), S. H. Spender, H. Read (1893-1968), P.E. Thomas (1878-1917), P. A Larkin(1922-1985), H. MacDiamid (1892-1978), F. L. MacNeice (1907-1963), F. L. Macneice (1927-), T. W. Gunn (1929-), and S. Plath (1931-). All data and detail explanations are not given here on account of limited space, and further only Eliot's lines are presented here.

2. Metrical Scansion and Acoustic Analysis

2.1. Metrical Scansion

The duple rhythm foot types for basic and regular patterns are /ws/ for iambus and /sw/ for trochee; however, the changed patterns for iambus are /wSs/(s: stressed but weakened as extrameter; ex. 'the small-pox'), /wsw/('arrival', 'the river', 'I love you'), and the inverted pattern /sw/ appeared line-initially and hemistich-initially. In iambic stanza these inverted feet are irregular, together with the emphatic or rhythmically adjusted feet. Types of /wsw/, /wsww/, /wwsw/, /wwsww/, /sww/, /wws/ found in the data could all be resolved or incoperated a in strong or weak position. The triple is /wws/ or /sww/. 53 feet among 288 were classified as triple. Regular and strict forms of stress patterns took the larger portion; however, a small part of variety in this rhythm is found in /swSw/, /wsSw/, /wwsw/, and so on. The last /w/ of every variety is an extra-meter. Extra-meters are found, especially hemistich-finally or line-finally.(These inversions have been regarded as natural rhythm just as they are in spoken language.) Therefore, this type of inversion is not eccentric and as such was not included as deviated feet. Beat of rhythm in the fixed meter matters little for this study, however the array of types of inverted metrical patterns, compared with those of metrical scansion, is of great significance. A. /sww/, b. /wws/, c. /sws/, d. /sss/, and e. /wss/ are classified as regular pattern /wws/, which are naturally /w/ or /s/ inverted into /w/ before the /s/ in strong position. Therefore, strong positions are always stronger relatively to pre-positioned /w/ or /s/. As a result, the variety of anapest is a. wwsw, b. swsw, c. sssw, d. wssw. Moreover, there are no stanzas of dactyl.

This classification by metrical scansion results in problematic foot types with iambic and anapestic feet mixed: Stanza 1 of T. S. Eliot's Gus, Stanza 1, The More One of W. H. Auden, J. Betjeman's 1st stanza in Late Flowering Lust, Stanza 1 of

Graves's The Devil's Advice to Storytellers. Stanza 3 of Spender's Seascape, Stanza 2 of H. Read's To a Conscript of 1940, and Stanza 8. Stanza 3 of E. Thomas's Adlestrop, Stanza 2, and 6 of P. Larkin's The Explosion, Stanza 2, and 6 of H. MacDiarmid's O' Wha's the Bride? Stanza 3 of L. Macneice's Carricfergus, and Stanza 4 and 6 of his Prayer Before Birth, Stanza 1 of T. Gunn's Innocence, Stanza 1 of S. Plath's Daddy.
The result of scansion of 67 lines are as follows:

	Rhythm Adjustment									Inversion				Extrameter	
Div	Du	Tr	P	D	S-B		P R			L-i	H-i	Em	MR	L-m	L-i
					Li	Hi	R	W	p						
Sm	235	53	38	37	1	7	3	1	1	16	9	12	5	9	8

<Table 1. Problematic Feet on Metrical Scansion>
Sm: sum, Du: Duple, Tr: Triple, P: Promotion, D: Demotion, Li: Line-initial, Hi-: Hemistic-initial, Em: Empahtic, MR: poet's Cadence, PR: Prosodic Rule applied, L-m: within Line

2.2. Acoustic Analysis and Problematic Lines

Every syllable in 67 lines from the 12 poets' reading of their own works are measured through 'wave' in order to discover the correspondence and deviance between theoretical scansion and acoustic measurement. Do the measured scalar values of syllables show foot division or scansion? Does the theoretical scansion play a compass that grasps the rhythm of fixed meter? Does any one supra-segmental scalar value show scansion itself? The figure shows the match and mismatch of stress intensity, foot duration, and peak frequency of every syllable. Mark 'O' indicates match between suprasegmental scalar values and foot division by scansion and 'X' stands for mismatches between the two. The more O's of any supra-segmental scar value, the more correspondence between value and scansion. What does the scalar value of peak in every foot in T. S. Eliot reveal? The statistical credibility of measurement is the mean value, for every poet recites, reads, and repeatedly eurythmizes his own poem before it ever sees the light of day.
Thin and ***makes*** in his three lines of Table 2, are all in strong position of the 3rd foot of the line and in scansion are regarded as stronger such content words, comparatively with italicized words as ***that*** and ***his*** in the weak position. However, these bold-typed words show mismatch with the scansion. The scalar values of the strong position points out the intensity of the peak, foot duration, and pitch height. The scalar value of dB, or the energy of the foot peak agrees with the scansion in 9 among 12 feet, while that of ms agrees, in 8 among 12, and that of Hz in just 5 among 12. The following table shows the measurement of Line 5, 6 of Gus by Eliot..

Syl	4	5	6	7	8	9	10	11	12
L 5	Ver-	y	Shab-	by	he's	**thin**	As	a	rake
Msc	66.2	122.4	306.1	463.5	721.5	249.2	153.0	104.9	531.8
DB	78.7	78.4	80.5	78.7	79.0	78.8	79.9	76.9	81.9
Hz	153.3	177.0	128.6	105.3	110.7	111.3	131.6	161.8	149.4
L 6	from	pal-	-sy	***that***	**makes**	***his***	Paw	shake	
Msc	424.7	446.0	284.6	140.2	352.5	212.4	412.0	686.5	
DB	76.3	80.1	77.3	77.6	76.6	73.4	74.0	78.7	
Hz	154.4	134.4	96.4	144.0	108.5	130.3	98.1	140.1	

<Table 2. Scalar Values of Peaks of Syllables in Eliot's L 5-6>

3. What Acoustic Analysis Provides

3.1. Strong Positions and Metrical Hierarchy

Statistics do not always show strong positions with stressed syllables to be higher in the scalar value. In 'To pronounce that **we usually call him Gus**' of Figure 3 below, two words 'usually' and 'Gus' are focused in the poetic meaning. This line is composed of 4 feet by scansion, resulting in anapestic tetrameter with the foot type of typical anapestic tetrameter like /wws/ wws/ wws/ wws/. And we can divide this line in to four feet: To pronounce/ that we u-/ sually call / him just Gus//. No one will deny for this line we had better assign stronger stresses to –nounce, u-, call, and Gus. However, we find in the third foot the weak position –ly carries stronger than the strong position of call. Why? The former gets 78.5dB, while call only 76.0 dB. This is the very point of the necessity of acoustic analysis of reading poems.
First, power representing energy, when uttering, is down-drifted, as is well known; likewise, the scalar value of dB is also decreasing. Therefore, at the 2nd foot or focused foot, a greater force or energy is ahead on '-u-' and stretches the energy into -sually', in addition '-y' is a tense vowel. Moreover, the location of the next stressed-syllable in the strong foot is placed in the weak foot position, according to the Metrical Hierarchy. However, through restructuring, the 3rd foot is attached to the second, focused foot. The intensity of the second foot appears to have 80.0 dB, an increase from the former weak position at 72.8 dB. This suggests that F2, the 2nd foot is focused in its meaning and hence, intensity increases to the resolved two syllables, -u-al-, which are amalgamated into one by the Prosodic Rule and still increases to the tense vowel '-ly', however, at 'call', the intensity decreases from 7.5 dB to 7.6 dB, just as though there were no stress on 'call'. The 3rd foot attached here, in either way, is weakened and becomes weakest as shown below:

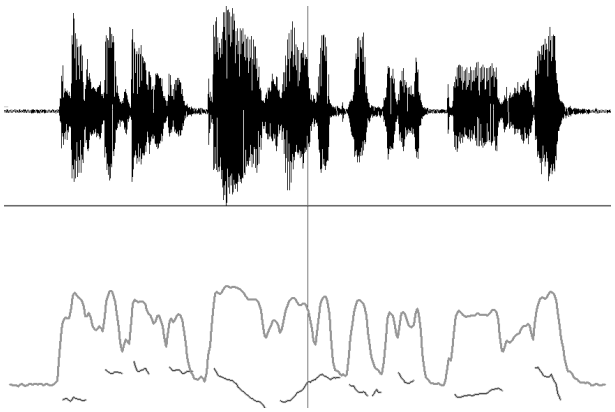
```
                                    X     : NSR applied
     x                              x
     x                  x           x
     2                  3           1     : degree of intensity
We  u-   su-  al-ly    call  him  just Gus
     F2                 F3          F4    : Foot
76.8 80.0 72.8 77.8  78.5 76.0     . . .       : intensity (dB)

     x                                      : restructured
     x                                 x
     x                  x              x
     2                  3              1  :
We  u-   su-  al-ly    call  him  just  Gus
     F2                 F3          F4  : Foot
```

<Figure 1. Grid Movement for Restructuring of "To pronounce that we usually call him just Gus"

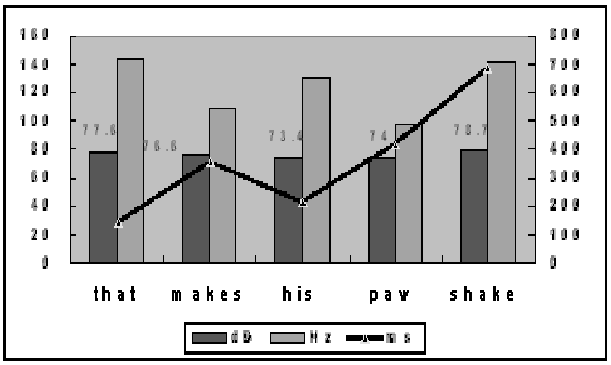
On a Metrical Hierarchy, the 3rd foot is in the weak foot position; however, the focused foot, or the 2nd foot, adds the 3rd foot to its weak partner when the line is restructured. The 3rd foot also becomes the weakest as the 4th foot remains strongest foot when the Nuclear Stress Rule is applied.
Similarly, in the 6th line of Gus, as shown at above Table 2, ***that*** carries 1.0 dB larger energy than ***makes*** of the strong position, though it is assigned lexically and post-lexically. Just as ***u-*** in ***usually*** in the 4th line as the focused foot did, 'pal-' in the 2nd foot and the focused foot in the 6th line played a radiator's role, the greater energy of which stretches to the next

and the next to the other focused foot with ***shake***. What is interesting in these cases, the influence stretching reaches to the last focused, strong position, **Gus** (Figure 1) and shake (Figure 2) line-finally. Why, then, do we not think or perceive that and his stronger than makes between them? The answer is likely to find in spectrogram of Figure 2 below. The strongest intensity tells that the peak of pal- diminishes to the space between paw and the other focused and the strongest peak, shake. And the little spaces between syllables in every foot needs analyzing, which suggests detail and micro pieces of rhythmic pieces.



And he suffersfrompal sy that makeshis paw shake
<Figure 1> Intensity and Duration of Strong position

In the 6th line, 'makes', does not identify itself as a stressed word. However, it not eccentric but rather natural in casual speech. The latter half of the line begins with 'that', therefore, that is given more energy. Over-relying on the stress of mono-syllabic content words makes one believe that 'makes' should be stressed stronger than 'that' as a clitic or function word. Such hemistich-initial inversion builds readers keenness by removing the tired flow of a monotonous rhythm. In this line, what is most noticeable is the 4th foot, which is composed of /wss/. However, the first /s/ does not play a role as the rising peak in the embedded part of the last foot. The poet suppresses it under the real strong peak 'shake', which sounds unnatural and awkward. To avoid this unnaturalness Eliot does not use a stronger energy even with 0.6 dB on the weak position, which produces a natural metrical type like /wws/.



<Figure 2: Down-drifted intensity
of seemingly deviated strong position>

As seen in Figure 2, peaks of two feet well disclose themselves as the highest peaks. What seems strange is that the foot 'his paw shake' increases in intensity from the first /w/ to the second /w/ until the last strongest /s/. This indicates Eliot sounds awkward because in the last foot of anapestic foot, the poet exercises a rising peak, while a falling peak would have sounded more natural and rhythmical.

To illustrate the mismatches, an 'X' is placed in the following table, while an 'O' is used for words or syllables matching with the previous word or syllable weaker, shorter, and lower in the weak position and stronger, longer, and lighter in the strong position. All X's in a foot indicate that scansion contains faults. According to the above measurement of the 3 lines, match and mismatch are seen for each factor of suprasegment of syllables and feet. An appropriate foot mark O means that the weak position shows smaller energy(dB) compared with the strong position, and that the weak position also has shorter duration (ms) compared with its counterpart. This is also true of the frequency of foot peak. The results of a confirmation is shown below:

Poet/Poem - Stanza/Line	Foot Match(O)/Mismatch(X) of Scalar Values of Peak, Duration, Height																	
	1			2			3			4			5			6		
	dB	ms	Hz	dB	ms	Hz	dB	ms	Hz	dB	ms	Hz	dB	ms	Hz	dB	ms	Hz
011-104	**O**	**O**	**O**	**O**	**O**	**x**	**x**	**x**	**x**	**O**	**O**	**O**						
5	**O**	**O**	**x**	**O**	**x**	**x**	**x**	**x**	**O**	**O**	**O**	**x**						
6	**O**	**O**	**O**	**O**	**x**	**x**	**x**	**O**	**x**	**O**	**O**	**O**						

<Table 3: Correspondence of Scansion
to Acoustic Measurement>

4. Acoustic Analysis Helpful to Scansion

4.1. Foot Formation by Stress Intensity

67 lines have 288 feet, each with 4 feet individually. Interestingly, each line has complete agreement in the intensity of peaks in the first, second, and fourth feet. These feet held previous weaker positions with lower intensity, compared with the peak of feet in strong positions. However, each third foot has disagreement of the strong position to its counterpart, the weaker position. A total of 42 mismatches of stress intensity in all produce flexibility for natural inversions as in line-initial (16) and hemistich-initial (9), emphatic (5), and contrastive (12).

4.2. Scansion by Durational Measurement

30 mismatches of duration in strong positions were found, however, 9 cases could be regarded as agreeable with the intensity of strong positions. Contrary to the very similar match of two factors, intensity and duration, of the strong positions, the scalar value measurement of the pitch height of the peak matches little with the scansion. The mismatch amounts to 72 feet. However, cubic analyses will probably indicate important clues for the rhythm. The measurement of intensity of stresses in feet will lead to correct scansion in proportion to 100.00%(00: 42/288), and that of duration, to 72.91% (21: 30/288), and to 13.54% (38: 72/288). Conclusively, stress intensity and its acoustic scalar value can be depended upon when performing scansion. Next to intensity of stress, we could depend upon feet duration.

For the 3rd foot of *Gus*: *The Theatre Cat*, there are four syllables: '-su', '-al', '-ly', and 'call'; the first and second weak

syllables are amalgamated into one. A student in phonology or in phonetics can easily find that when a prosodic rule is applied, the two convert into one. Statistics of the foot presents us the shortest duration of 77.6 ms for the –al. Likewise, in the 2nd line the number of feet can change from 5 to 4. The reason is simple, first, both the 2nd and 3rd line are in anapestic tetrameter; nevertheless, only the 2nd line consists of pentameter. The combination of mixed meters in the 2nd line of Gus among three general anapestic tetrameter is not natural; what is more unnatural is that the line, if in pentameter, is composed of /ws/, /sw/, /sw/, /ws/, and /wws/. The fact that the second and the feet are inverted, not /ws/ but /sw/, or in trochaic meter is very unnatural and unmetrical. Viewed from the general anapestic meter and 'left-looseness and right-strictness' principle in metrics, the thought of the second line as iambic or anapestic pentameter mixed with two metrical types is unreasonable.

The scalar values measured for the durational analysis of this line provides us a chance to solve this problem more naturally and reasonably. 'Very shabby' of two feet are very loose and above all, if each word were a foot, the first reads in 288.6 ms while the second in 769.6 ms almost three times longer than the first. To match the 1st and 3rd in anapest tetrameter, the 2nd and the 3rd into one foot, by incooperating 'very' as /ww/ and 'shabby' into /sw/, resulting in /wwsw/, the last /w/ of which is an extrameter. This foot took Eliot to read in 769.6 ms, the 3rd, 'he's thin' in 970.7 ms, and the last foot 'as a rake' in 789.7 ms. The three feet agree with each other in durational scalar value. Even though the first is very short, a silent beat, or a catalexis can be placed before 'His', which does not deviate greater when applying, 'Left-loseness and Right-strictness'.

The scalar value of the pitch height of the feet peak is not likely to result in a favorable compass for scansion. However, if one counts and measures the whole contour of the line, finds the focused points, and measures the cubic quantity of the pitch wave, one can probably rely upon the scalar value for scansion and understand the poetic meaning as the poet has truly suggested and painstakingly tried to conceive in his/her creation.

5. Closing

Scansion is not easy to do though with much knowledge of prosodic, metrical, and thythmic theoretical background. To readers' embarrasement, there are too many feet eccentric and strange with metrical patterns and meanings, implying that current poetry makes use of prosody and meters in casual speech . Therefore, even a simple poem of fixed meter is not easy for readers to scan for rhythmic reading and true meaning.

First of all, this research proved a variety of type changeable for iambic and trochaic foot 1) with one or two extra-meters (/ws w/, /ws ww/), 2) with rising or falling peak embed(/ws S/, /sw S/). Second, the results of acoustic analysis, especially the scalar value of stress intensity in the strong position of fixed meter can provide readers deviation from the regular and give the inverted feet which readers have difficulty finding. This study reveals the fact that scalar values of stronger positions, whether stress patterns are inverted or not, we can solve the seemingly disagreement of scan and explain results of acoustic analysis.

Idealistic scansion will imply the writer's intention and reflect a most favorable poetic rhythm. As language aspires to be musical, both scansion and reading provide speakers and readers with lessons on how to learn a language through music. Various lines in a fixed meter of current poetry, in fact, are full of cadence. Cadence attracts readers more than those in fixed lines as it is from casual speech. All feet in casual speech carry cadence full of prosodic and metrical phenomena. This research tried to illustrate how acoustic analysis can be of great help to scansion. The study suggests stress intensity and acoustic scalar value to be most contributable to scansion for mismatches when scansion encounters difficulty and when attempts are made to read poetry more rhythmically.

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