

TWO KINDS OF METRICAL SHIFTS IN ENGLISH TEXT-SETTING

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ABSTRACT

The way text (or lyrics) is assigned to musical notes (or tunes) partly depends on native speakers' intuition. Earlier studies on English text-setting, as it is called, used sung or chanted verses, and an algorithm or a set of constraints was proposed to explain the intuition. These attempts avoided vocal music because of its complexity and idiosyncrasy.

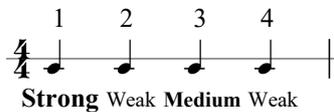
This study examined twenty pieces of English vocal music and tried to explain apparent exceptions to text-setting rules, which predict a well-formed matching of stressed syllables with musically strong beats. The results showed that most of the apparent exceptions are no longer exceptions if two kinds of metrical shifts are introduced into the framework; one is a leftward metrical shift proposed in the literature, and the other is a rightward metrical shift, which is dealt with in this work. This work also suggests the need to introduce the idea of intonation phrases into text-setting.

Keywords: English, stress, text-setting, intonation, vocal music.

1. INTRODUCTION

Text-setting is another term of text-to-tune mapping and is one aspect of speech-music interface. In Western music tradition, the following relationship holds for music with a time signature of 4/4 [8, 9]:

- Beat strength:
1st beat > 3rd beat > 2nd and 4th beats



The Syllabic Distribution Algorithm (SDA) [3] is a rule-based formalisation of the strong tendency of 'stress-to-beat' matching observed in English, which refers to a grid notation such as that depicted in Figure 1 [1, 2, 3, 5]. The grid notation is a linguistic parallel of a musical notation.

Figure 1: The grid notation used in text-setting.

whole note	ES:			x								x							
half notes	S:			x				x				x							x
quarter notes	M:	x		x		x		x		x		x		x		x		x	
eighth notes	W:	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
sixteenth notes	EW:																		

The rows of x depict a series of isochronic beats, and the columns indicate the strength of individual beats. 'ES', 'S', 'M', 'W', and 'EW' stand for extra strong, strong, medium, weak, and extra weak, respectively.

The SDA is summarised as follows [3]:

- Map stressed syllables one-to-one, left-to-right onto S (Strong) positions;
After each iteration:
 - Map stressless syllables one-to-one, right-to-left onto the highest grid level able to accommodate them.
- Once (a) and (b) have applied as many times as they can:
- Map any remaining stressless syllables one-to-one, left-to-right onto the highest grid level able to accommodate them.

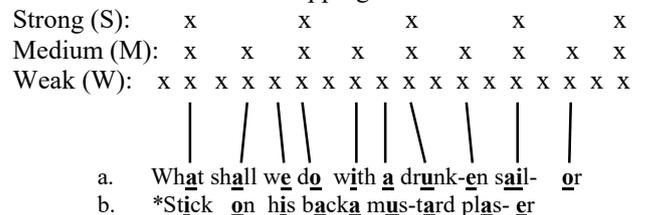
2. BACKGROUND

This section deals with earlier studies on text-setting.

2.1. How the SDA works: Chants

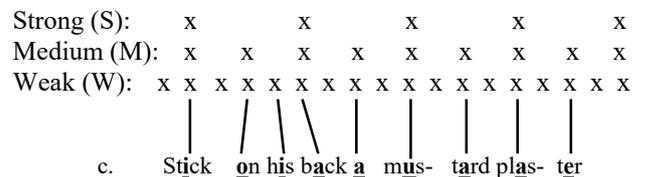
Figure 2 shows a frequently cited example of English text-setting: verses from 'What Shall We Do with a Drunken Sailor.' There are ten syllables in verse (a), and nine in verse (b). The solid lines indicate how syllables are mapped onto the grid. The way of mapping in (a) does not lead to well-formed mapping in (b) because of a different arrangement of stressed/stressless syllables in (a) and (b) [1, 2, 3]:

Figure 2: Grid notation and the two ways of text-tune mapping.



The SDA rightly predicts (c) in Figure 3.

Figure 3: Grid notation and a well-formed mapping.



(2)

Ju-pi-ter a-ligns with Mars

The curved line linking the two notes on which the lyric *with* is mapped is called a 'slur', and it 'links two different notes' [9]. At the same time, the three notes on which *-ter* in *Jupiter* is mapped in (2) are all the same pitch; this is called a 'tie' and 'joins two notes of the same pitch to produce one extended sound' [9]. Following the music literature, tied notes were treated as one long note in this work.

The 'stress-to-strong principle' does not deny matching of a stressless syllable to musically strong beat [2]. Accordingly, cases where stressed syllables in the lyrics failed to fall in musically strong positions were examined in this study. There were four types of possible situations where this could happen:

(3) Stressed syllables fail to fall on the strong beats.

That is,

- (i) Stressed syllables fail to fall on the first beat.
 - (ii) Stressed syllables fail to fall on the third beat.
- Stressed syllables fall on the weak beats. That is,
- (iii) Stressed syllables fall on the second beat.
 - (iv) Stressed syllables fall on the fourth beat.

4. RESULTS

Each bar (total = 554 bars) was examined to determine how stressed syllables are aligned with the above-mentioned four beat positions. As an example, the results of the examination of the first score are shown here:

Table 2: Results of text-setting in #1.

	Part of lyrics	(i)	(iii)	(ii)	(iv)
		Position of beat			
		First	Second	Third	Fourth
1	sev(enth)	✓			
2	house			✓	
3	Mars			✓	
4	stars	✓			
5	This		✓		
6	dawn(ing)	✓			
7	(under)stand(ing)	✓			
8	(a)bound(ing)	✓			
9	false(hoods)		✓		
10	(de)ri(sions)	✓			
11	dreams			✓	
12	(reve)la(tion)	✓			
13	mind's	✓			
14	true		✓		
15	(liber)a(tion)	✓			
16	sun(shine)	✓			
17	sun(shine)	✓			
18	sun(shine)	✓			
19	sun(shine)	✓			

There were 19 examples of misalignments in #1. Among them, 16 examples (Nos. 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 15, 16, 17, 18, and 19) were all preceded by the 8th note in either the first or the third beat positions (they are shadowed in Table 2). This is the leftward shift mentioned in 2.3. above. If two levels of structure, deep and surface, are postulated, they are no longer exceptions to 'the stress-to-strong principle'.

Discussion of the remaining three examples (Nos. 5, 9, and 14) and similar cases will be conducted in Section 5 below. The apparent exceptions to the SDA total 353. The breakdown is shown in Table 3:

Table 3: Apparent exceptions to the SDA.

	(i)	(iii)	(ii)	(iv)	Total
	Position of beat				
	First	Second	Third	Fourth	
1	13	3	3	0	19
2	14	6	2	1	23
3	9	1	2	9	21
4	9	3	11	6	29
5	11	4	9	1	25
6	0	4	3	4	11
7	1	0	16	0	17
8	1	0	5	0	6
9	2	13	8	1	24
10	1	2	0	10	13
11	4	6	9	4	23
12	0	5	1	6	12
13	3	0	0	2	5
14	0	8	4	4	16
15	10	1	2	4	17
16	2	4	4	3	13
17	16	0	5	3	24
18	5	8	5	7	25
19	0	1	0	1	2
20	3	16	7	2	28
Total	104	85	96	68	353

There were some cases where notes fell on 0.5 after either beat position (that is, 1.5, 2.5, 3.5, or 4.5 beat). To cite an example from #3, the lyric *hear* starts on 0.5 beat after the third, that is on 3.5 beat:

(4)

I hear the music

beat 1 2 3 4

Such examples were not included in the total.

Another example from #5 will make the criterion of my classification clear; the lyrics *mean* and *dance* boxed in (5) start on 0.5 beat after the 1st and 0.5 beat after the 4th, respectively. Accordingly, they start on 1.5 beat and 4.5 beat. Such examples were not included in the above count.



Among the 353 examples, 230 were preceded by an 8th or 16th note, as shown in Figure 4. The breakdown of the examples is as follows:

Table 4: The distribution of beat positions where notes are preceded by 8th or 16th notes.

	(i)	(iii)	(ii)	(iv)	Total
	Position of beat				
	First	Second	Third	Fourth	
1	13	0	3	0	16
2	14	0	2	0	16
3	9	0	2	0	11
4	9	1	11	2	23
5	11	3	9	0	23
6	0	1	3	1	5
7	1	0	16	0	17
8	1	0	5	0	6
9	2	1	8	0	11
10	1	0	0	0	1
11	4	0	9	2	15
12	0	2	1	6	9
13	3	0	0	0	3
14	0	4	4	4	12
15	10	0	2	0	12
16	2	1	4	0	7
17	16	0	5	0	21
18	5	0	5	1	11
19	0	0	0	0	0
20	3	1	7	0	11
Total	104	14	96	16	230

5. DISCUSSION AND CONCLUSIONS

The number of scores examined was twenty and that of beat positions was 1,718. The number of apparent exceptions to the SDA, or misalignment, was 486. Among them, 133 examples were of cases where a stressed syllable fell on 0.5 after either beat (see (4) and (5) above), and these were excluded from the count. Therefore, 353 (= 486–133) beat positions were the object of analysis. Among them, 230, that is 65.2%, were explained as a result of leftward metrical shift in a surface structure. The breakdown is shown in Table 5.

Table 5: The ratio of left metrical shift.

	(i)	(iii)	(ii)	(iv)	Total
	Position of beat				
	First	Second	Third	Fourth	
N	104	14	96	16	230
%	100	16.5	100	23.5	65.2

It is worth noting that 100% of the first and the third beat positions were explained by postulating two levels of metrical structure, and they are no longer

exceptions to the SDA. Furthermore, the notes were given an extra duration by preceding the 8th or 16th notes. The first and third beat positions were strong or medium strong, and this is a good reflection of one of the constraints in (1): STRONG IS LONG.

Another example of apparent exceptions to the SDA should be explained if the idea of intonation phrases is introduced in text-setting. For example, (6) is a prediction of the SDA. However, the actual score shows a mapping like (7). In a phrase consisting of an adjective + a noun (e.g. *silent tears*), a noun, which is the last content word in a phrase, usually receives more prominence than the preceding adjective, but this fact is not reflected in the SDA. When a noun is aligned with the first beat as in (7), the preceding adjective ‘silent’ is to be submitted to a weaker position than the noun.

(6) || silent tears || full of pride || (from # 3)

1 2 3 4 1 2 3 4

(where ‘||’ means a bar in a score)

(7) silent || tears full of || pride ...

4 1 2 3 4 1

The word that is a nucleus (*tears* in this case) appears in the strongest position, that is, immediately after a bar. This work calls such a shift a ‘rightward’ metrical shift. If the idea of intonation phrases is introduced into text-setting, 45 examples will no longer be exceptions to the SDA.

Table 6: Total number of examples of shifted mapping.

leftward metrical shift	230	65.2 %
rightward metrical shift	45	12.7 %
Total	275	77.9 %

The two kinds of metrical shifts explain 77.9% of the apparent exceptions to the SDA. Thus, the real number of exceptions amounts to 78 (= 353–275). Mapping of stressed syllables with the second and the fourth beats is not distributed evenly in the 20 pieces of vocal music examined. Some songs prefer this type of mapping, whereas others never use it. Further study will be needed to decide whether this can be attributed to ‘backbeat’, which emphasises beats two and four in some styles of music, especially in rock music [8].

6. ACKNOWLEDGMENTS

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