ON THE DERIVATION OF MUSIC FROM LANGUAGE

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Abstract

This paper describes techniques developed and employed by myself as composer during the past thirty-seven years to transform aspects of language into performable music. Classed under seven headings, they are: I. *Orthographic Metamorphosis*, where graphemes (units of written language) translated into pitches recreate language syntax in melodies and chords, II. *Phonetic Composition*, where phonemes (units of spoken language) are musically treated as timbral elements, III. *Electronic Transformation*, where the sounds of spoken language are filtered, transposed and/or otherwise acoustically altered, IV. "*Synthrumentation*", where an ensemble of acoustic instruments is employed for spectral speech synthesis, V. "*Spectastics*", where a rapid pitch-stream (or monodic tone-cloud) generates phonemic timbres, VI. "*Sound Wave Surfing*", where the sound wave in a speech recording is traversed forwards and backwards in time, and VII. *Semantic Composition*, where sounds of acoustic instruments form a vocabulary of words used with specific grammatical rules to generate performable sentences containing meaning.

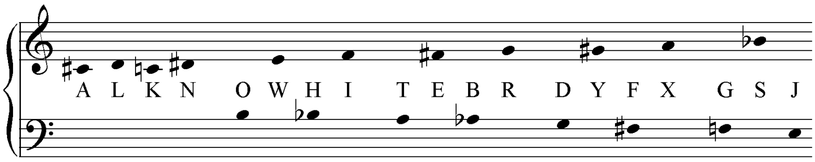
Keywords: acoustic, note, phonetic, semantic, spectrum

I. Orthographic Metamorphosis

Here, as exemplified by my *Textmusic for Piano* series, the letters comprising a given written text are allocated in a zig-zag fashion to the black and white keys of a piano, paying attention to the key-colour (making for pentatonic, diatonic and/or chromatic passages), after which the text can be 'played' as a melody on the level of individual letters, or as chords on the level of syllables, words, phrases or whole sentences. A change in this level may be effected at specified times. Attention is also paid to the loudness, the duration etc. of the musical events.

Between 1971 and 1984, fifteen versions of *Textmusic* were realised, seven by myself and eight by others. The languages employed included English, French, German, Hindi and Hungarian. Figure 1 shows the allocation to the piano keyboard, chromatic mode (i.e. disregarding the colour of the keys), of the letters of Samuel Beckett's *Ping* in their order of first appearance in the text for use in *Textmusic #6* (1973). The text begins as follows: "all known all white bare white body fixed one yard legs joined..."

Fig.1 – Allocation of the letters of Beckett's *Ping* to the piano keyboard for use in *Textmusic #6*



Textmusic #10 (1974) stems from various Kathak-bols. Figure 2 displays bars 21-27, comprising a bol by Birju Maharaj based on the numbers one to ten in Hindi and shown in sargam notation. The Devanagiri letters were allocated to the piano on the three key-colour levels – pentatonic (black keys), diatonic (white keys) and chromatic, including the letter for the short sound 'a' (the first vowel of the Devanagiri alphabet), used in all words ending with that letter, viz. *ek(a)*, *tin(a)*, *char(a)*, *panch(a)* and *sat(a)*. Also included among the letters is '-', a symbol for prolongation in time; the bars are pentatonic, diatonic, chromatic and diatonic in turn. The rhythms (prolongations included) correspond exactly to those in the bol.

Fig.2 – Excerpt from *Textmusic #10* (based on a Kathak-bol by Birju Maharaj)

II. Phonetic Composition

In this field, spoken language is itself treated according to musical considerations. In one work, specially composed phonemes using sounds from different languages were concatenated by musical techniques (e.g. a dodecaphonic-like system) forming a text then set to music.

In another, stanzas of verse were so written that every syllable of one line phonetically resembled to a certain degree the corresponding syllable of another; then all lines synchronised were used as a source for sound material rendered electronically – see Figure 3 for this text.

Fig.3 – *Ode to St. Cecilia* (1989)

The	view	se-	cure,	in	flight	a-	bove	the	lawn /	A	haugh-	ty	fea-	thered	friend	of	mu-	sic	be
And	through	this	song-	ster's	throat	(but	not	for	long) /	Be-	fore	it's	caged	and	braised,	a	me-	lo-	dy.
A	su-	per-	mar-	ket	oo-	zing	gen-	tle	sound /	Sees	for-	tunes	spent	with	grey	ra-	pi-	di-	ty.
Be	mu-	sic	but	a	fruit	of	love,	pay	on! /										
(If	you	think	"can't	af-	ford	e-	nough",	be-	gone!) /	And	more	we	serve	this	fair	com-	mo-	di-	ty.
En-	thu-	si-	ast?	Be-	fud-	dled?	But	you're	one! /	It's	Form	where-	with	so	sheer	con-	tent	we	be.
A	few	would	fain	be-	lieve,	o-	bey,	be-	long… /										
Here	mu-	sic	(just	the	thing	to	lull	the	throng!) /	Lets	dou-	bters	yield	to	hap-	py	sa-	ni-	ty.
With	you,	O	bu-	gle	bright,	men	rise	at	dawn; /	Their	chore,	to	e-	du-	cate	an	e-	ne-	my,
										A	jaun-	ty	march	to	spur	their	jol-	li-	ty.
In-	qui-	si-	tors,	be	full	of	lus-	ty	song, /	And	tor-	tured	yells	dis-	perse	in-	au-	di-	bly.
Thus	beau-	te-	ous	is	mu-	sic… /				And	more	we	serve	this	fair	com-	mo-	di-	ty.

In a third work, a text starting in German was phonetically transformed so as to almost imperceptibly pass through English into French; this transformation is more symptomatic of a musician's timbral sensitivity than a poet's way of thinking.

III. Electronic Transformation

The use of an analogue electronic studio is here referred to. In my tape composition *Deutscher Sang* (1980), a text spoken in German (by an Englishman with a strong Hampshire accent), was progressively filtered with the central frequencies taken out, until only extremely low and high sounds caused e.g. by the [d]s and [sch]s (both as in “deutsch”) remained, forming a kind of percussive music rhythmically shaped by the speaker’s enunciation.

IV. “Synthrumentation”

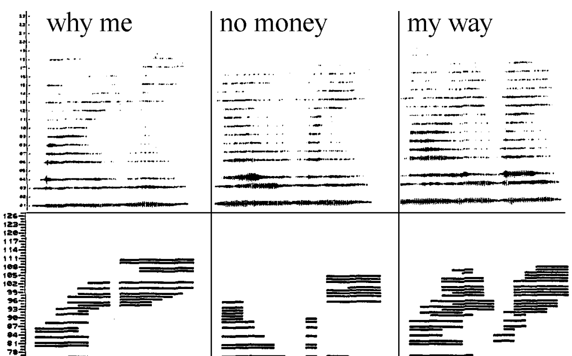
I invented this term – from “synthesis through instrumentation” – to denote the following technique: a recording of spoken language is spectrally (Fourier-) analysed and the analysis rendered as a series of chords of short duration (that of one or a few ‘telescoped’ Fourier time windows), representable as a data file in MIDI format. This file is then ‘calmed’: harmonic partials, the MIDI velocities of which fall near multiples of a given velocity tolerance value are rounded to those multiples and made continuous, i.e. the interruption between a partial in a chord and the same partial in the following chord is removed. The result is a MIDI file sounding remarkably like the original sound recording. I first used this technique in my ensemble composition *Im Januar am Nil* (1984) and subsequently in the orchestra piece *Orchideæ Ordinariæ* (1989) and other later works.

Figure 4 shows an excerpt of the score of *Im Januar am Nil* – when computer-synthesized, this music is clearly phonetically recognizable as the German words “In Armenien” (= “in Armenia”); when played by musicians, the residual similarity to spoken language is still very strongly evident.

Figure 5 (upper half) shows sonagrammes of the phrases “why me”, “no money” and “my way” and (lower half) the corresponding pitches as scored in *Orchideæ Ordinariæ*, plotted as frequency (y-axis) against time (x-axis).

Fig.4 – Excerpt from *Im Januar am Nil*

Fig.5 – Sonagrammes and Pitch scores from *Orchideæ Ordinariæ*



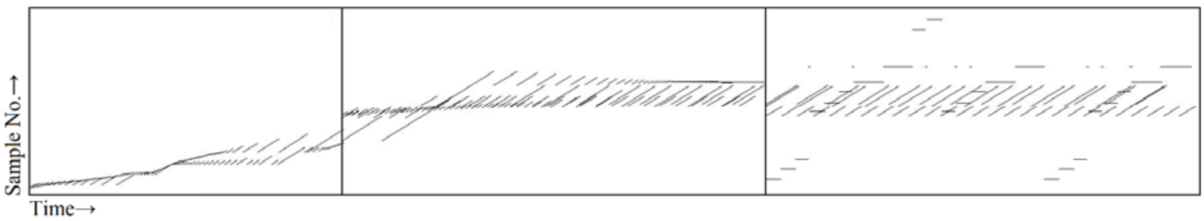
V. “Spectastics”

This, too, is a term (here derived from “Spectral Stochastics”) invented to denote a technique for converting a spectral analysis of speech into music. Whereas in “synthrumentation” the analysis is rendered as a “calmed” chord-succession (see above), we are dealing here with a rapid melodic succession of single notes: first the spectrum’s calculated amplitudes are interpolated between the harmonic partials to give an amplitude value for every degree of the chromatic scale upwards from the fundamental frequency of the analysis. These chromatic pitch amplitudes are then used as probability values for the random generation of a rapid melody of ideally 20-200 notes per second: the ‘louder’ a note is during a certain stretch of time in the chromaticized spectrum, the more frequently it will appear in the melody during that stretch of time. A “spectasized” melody, as rendered on a synthesizer or a player piano, bears a remarkable resemblance to the original sound recording.

VI. “<u>Sound Wave Surfing</u>”

This technique, one I first used in 1987, employs forwards and backwards motion along the samples of a recorded sound wave. The parameters are sample rate, first sample and the sample-length of a sound segment as well as number of iterations of the segment. With a sample rate the same as in the recording, the first sample at the start of the recording, the segment length that of the recording and the number of iterations one, we obtain nothing but the recording itself. However, if the sample rate is 44,100 Hz, the first sample anywhere within non-silence, the length of the segment 441 samples and the number of iterations 100, one obtains a 100 Hz tone one second long. This simple technique, applied to spoken language, yields attractive results: my tape piece *fLvXv$* (1990) has sounds moving organically from a form of concrete poetry through music resembling rap to electronic clicks and bleeps. Figure 6 is a “surf chart” of another piece, *Herre Gott* (1987) – diagonal lines are sound segments played forwards “normally”. Horizontal lines as seen mainly on the right are tones caused by small numbers of samples looped several times: the vertical width of a loop sets the frequency of the perceived tone, the number of iterations (horizontal) its duration.

Fig. 6 – Surf chart of *Herre Gott*



VII. <u>Semantic Composition</u>

Here the sounds – as in my piece *Progéthal Percussian for Advanced Beginners* (2003) – are not derived in any way by spectral analysis or synthesis but engendered by percussionists performing on a wide range of percussion instruments. The music they are playing is pure language, not imitated phonetically, but composed of words and sentences based on a vocabulary and set of grammatical rules created especially for the purpose. This vocabulary owes a great deal to Peter Mark Roget’s Thesaurus of 1852: to each of Roget’s thousand categories of meaning I allotted a new five-digit encoding reflecting – in addition to Roget’s six classes and the sections and divisions therein – shades of meaning such as negation etc. A text was then taken as source material, parsed into parts of speech and attendant properties such as plural, genitive etc. for nouns, transitive/intransitive etc. for verbs and so on. At the end of an elaborate process including a comprehensive set of grammatical rules in part inspired by various existing languages, in part newly devised, a computer program I wrote in a Linux environment converted the parsed text, its words thesaurally encoded, into a musical score. Texts thus translated were Hamlet’s Soliloquy as well as a number of resolutions passed by the United Nations.

Figure 7 shows Roget’s categories 1-32 within Class I, Sections I-III with my five-digit code at left.

Figure 8 shows Hamlet’s lines “To be, or not to be: that is the question: whether ’tis nobler in the mind to suffer the slings and arrows of outrageous fortune, or to take arms against a sea of troubles, and by opposing end them?” expressed in a meta-language, parsed and algorithmically converted into a meta-score, of which e.g. the first line [6 :a<M1---002…---   >] (corresponding to the first word of the text and the first bar of the music) means:

[6 :] the bar length (six beats, see below),
[a] the first synonym within category 11111 ([b] would mean the second of altogether six),
[<M1] Metal instrument 1 (for Roget’s Class I. Abstract Relations – the others were so allotted: II. Space:Air, III. Matter:Wood, IV. Intellect:Plastic, V. Volition:Glass, VI. Emotion:Skin),
[---002] three silent beats followed by three notes of which the last has an instrument offset of 2,
[…] these three notes are short (i.e. of one beat each, leading to a total duration of six beats for that bar or word; long notes notated [-] last two beats) and
[---   >] the three notes are soft (loud=[!]). These rhythms and dynamics derive from the parsing. Compare this description with the first and following bars shown in the score excerpt in Figure 9.

Fig.7 – Categories 1-32 from Roget's Thesaurus, recoded with five digits seen at left

```
       CLASS I: WORDS EXPRESSING ABSTRACT RELATIONS
       SECTION I. EXISTENCE                    2. CONTINUOUS RELATION
       1. BEING, IN THE ABSTRACT    12211      #16. Uniformity.
11111  #1. Existence.               12210      #16a. Nonuniformity.
11110  #2. Inexistence.                        3. PARTIAL RELATION
       2. BEING, IN THE CONCRETE    12311      #17. Similarity.
11211  #3. Substantiality.          12310      #18. Dissimilarity.
11210  #4. Unsubstantiality.        12321      #19. Imitation.
       3. FORMAL EXISTENCE          12320      #20. Nonimitation.
       i. Internal conditions       12331      #20a. Variation.
11311  #5. Intrinsicality.          12341      #21. Copy.
       ii. External conditions      12351      #22. Prototype.
11310  #6. Extrinsicality.                     4. GENERAL RELATION
       4. MODAL EXISTENCE           12411      #23. Agreement.
       i. Absolute                  12410      #24. Disagreement.
11411  #7. State.                              SECTION III. QUANTITY
       ii. Relative                            1. SIMPLE QUANTITY
11410  #8. Circumstance.            13111      #25. Quantity.
                                    13112      #26. Degree.
       SECTION II. RELATION                    2. COMPARATIVE QUANTITY
       1. ABSOLUTE RELATION                    i. Comparative Quantity in general
12111  #9. Relation.                13211      #27. Equality.
12110  #10. Irrelation.             13210      #28. Inequality.
12121  #11. Consanguinity.          13221      #29. Mean.
12131  #12. Correlation.            13231      #30. Compensation.
12141  #13. Identity.                          ii. Quantity by comparison with a standard
12142  #14. Contrariety.            13241      #31. Greatness.
12140  #15. Difference.             13240      #32. Smallness.
```

Fig.8 – Excerpt from Hamlet Soliloquy in meta-language, parsed, converted to meta-score at left

```
 1: 6 :a<M1---002...---    > 11111  Verb  intr  inf               existing
 2: 7 :b<G1--2022._.---    > 51161  Conj  coor                    or
 3: 6 :a<M1---002...---0   > 11111  Verb  intr  inf         Neg!  not existing
 4: 7 :a<M4-11000.._--!    > 14432  Pron  demon sing  sub         that
 5: 6 :a<M2---220...-!-    > 12141  Verb  intr  pres              is
 6: 8 :a<P1---212__.!--    > 41132  Noun  comm  sing  sub         topic
 7: 6 :a<M2---220...-!-    > 12141  Verb  intr  pres              is
 8: 7 :d<G1--2022._.---    > 51161  Conj  subor                   whether
 9: 7 : <P1---002_..!--    > 41111  Adv.  qual  posit             conceptually
10: 7 : <S4--1011_..!!-    > 64321  Adj.  qual  comp              nobler
11: 6 :a<M2---220...-!-    > 12141  Verb  intr  pres              is
12: 6 :f<S2---001...---    > 62110  Verb  tran  inf               bearing
13: 7 : <G2---201_..!--    > 52320  Adj.  qual  posit             outrageous
14: 8 : <M8---111__.!!-    > 18131  Noun  comm  figur gen         fate's
15: 8 : <G4---121__.--! &  > 54221  Noun  comm  plur  obj         attacks
16: 7 :b<G1--2022._.---    > 51161  Conj  coor                    or
17: 6 : <G4---100...---    > 54220  Verb  tran  inf               arming
18: 8 :a<G4---021_._---    > 54130  Prep                          against
19: 7 :a<M3---200._.---    > 13311  Conj  coor                    and
20: 6 :b<G4---021...!!-    > 54130  Verb  tran  gen               opposing's
21: 6 :a<M7---020...---    > 17121  Verb  tran  inf               ending
22: 7 :b<M4-11000_..--!    > 14432  Adj.  demon def               this
23: 8 :b<S2---001__.!!- &  > 62110  Noun  comm  plur  gen         troubles'
24: 8 :a<M4---200__.--!    > 14311  Noun  comm  sing  obj         pool
```

Fig.9 – From *Progéthal Percussian for Advanced Beginners* (2003): Hamlet Soliloquy (excerpt)