Tomasz Siegrist

At the borders of Polyphony

About different Text simultaneously in a choir setting, with a particular focus on vowels.

Skriftlig reflektion inom självständigt arbete
Till dokumentationen hör även följande inspelning:

1.) DVD: rehearsal 7.4.2017 with the Swedish Radio Choir: (Lidholm- Carter – Schnittke – Tarrodi)
2.) CD: Audio-examples
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1. Introduction

It occurs mainly in polyphonic music that there are different texts eg. vowels and consonants for each voice at the same time – it is a phenomenon which is often spoken of as a source of problems for the singers and the conductor. The choir gets often more unstable in intonation and singers have difficulty to follow the conductor’s beating. In homophonic music, a often heard remark of choir conductors facing problems with intonation is to sing the "same vowel", to achieve a homogenous blend of all the voices, which seems to make intonation easier.

There are however some situations I encountered while studying at the Royal College of Music in Stockholm which seemed to contradict this concepts. One experience was when we sang Salut, Dame Sainte, a work for male choir by Francis Poulenc. Due to a lack of attention, I was constantly singing a quite different vowel than my colleagues at one specific bar – and we only found out after 3 rehearsals that I was doing so. For the conductor (and obviously also for my fellow singers) It seemed not to pose any problems. Another experience was the Piece Motettum Archangeli Michaelis by Bengt Hambraeus. At one Point the voices sing 5 different vowels at the same time in a strong dynamic - the result is a rich sound which reminded me of a distorted synthesizer, and which was foreign for me until then – but had its kind of beauty.

The main questions I had when I began writing where:
are different vowels and consonants simultaneously in itself already a source of “problems” or not? If yes, why? And is there, apart from this practical aspect from the conductors perspective, also a aesthetical value in placing different vowels and consonants simultaneously – and are there examples of composers which did search actively those situations.

I felt that it is important for a me as a conductor to deal with this subject to have the consciousness about those situations. On the other hand I had the impression that there is a lot of unused or just hardly known potential of
new choral sounds which can be gained by placing of different texts, vowels and consonants over simultaneously.

The paper consists of three parts. The first will shortly explain some scientific background to vowels, in a lesser degree also of consonants. The second will show some examples from the choral repertoire concerning superposition of different texts eg. vowels and consonants. In the last part I will try to show some of my own exploration with different texts at the same time in a choir setting. With a choir I did overlap some of the most used vowels in different registers, and tried also some compositional Ideas, which could be a starting point for new pieces.

While writing my text and having already done some of the meetings with the choir, I decided to focus particularly on vowels and neglect therefore the consonants. Nevertheless there is a discussion of some fricatives, which played a role in one of my exam concerts pieces, Elliot Carter’s *musicians wrestle everywhere*.

Because of the terrorist attack in Stockholm at Drottninggatan on the 7.4.2017 and the corresponding collapse of the public traffic, the diploma concert in Hedvig Eleonorakyrkan was unfortunately cancelled and could not be repeated due to the full rehearsal schedule of the choir. The DVD consist of parts of rehearsals with the swedish radio choir, which was preparing the concert.

The rehearsed pieces where:
Ingvar Lidholm: *De profundis* (1983)
Alfred Schnittke: 12 Busspsalmen (1988) ( V, VIII )
Elliot Carter: *Musicians wrestle everywhere* (1945)
Andrea Tarrodi : Natt (2007)

The Audio-CD contains audio-examples of the experiments presented in chapter 4.
2. Some scientific facts

I will try to show some relevant scientific facts of the two main speech sounds, vowels and consonants, in order to understand the proceeding parts of the text. It is difficult to make definitive statements about vowel colors and consonants, for the reason that there are so many differences between the different languages, accents and dialects of human language, and their production is in constant change. Nevertheless there are some scientific studies about vowels, and those results can be used to generalise at least in our field of singing, also through the usage of the International Phonetic Alphabet\(^1\), which is a trial to find a way to cover all the vowel – and consonant sounds into one system.

2.1 about Vowels

The sound of the human voice originates from the vocal cords. The vibration of the vocal cords brings the air column in the room of the Larynx and the naso-oro-pharynx into vibration, and then the outer material of those rooms, muscle and bone structures. Those 3 elements – vibrator, room, and the resonator material, determine the “basic” sound of the human voice.\(^2\) This “vowel base” can be modified with the articulation organs, mainly the jaw, velum, tongue, lips, which enforce or weaken certain frequencies in order to make audible what we call vowels.

Every vowel has its specific formants, high frequency pitches, which stay more or less the same, no matter if the voice moves up or down in pitch – and those make the vowel as such distinguishable. They will be spoken in the following text in the way of F1 for the first formant, F2 for the second, F3 for the third, F4 etc.

The table of Catfords *introduction to phonetics*\(^3\) shows (of the International phonetic alphabet) for the two first formants\(^4\):

\(^1\) http://www.internationalphoneticassociation.org/content/full-ipa-chart
22.5.2017
\(^2\) The closest sound to this “raw” material is experienced at the dentist, when he asks the patient to pronounce different vowels such as “e”. The mouth plainly open, and unable to use his tongue and lips, he will just pronounce a very bright “a”
The Vowel “I” : (F1 240 Hz, F2 2400 Hz)  
The Vowel “U “: (F1 250 Hz, F2 595 Hz)  
The Vowel “ɔ” : (F1 500 Hz, F2 700 Hz)  
The Vowel “A”: (F1 850 Hz, F2 1610 Hz)  

There are some thumbrules according to the use of our articulation system, which can be showed on this few Vowels. One is that the first formant is generally dependent of the Jaw and lip opening – the more open they are, the higher the pitch of the first formant will be. According to this, “u” and “I” have a low F1, while the “A”, which demands a somewhat open Jaw, has the highest F1. The second formant is dependent of the position of the tongue, how high or/and forward or low or/and backward the tongue is placed. According to this, the “I” has the highest second formant, while the “U” has the lowest. One gets a better visual impression of those differences through the following table:

![Fig.1: Vowel formants after Neppert/ Pétrusson](image)

It is a known tendency that vowels with a high F2 (as the vowel “I”) are tendentially intonated too high, and vowels with a high F1 are in danger to be intonated too low. Johan Sundberg speaks about the tendency of a pitch

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4 Full table on page 30  
6 Magnús Pétursson, Joachim Neppert, Elementarbuch der Phonetik, Helmut Buske Verlag, Hamburg 1991, S. 125
drop when choir singers shift from a “I” to f.ex. an “E”, and a pitch rise, if they do so from a “U” to a “I”, but points out that the experienced singers learn to compensate the fault.\textsuperscript{7} Per Gunnar Alldahl recommends to sing the “I” vowels “darker” and the “U” vowel “brighter” in order to avoid intonation shifts.\textsuperscript{8}

Vowels have a certain predisposition in their dynamic possibility – the higher positioned and the closer the formants are to each other, the louder the vowel will sound. An “I” will therefore sound less strong as an “A”, an “U” less strong than an “O” while the The “ɔ” where the frequency of the both formants lie with a difference of only 200 Hz very close to each other will be one of the loudest vowels. This can explain one main reason for intonation problems with a differing vowel production – there is a lack of balance, because the singers don’t hear each other properly in order to sing in tune.

Many singers and voice teachers advocate the modification of vowels which are on high phonation frequencies. The need for this can be explained in the light of the first two formants, especially for high womens voices.\textsuperscript{9}. It is tendentially hard to determine vowel formants when the fundamental frequency is higher than about half of the frequency of the first formant – this is f.ex. the case for the vowel “I” and “U” when a soprano sings for a C6. In order to gain volume, especially when singing with an orchestra, the singer “tunes” his F1, through a bigger jaw opening, closer up to the phonation frequency, and arrives at more neutral articulation positions such as in the “A”, which however won’t be percieved as such on such high pitches. This fact makes it senseless, and even contraproductive, to insist on “pure vowels” at these high frequencies.

The third, fourth and fifth formant are less connected to a certain vowel, but more to the general timbre of the voice. F3 is connected to the space between the tonguetip and the front teeth, while F4 is dependent of the position of a larynx. Through a close clustering of those 3 formants the so

\textsuperscript{7} Sundberg, Johan “ the science of the singing voice”, Northern Illinois music Press, Illinois 1987, P.144
\textsuperscript{8} Alldahl, Per Gunnar: “Choral intonation”, Gehrmans Musikförlag AB, Stockholm 2008, P.9
\textsuperscript{9} Sundberg, Johan “ the science of the singing voice”, Northern Illinois music Press, Illinois 1987, P.124
called “Sängerformant” can be achieved, used by operasingers in order
to sing “above” the orchestra. This way they avoid competing with the
strongest overtones of the string and wind instruments, which lie around
450 Hz, while the “singers formant”, or better said, formants, lie for low
mens voices around 2800 Hz, for tenors and low womens voices slightly
higher. Sopranos, which phonate usually at a frequency above 500 Hz,
are less in need of the singer formant when they meet the orchestra, but it
can be also present in their voices.

An interesting approach worth mentioning in the context of vowel formants
is the trial of finding piano cords to tune vowels properly. In the choir library
of the Royal College of Music in Stockholm, one can find the trials showed
in the image below, a short note of Anders Colldén.

Using the first two formant frequencies of a vowel as a departure point, 4
more pitches are chosen which all have strong partials at the pitch of the
vowel formant. Although it seems questionable if these cords really can be
used, the idea of reinforcing vowels though partials of other notes is
interesting. The concept will be taken up again in chapter 3, discussing the
issue on examples out of the choir repertoire.

10 Sundberg, Johan “the science of the singing voice”, Northern Illinois music
Press, Illinois 1987, P.123
11 appendix chapter 7.2, p.34
2.3 about Consonants

The articulation of consonants happens with the lips, jaw, tongue, velum, using the air column and the same spaces which are used for the vowels. In the unvoiced consonants however there are no vocal cords which vibrate. For those it is much more difficult to point out definite formants, as one can in the vowels. Often these are wide spread frequencies, white noises, which have however certain high points.  

![Consonant spectral analysis](image)

**Fig.3: Consonant spectral analysis after Neppert/Pétursson**

For most fricatives, as the consonants “F” “S” and “ç”, the frequencies lie over those of the most vowel formants, touching those of the F2 of the Vowel “I”. The “CH” however lies around 1500 Hz close to the range of the F2 of Vowel “A” (around 1600 Hz).

The voiced consonants are a combination of vowel formants and the corresponding white noise, the formants of the vowel and those of the consonant are similarly present – the result are very complex auditive phenomena, which I decided not to delve too much into, knowing it would take too much space in this work, especially considering superposing those sounds. Nevertheless, It seems important that conductors and composers

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13 Magnús Pétursson, Joachim Neppert, Elementarbuch der Phonetik, Helmut Buske Verlag, Hamburg 1991, S. 144
gain a sensibility, an inner ear for consonants – the first example in chapter 3.2 was such a case for me, and will be discussed at this place.

Also it seems important to me to realise the very basic fact that consonants are first of all a rhythmic element – and it is also on this level that the most problems. Especially orchestral conductors, which are not used to “give time” for the consonants, make it at times very difficult for the choir to be together. It seems logical that those coordination problems will increase when there are different consonants at the same time – there will be some own experiments in chapter 4.1-2, which try to take a closer look on those examples.
3. Different examples from the 16th to the 20th century.

The examples are all drawn out of my studytime in Stockholm, and do range from early baroque music to newly written pieces. It is in order to show how composers have been dealing with the issue, where they avoided problems, where they actively searched the conflict zones, and where they began to search for synthetic new sounds.

3.1 Blending – Boltzius, Nystroem, Nielsen

The piece *Threnodia* by the Swedish composer Thomas Boltzius is a 7 minute long funeral music for the death of Gustaf II Adolf the great in 1634, for 2 choirs, one singing in Latin (3 voices) and one in German (4 voices). The biggest part of the work they sing separately, but in the last bars, they join each other, singing “herr, erbarm dich unser” and “miserere nobis” at the same time.

![Fig.4: Thomas Boltzius: Threnodia, measure 210-215](image)

Already in the beginning of the seven part writing Boltzius places the vowels of “miserere” and “Herr” over each other. The vowels of “Domine” und “unser” are less similar, but blend in performance well, as long as the

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“U” is sung more open, as it would be spoken in the German word “unser”, rising the frequency of the first vowel formant closer to the vowel “O”. The composer in such cases searches the uniformity of the vowel sounds for a good sonority, avoiding the problems, that could occur if he would start with blending “Herr” and “miserere”. The effect is a very compact 7-voiced polyphony – a masterpiece of counterpoint considering the very unique disposition of the two choirs, and their different languages.

A more extreme example of “vowel consciousness”, where polyphony becomes almost homophony I find in Gösta Nystroems Golfiner from 1966.

Entering seemingly in a canon, the voices all have the same vowels at the same time. The result is more a continuous addition of sonorous material instead of single voices, a kind of “pseudo-polyphony”. The impressionistic aesthetic does obviously not tolerate voices which stick out of the polytonal cords, which can be already in themselves a challenge to intonate properly. Almost an anti-example of this thinking is Carl Nielsens Motett Dominus regit me:

Fig.5: Gösta Nystroem: “tropisk orkester” out of “Golfiner”, measure 4-5

Gösta Nystroem: Golfiner (1966), Sveriges Körförbunds Förlag, Stockholm 1991
Written around 1920, it was a reaction of the composer to a experience of some palestrina pieces, and one of his only polyphonic choir a capella work. The piece is known for its difficulties concerning intonation. It shows what happens if the composer does not care about this aspect of choral composition. In Bar 13 there are not less than 4 different vowels at the same time, through big intervalls separated from each other, what makes it even more difficult to listen properly. It does in this case not seem to be a conscious choice, but more a lack of experience of the orchestral composer unknowing about the instrumental aspects of the voice, and of the text.

3.2 Intentional heterophony – Carter, Börzt

There are however cases where composers actively search for the collision of different texts. Such an example is the choir piece *musicians wrestle everywhere* by the american composer Elliot Carter, written 1945. Seemingly easy to play and read in its almost completely diatonic

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language, the piece unvails its difficulties, but also its qualities in the auditory experience or in the rehearsal situation. The different vowels, but also consonants which come at the same time can catch the choir and their conductor on the wrong foot, and demand a high attention to rhythmic steadiness.

Fig. 7: Elliot Carter: musicians wrestle everywhere, measure 5-8

The result is a chaotic polyphony, a “heterophony” - the number of the voices seem to blur, there seem to be more singers singing than there actually are. This is enforced through the rising dynamics (piu forte), which create the illusion of new voice entries. What also occurs is something what one could call “consonant-melodies”, resulting out of the canonic accumulations of the fricatives “musicians wrestle everywhere”. Suddenly, the polyphony gets a new counterpart, which is happening in the much

17 Elliot Carter: musicians wrestle everywhere (1945), 1982 Theodore Pressler Company, Pennsylvania
higher frequency field of the fricative sounds between 2000-4000 Hz. And a new dimension of listening (and composing) choir music seems opened.

In contrast to the piece of Carter, Daniel Börtz Motett *Herrens dag kommer som en tjuv* seems to be difficult on the first sight. On the second sight one realises how easy and effective it is written.

![Musical notation of Daniel Börtz: Herrens dag kommer som en tjuv, measure 5-6](image)

*Fig.8: Daniel Börtz: Herrens dag kommer som en tjuv, measure 5-6*  

The 2 sopranos alternate between 2-3 notes, follow each other in a rhythmical canon, in which the highest of the two notes is replaced by the low note and vice versa, as in a kind of mirror technique. The bass voices are worked the same way, and the tenor and alto voices follow each other in simple canon without any mirror techniques. The harmonic sum is just a augmented triad E –G# - C with some passage notes, much more steady and much less moving than Carter’s piece. The resulting heterophony is in its way even more efficient in creating a chaotic impression. Its much easier to realise in the rehearsal situation because of the repeating rhythms and the lack of big jumps.

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3.3 Vowelpolyphony – Schnittke, Varèse, Hambraeus

To this point there wasn’t any example which would have used the basic elements of text, vowels and consonants, to superpose them. A first direct superposition of different vowels at the same time can be found in Nocturnal by Edgar Varèse (1883-1965) written 1961 as for bass-voice chorus, soprano solo, and orchestral ensemble. There is a very short passage, where the voices sing 3 vowels at the same time.

Fig.9: Edgard Varèse: Nocturnal, bass-voices, measure 64-68

Unfortunately, the instrumental texture at this place is very dense, with trombones and woodwinds playing forte, and the voices are doubled by the strings, so that the effect seems inaudible, perhaps even neglectable. But it has to be considered that Varèse did a lot of choir work - he was leading very big choirs in Paris and New York, performing old and new music in the same concerts, and writing a lot of works for choir and percussion, which unfortunately never have been published. Taking this into consideration, this passage is probably more than just an unreflected idea – perhaps it could have been the ground for a new way of composition for choir, which unfortunately never has been developed. “Nocturnal” was Varèse’s last piece to be performed as a fragment 1961 before his death in 1965.

There are some pieces, which could be seen as a continuation of Varèse’s ideas. The Motettum Archangeli Michaelis, written 1967 by the Swedish composer Bengt Hambraeus, has as a subtitle “omaggio à Edgar Varèse”. Written 2 years after the death of Varèse and six years after the première of the “Nocturnal”-fragment, it could be that he got inspiration from it, while writing the following passage:

19 Edgard Varèse: Nocturnal (1961), 2000, Casa Ricordi, Milano
20 appendix, chapter 8.3
The choir sings on undefined pitches (which on the other hand have to be held) the vowels “A”, “E”, “J”, “U” and the sounding consonant “L” – all the elements of the word “Alleluja”. The horizontal succession of vowels in a word is turned into a vertical “vowel”-chord, the same way as superposing the notes of an overtone scale to a major chord – an extraordinary idea. The resulting richness of the sound is comparable with the examples of Carter and Börtz, with the difference, that vowels are used, and that there is no movement in it. There is a perception of space, of different layers, which stands in contrast to the choir blend, so often tried to be achieved by the choir conductor. It reminds me of the instrumental pieces by Varèse, where the pitches are placed in such big and dissonant intervals to each other,
that they all stick out as single elements, creating the illusion of space. The result of an aesthetic standing in opposition to the thick blending orchestral sounds of the romantic orchestra. In this sense, it is really a successful hommage, a translation of Varèse musical language into choir music.

There are some objections which can be raised when one listens to the realisation in the concert situation. There is a succession of swelling dynamics in the different voices, which should bring out the word “alleluja” back on the horizontal level. Listening to different recordings, it seems at times to be difficult to hear the effect – this can be voluntary, but it is worth to mention that the score at times promises more that one actually hears. The Vowel “E” in the sopranos is in the risk of not being really understood when using too high pitches (as the upward showing arrows suggest), which would probably imply frequencies far over the first formant of the vowel which lies around 400 Hz, approaching more a neutral vowel quality. Especially in professional choirs, the singers are through their classical training used to modify the vowels for high pitches and sometimes even at register transitions, and sing with a considerable amount of “singer’s formant” in their voices, which tends to blend the vowels even more – this otherwise very useful feature can potentially take away a lot of the possible impact this passage can have. The choir conductor has to be careful about the singers to sing on pitches where the vowel can still be recognised as such. It could be a question if a more specific notation with register indications, or even some concrete pitches would bring a more convincing result, on the other hand, it could bring restrictions to the richness of the sound itself. Some much more simple, but in their way striking examples are taken out of Alfred Schnittkes 12 penitential psalms, written 1988.
In the first example, the bass voices sing their long notes on an “O”, while the rest of the choir having a homophonic recitation in parallel moving intervals. The “O” is used here in an instrumental way – like string instruments as a ground on which a melody can develop. This may be a banal example compared to the work by Hambraeus. There are a lot of late romantic pieces which use this way of writing. In bar 20 however, the situation gets more complex. The initial “I” vowel is gradually brought into superposition with vowel “E”, “A” and “O”, in measure 22 all the vowels sounding at the same time. The vowel “O” with 360 Hz for F1 and 640 Hz for F2 is placed slightly above his first formant while the “E” with 390 Hz for F1 and 2300 for F2 is placed slightly below his first formant. The “A” with around 850 Hz for F1 and 1600 Hz for F2, but also the “I” with 250 Hz for F1 and 2400Hz for F2 clearly below their first formants. There are therefore 7 formant frequencies - 250 Hz, 390 Hz, 640 Hz, 850 Hz, 1600 Hz, 2300 Herz and 2400 Herz – sounding at the same time. It seems quite remarkable that there are not more problems occurring at this place, that there are no major intonation problems arising in rehearsal and concert. The result is in this case a transparent sound where every voice can be equally well heard without dominating too much over the others. Perhaps, in contrast to the Nielsen-example in chapter 3.1, all the vowels are

placed at frequencies where they don’t interfere with the formants of the others, but still are as such recognisable. The slow unfolding of the different vowels, growing out of the “I” possibly evokes a picture of a plant – the text “и секира при корени” – “and the axe lies at the root” finds here his musical counterpart.

At measure 26-27, we have a similar situation, but here, the use of the different vowel colors seems to be more consciously chosen. The sopranos sing on the vowel “I” a c-minor chord in a 6-4 position with a added “d” in the Altos, while the basses and tenors have a c-major chord on a “O”. It is a cord at the end of a crescendo, held for three beats, and then released in the next bar by letting everyone sing on the vowel “A”.

![Fig.12: Alfred Schnittke: Penitential verses, no.V, Measure 25-28](image)

There are some remarkable features of this passage. On one level, the vowel-colors reinforce the polytonal way of writing, choosing “I” for c-minor and “O” for c-major to strengthen the identity of the different cords. It is comparable to an orchestral situation, where polytonality is often differentiated between different instrumental groups.

Beside this conceptual level, there are other qualities of the chord which show a great intuition and inner hearing from the composers side. The first formant of the vowel “I” is around 300 Hz, which is approximately the “d” sung by the altos, while the first and second formant of the vowel “O” are around 400 Hz and 800 Hz, the two “G”s on the treble clef. Those pitches

Schnittke, p.15
are partly contained in the cord itself and will be probably reinforced by the
vowel formants. This could be one explanation for the sonorous force this
chord has in picturing the meaning “душе, вострепещи” – “tremble, my
soul”. In contrast to Hambraeus piece, it seems to be a more specific and
differentiated way to superpose vowels, even if the usage is probably a
more intuitive than systematic or calculated one.

3.4 Varèse’s dream - Erik Bergman

The piece Lapponia written 1975 by the Finnish composer Erik Bergman
(1911-2006), omits the use of a concrete Text but uses all the elements of
it, vowels and consonants, superposing them in different ways, and
achieving a great variety of very fresh sounds.

![Fig.13: Erik Bergman: Lapponia, 1 movimiento, beginning](image)

In the first movement, “midwinter night”, a cluster of different vowels is built
up in the divided bass and tenor voices. Starting with low pitches and
adding higher ones, the same is happening on the level of vowel formants
with “U” around 300 Hz, “O” around 400 Hz, and “A” around 800 Hz. In the
beginning the vowels are closed by a following sounding “N” consonant –
the resulting blurred dark mix of the mens voices paints well the never
ending night of the lappland region. The moment when the men’s voices
open their vowels towards a brighter production, the women’s voices enter,
with fast sequences of high pitches and sounding consonants. The
sounding fricative “Z” and the bright plosive “C” combined with the high

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25 Erik Bergman: Lapponia (1975), 1976, society for the publication of finnish music,
Helsinki, p.1
frequency F2 of the Vowel “I” evokes associations to electric high tension sounds – sounds also described at the sightings of northern lights.

In a second example out of the third movement – midsummer night – Bergman chooses the superposition of very gentle vowel fluctuations in the mezzosopranos, while the altos and sopranos sing thirds in exchange, in some kind of pendulum motion.

It is an experiment at the border of the famous choir blend, the ear gets very attentive to the little shifts in vowel color, which is caused by the

26 Bergman, p.5
27 Bergman, p.14
fluctuating mezzosopranos. In a last example, he creates something one could call a “vocal trill”. He uses the tendentially problematic vowel shift from closed vowels to open ones for artistic reasons, superposing the resulting fast change between “o” and “u” in the sopranos by a slightly delayed version in the altos. This results in a unique shivering sound quality.

Fig. 13: Erik Bergman: Lapponia, 3. movement, figure 41-46

There could be many more examples derived from the piece – it is an extremely vocal way of writing, combined with a very good ear for the superpositioned vowels and consonants, using them in a very natural and authentic way – something, which is not often the case in abstract vowel-and consonant-compositions. The resulting music, and those sounds in general, even if the piece was written in 1976, is unfortunately rarely listened to in today’s contemporary music life. At least it took me very long to find the piece and I haven’t found another piece yet which would have been composed on a similar level concerning the richness of the sounds. Was this perhaps the new sounds that Varèse was thinking of?

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*28 Bergman, p.15*
4. Own experiments:

The last part of this work is a short documentation of the meetings friday the 10.3.2017, friday 17.3.2017 and thursday the 20.4.2017. The first part consisted of testing the superposition of different vowels (in a lesser extend of consonants). It has to be said that there was much too little preparation and time to develop a systematic approach. This work in itself is far from being a scientific study, but it could be a starting point for a further, more detailed research – one is invited to listen to the examples on the attached CD. The full tables used can be found in the appendix. At the first and the last meeting there where 6 singers (2 sopranos 1 alto, 1 tenor, 1 baritone, 1 bass), so that the division in 6 parts was balanced. The second meeting was more uneven with 3 sopranos, 2 Altos, 1 tenor and 2 basses.

4.1. Vowel and consonant superposition

The first table was a superposition of different Vowels in women´s and men´s voices on the same pitch – in this case a B4. The men where singing a bourdon note, while the women sang the different vowels at the same time – the example was performed one octave lower as written.\(^{29}\)

![Fig.16: Vowel superposition, in unison\(^{30}\)](image)

The performance of the first table was not unproblematic – the two voices had to sing equally strong, and it was hard to keep the straight tones for long. Nevertheless, there where several trends to discover.

Trend 1: only one vowel stays recognisable, but it is slightly colored, sharpened or rounded by the other vowel. – for example “U” on the same time with “A” was almost not audible anymore, but gave the “A” some kind

\(^{29}\) appendix, chapter 7.3 (Audio-CD track no.1 and no.2)

\(^{30}\) appendix, chapter 7.3 (Audio-CD track no.1 and no.2)
of a round shape, similar with “I” and “E” (dominating “I”). or for “O” and “U” (dominating “U”). “Ü” and “Ä” (dominating “Ä”)

Trend 2: both vowels where understandable, but did not blend, stayed apart from each other. This was the case while superposing “E” and “O”, “E” and “A”, “E” and open “Ä”.

Trend 3: The two vowels merged to a new quality, both still understandable as such, but in a seemingly harmonious relationship. This happened with “A” and “O”, “A” and “Ö”, “Ö” and “I”.

Trend 4: in some cases there occurred intonation difficulties. Superposing the vowel “U” with a “E” and “Ä”, it seemed to be difficult to hear and tune the pitch properly to the other, because the “U” was much softer than the other Vowels. Those Problems got bigger, when the table was performed with a bigger interval between the voices, placing the upper voice on a B4 and the low held note on a E3. Another problem occurred at this point – placing the Vowels “Ä” and “Ö” and “A” over the “U” made it difficult for the upper voices to tune. However, in the case of placing “U” over “E” the intonation gained a more secure quality.

In the second table, a G-major chord was chosen, with shifting vowels in the upper and lower voices.

```
<table>
<thead>
<tr>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A</td>
<td>E</td>
<td>A</td>
<td>U(o)</td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>A</td>
<td>E</td>
<td>A(o)</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>1</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>
```

Fig.17: Vowel superposition, cords

The results where similar, even if the upper voices had the tendency to stick out more on open vowels as “A” or “Ä” in contrast to the lower voices. The third trend was even more striking in the vowel-shifts between “O” and “A” – the combination, especially when the low voices have the “O”, seems to have a direct “positive” influence on intonation, the cord seems to gain a particular stability. It could be eventually explained through the regular disposition of the vowel fromants of “O” with F1 400 and F2 800, and of “A”

31 appendix, chapter 7.3 (Audio-CD track no.3)
with F1 800 Hz and F2 1600. That these frequencies could be interpreted as partials of the note G4 could also be a reason why those cords on those vowels sound particularly good.

To a little extent, the possible influence of different starting consonants on the following vowel was tested,

![Consonant superposition with cords](image)

*Fig. 18: Consonant superposition with cords*  

but there weren’t really great differences perceived. It seems that experienced choir singers are trained to attack the vowel the same way, no matter which consonant did come before. It could be however interesting to do this with a beginners choir and see if there would be bigger differences.

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32 appendix, chapter 7.3
4.2. Own trials

To try out compositional fragments is a work which is done at the borders between conducting and composition. The conductors will to shape sounds meets with the composers will to hear the result of his ideas, getting this way most quickly an honest feedback. Some of those moments I would like to describe in this last part of the text.

In a first trial, the german sentence “auch ich bin ein sterblicher Mensch, wie alle andern” was spoken. New versions of the same sentence were written, where the vowels where shifted, while the consonants stayed on the same place, resulting in some kind of a vowel canon. :

auch ich bin ein sterblicher Mensch, wie alle andern
Ich Ich bain en styrблиcher Minsch, wa ölla öndarn
õuch auch bin in stairblechy Mönsch, we illa öndarn
ach öch baun yn styrblaichër Mynsch, wö elli andern
õch ach bön aun störблиchair Mensch, wie öllé indarn
ich ach bön an störblauchyh Mynsch wai elly öndérn

A choice of these possibilities was then sung in a three voiced combination (women singing the same an octave higher)

Sung or spoken in the low range, the result is a strangely modulating choir sound, speaking in a seemingly exotic language, but still understandable because of the unmanipulated consonants. the second version in the score was a version in which just some of the words contained superposed vowels, in order to understand the text better. The work consisted here to

Fig. 19: composition trial “auch ich bin ein sterblicher mensch”

Audio-CD track no.4
realise which of the modified sentences to use in order to gain the most interesting results, searching for possibilities which would produce most different vowels at the same time.

To picture the German word “Wasser” and “Feuer”, similar vowel fluctuations are used as in *Lapponia* of Bergman, but without the pitch changes.

To picture the German word “Wasser” and “Feuer”, similar vowel fluctuations are used as in *Lapponia* of Bergman, but without the pitch changes.

![Musical notation](image)

*Fig.20: composition trial “…die nicht satt wird von Wasser”*

Taking the score as a starting point, we tried out different speeds of the vowel fluctuations and their superposition – the rehearsing was sometimes done by just using rhythmical work, but even more through appropriate gestures, sometimes even very free ones f.ex. wildly shaking hands, to motivate a fast excited movement of the tongue in the word “Feuer”.

In the next example the german sentence “und weinen war mein erster Laut, wie bei allen” was sung, while in some of the voices the consonants

\[34 \text{ Audio-CD track no.5}\]
where shifted, so that multiple consonants were sounding at the same time.

Fig. 21: composition trial “... und Weinen war emin erster Laut”

Some problems occurred in coordinating the different consonants, especially for the finish of bar 2 and 4, where you have in the ending a short “T” superposed with a “L”, a “W” and a “R”. One solution was to place an additional “T” after the final consonants of the lower four voices, creating words as “Rauwt”, “Wauwt” and “Waumt”, which makes it easy for the conductor to find a final gesture which works for all.

Interesting at this point was, that one started to develop gestures which could show different consonants at the same time, for example showing the “R” with the right and the “N” with the left hand. Without knowing if this brought more confusion than it helped in this particular place, I think it is nevertheless worth mentioning. It could be a sign that this kind of music would also demand new conducting gestures, or more generally thought, a new approach to this kind of multidimensional music as a composer and a conductor.

Audio-CD track no.6
5. Closing words

Unfortunately, the topic itself turned out to be much too big to cover it sufficiently. There are a lot of other topics, sidethreads, which could have had the potential for a own paper. Nevertheless I found some answers on the questions which I had when beginning the work. One would be, that the placing of different vowels, consonants, or generally texts simultaneously can generate problematic situations for the choir and the conductor if it is not applied consciously. When it is, however, it adds a new dimension to choral writing – and to me it seems a pity, that so little of it is used, or even recognised. On the other hand the conductors job is often to deal with the problems the composer did perhaps not take into consideration, to find ways to make it nevertheless sound easy – the direct problem solving of the conductors perspective could be another topic to delve into more deeply.

Nevertheless I learned a lot about a subject which was and is still interesting for me and hope, that the reader gets a insight in my work which I was doing in this two years study of choral conducting – perhaps someone feels inspired to do more detailed and thorough experiments, which eventually lead to scientific and artistic results. I wanted to thank all the singers which helped me to do the experiments, the Swedish Radio Choir for the time we could spend in rehearsing Schnittke and Carter, Christopher Elgh for an intensive support and for a lot of interesting discussions in these last weeks of my studies, and Professor Fredrik Malmberg for the last two years of teaching, which had been a very important time for my development as a musician.
6. Sources

Literature in order of appearance:
- https://www.internationalphoneticassociation.org/content/full-ipa-chart
  22.5.2017

Music examples In order of appearance::
- Gösta Nystroem: Golfiner (1966), Sveriges Körförbunds Förlag, Stockholm 1991
- Elliot Carter: musicians wrestle everywhere (1945), 1982 Theodore Pressler Company, Pennsylvania
- Edgard Varèse: Nocturnal (1961), 2000, Casa Ricordi, Milano
- Bengt Hambraeus: Motetum archangeli Michaelis (1967), 1969 Eriksförlaget, Stockholm
- Erik Bergman: Lapponia (1975), 1976, society for the publication of finnish music, Helsinki
7. Appendix

7.1 Formant list (after Catfort)

Average vowel formants[^5]

<table>
<thead>
<tr>
<th>Vowel</th>
<th>Formant F₁ (IPA)</th>
<th>Formant F₂ (Hz)</th>
<th>Difference F₂ – F₁ (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>240</td>
<td>2400</td>
<td>2160</td>
</tr>
<tr>
<td>y</td>
<td>235</td>
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</tr>
<tr>
<td>e</td>
<td>390</td>
<td>2300</td>
<td>1910</td>
</tr>
<tr>
<td>ø</td>
<td>370</td>
<td>1900</td>
<td>1530</td>
</tr>
<tr>
<td>ɛ</td>
<td>610</td>
<td>1900</td>
<td>1290</td>
</tr>
<tr>
<td>œ</td>
<td>585</td>
<td>1710</td>
<td>1125</td>
</tr>
<tr>
<td>a</td>
<td>850</td>
<td>1610</td>
<td>760</td>
</tr>
<tr>
<td>œ</td>
<td>820</td>
<td>1530</td>
<td>710</td>
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</table>
Average vowel formants

<table>
<thead>
<tr>
<th>Vowel (IPA)</th>
<th>Formant $F_1$ (Hz)</th>
<th>Formant $F_2$ (Hz)</th>
<th>$F_2 - F_1$ (Hz)</th>
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</thead>
<tbody>
<tr>
<td>α</td>
<td>750</td>
<td>940</td>
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<tr>
<td>ɔ</td>
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<td>760</td>
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</tr>
<tr>
<td>Λ</td>
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</tr>
<tr>
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</tr>
<tr>
<td>u</td>
<td>250</td>
<td>595</td>
<td>345</td>
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</tbody>
</table>

7.2. Intonation chord note (and some attached tables on the backside)

Intonationsackord

Ett sätt att skapa akord länkage för
intonationsövningar kan göras på följande sätt:

Man väljer en frekvens som inte den direkta
vinna på första formanten på nämnda frekvensen.

Därav krävs att vilje och med andra formanter på
den givna frekvensen.

Det önskas även att vilje och med andra formanter på
den givna frekvensen.

Ex III  $f_0 = 500 \text{ Hz}$

$\{ f_1 = 750 \text{ Hz}, f_2 = 1000 \text{ Hz}, f_3 = 1250 \text{ Hz}, f_4 = 1600 \text{ Hz} \}$

Ex III  $f_0 = 600 \text{ Hz}$

$\{ f_1 = 500 \text{ Hz}, f_2 = 575 \text{ Hz}, f_4 = 700 \text{ Hz} \}$
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<th>( s ) (m)</th>
<th>( b ) (m/s)</th>
<th>( y ) (m/s²)</th>
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<td>a</td>
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<td>65</td>
<td>131</td>
<td>2.48</td>
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<td>139</td>
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<td>3.7</td>
<td>73</td>
<td>149</td>
<td>2.94</td>
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<td>5.23</td>
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<td>e</td>
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Anders Colldéns note was found around November 2016 in the unpublic orchestral-part and choir reference library, which is attached just to the main library of the Royal College of Music in Stockholm (Valhallavägen 105, 11551 Stockholm) and is signed with AC 25.3.1982.
7.3. Edgar Varèse: *Nocturnal* (measure 64-68)

Edgard Varèse: Nocturnal (1961), 2000, Casa Ricordi, Milano
7.3 Vowel superposition tables

used for the meetings on Friday 10.3.2017, Friday 17.3.2017 and Thursday the 20.4.2017 (Track no.1,2,3 on the Audio CD)
8.CD / DVD

Tracklist DVD:

- General Rehearsal with the Swedish Radio Choir
  (rehearsing Lidholm, Schnittke, Carter, and Tarrodi)

Tracklist CD:

1. Vowel superposition table 1 – unison
2. Vowel superposition table 1 – duodecima
3. Vowel superposition table 2
4. own trials: „auch ich bin ein sterblicher Mensch“
5. own trials: “… die nicht satt wird von Wasser”
6. own trials: „und Weinen war mein erster Laut“