vocal & instrument enhancement

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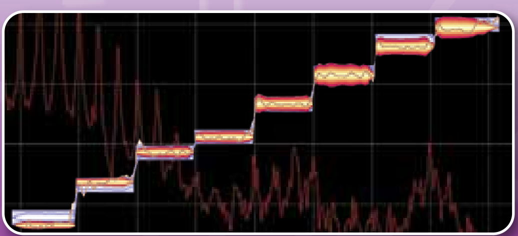
Scientific Report analysing the Effect of VoiceMagic™ on Human Voice.

by John Robinson
(director of Clique Production)
and Spring Beirer
(director of VoiceMagic™).

VoiceMagic™: where Magic merges into Sound



Magically transforming your sound!

VoiceMagic™ Vocal enhancement

Spring Beirer is the director of **VoiceMagic™** Vocal enhancement, which consists of the use of VortexHealing® Divine Energy Healing, NLP, and Hypnotherapy as the main coaching tools.

It is through the use of VortexHealing® Divine Energy Healing that the Vocal or Instrument enhancement is possible. In order to enhance the Vocals in this case, Spring Beirer channels this energy to work on the Vocal cords, and remove any blockages the artist may have that influence their singing capacity and the quality of their vocals. However to enhance the vocal quality this fascinating energetic tool, which is VortexHealing® Divine Energy Healing, enables Spring Beirer to instilled the vocal qualities into the vocals of the artist permanently.

"I decided to analyse the frequency spectrum of the voices of the participants after they had been given a free trial of the **VoiceMagic™** Vocal enhancement through VortexHealing® Divine Energy Healing.

The analysis shows that on a trial based on 2 subjects, a shift in the relative levels between the harmonics in the voice took place, resulting in the voice sounding richer and more appealing to the listener.

The research and some of the conclusions drawn from it are described below".

John Robinson, Clique Productions

Spring Beirer and Anita Maj during one of the sessions conducted for the study with John Robinson.



John Robinson and Anita Maj during one of the sessions for the study conducted at Clique Productions Studio, London.

Recording Vocal Samples for Analysis

The participant in this study was a moderately experienced female vocalist. The participant was asked to perform a vocal phrase & then repeat the same vocal phrase on three separate vocal sessions. The first and second vocal session took place on the same day within an hour of each other. In between these two sessions a VoiceMagic™ Vocal enhancement session was given to the Vocalist by Spring Beirer.
The final vocal session occurred one week after the first vocal session.

The vocal performances from all three sessions were recorded in an acoustically treated vocal booth located in a commercial recording studio.

The microphone (Neumann TLM103) was fixed in position for all the sessions and the vocalist's head position was lined up with markers placed on the walls as shown in Fig 1. below.

After some preliminary level checks were made, the recording process began. The vocals were recorded through a clean signal path free of equalization or compression using a TLA C1 pre-amp then digitalised to 24bit audio using a MOTU 2408 audio interface linked to a Mac G5 dual processor Power Mac computer running Logic Pro music software. The Digital recordings were stored on the computer as 24bit Aif files for analysis.

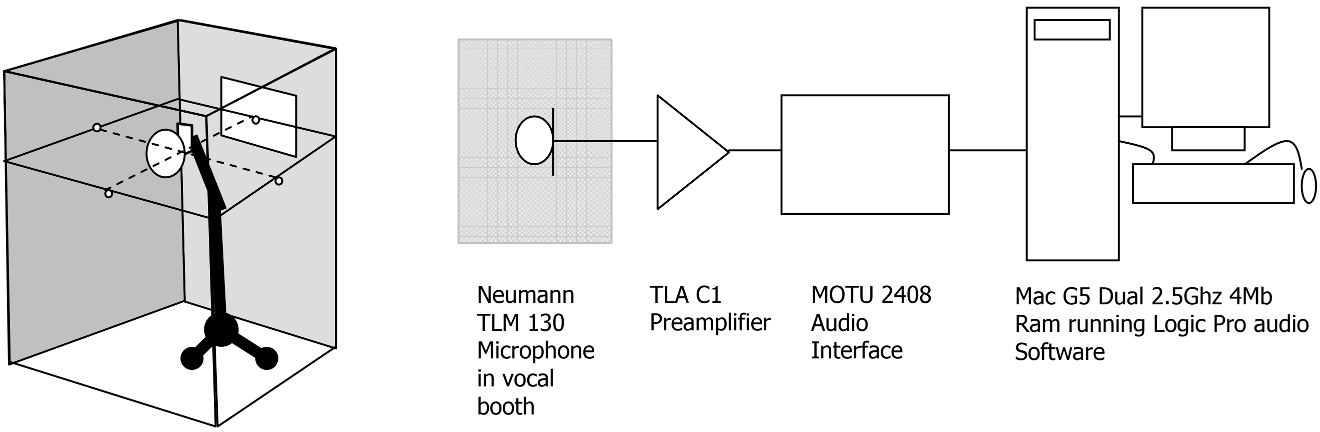
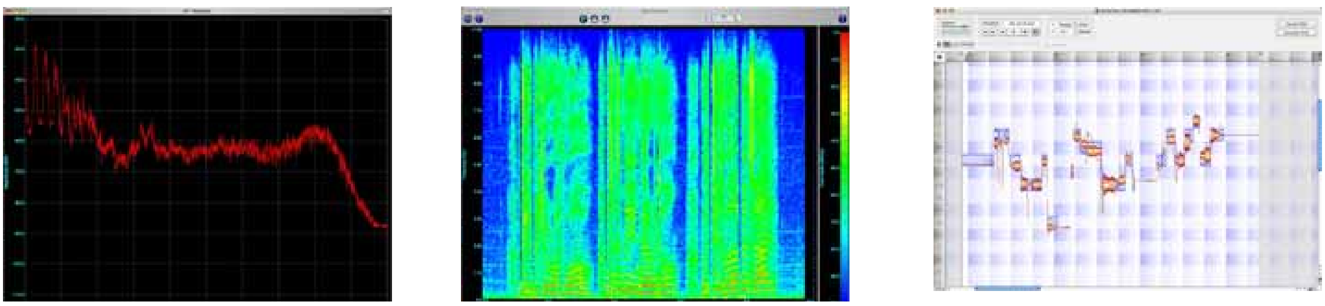


Fig 1. Microphone in the 2m x 2m x 2.4m vocal booth, showing the location of the microphone stand and the markers used to fix the position of the vocalists head. The signal path from microphone to computer is also shown.

The analysis of the digital samples took place after the final VoiceMagic™ Vocal enhancement session and required the use of specialised software. For analysis of the frequency spectrum, SampleScope software was used. This provided FFT and Sonogram responses. Melodyne pitch correction software was used to estimate the accuracy of pitch in the vocal recording, when compared to the notes from a piano keyboard. The graphic display in this software allows inspection of the harmonics present in the samples.



SampleScope FFT display | SampleScope Sonogram output | Melodyne pitch correction software

Fig 2. Example of the graphical output of the software used to analyse the digitalised audio samples.

During each recording session, the vocalist was asked to repeat the same 3 lines of a song, followed by one sustained 'La' note sung one octave above middle C.

The samples were grouped into 3 conditions: Before, After & Later. The FFT displays from each of the 3 lines of the song are shown in fig 3 below. The three 'La' vocal sample's FFT are shown in fig 4.

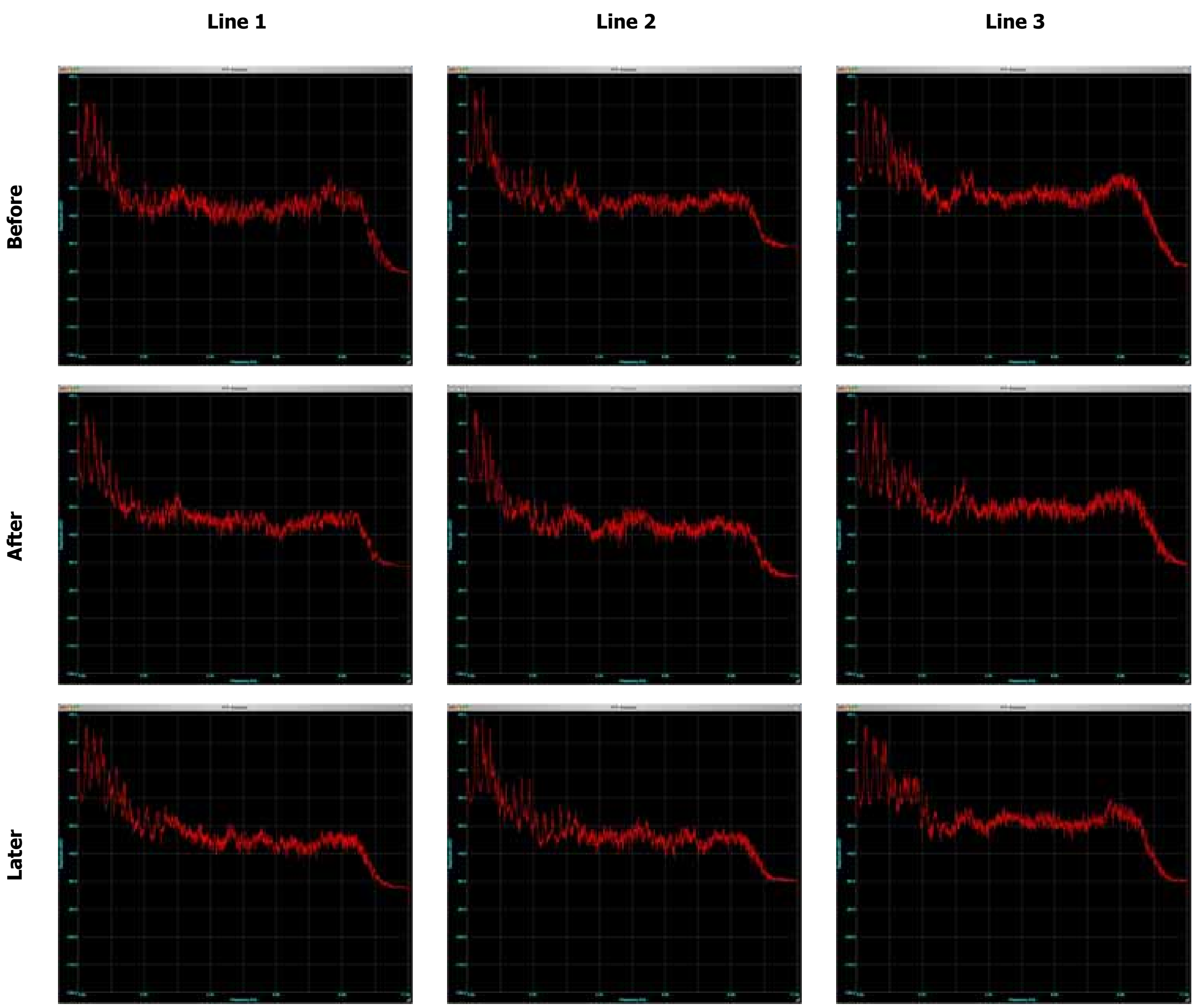


Fig 3. FFT graphics created by SignalScope software for each of the 3 lines of the song. These graphs were generated for the vocal samples recorded for each of the 3 conditions: Before, After & Later.

Harmonic Analysis

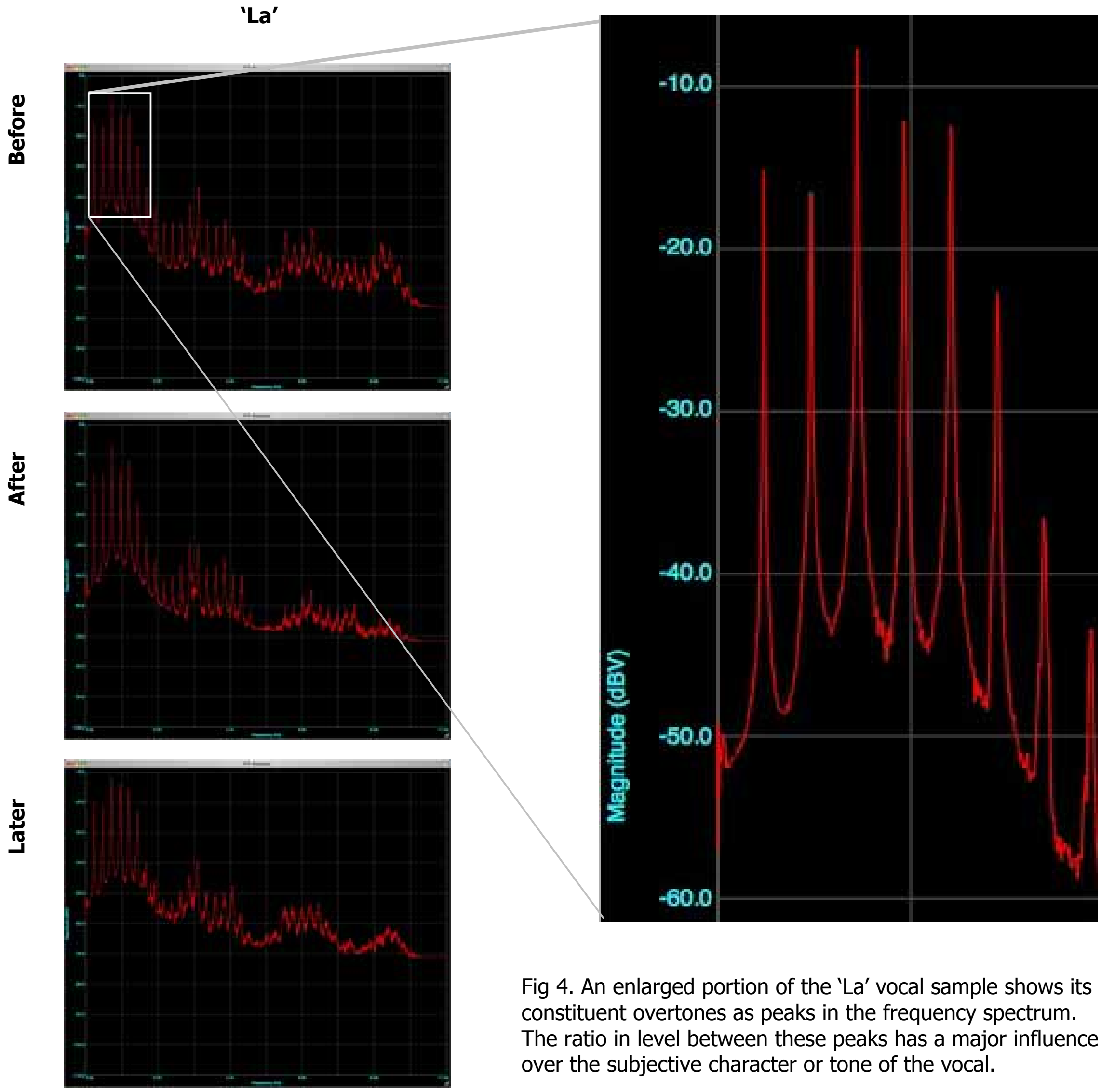


Fig 4. An enlarged portion of the 'La' vocal sample shows its constituent overtones as peaks in the frequency spectrum. The ratio in level between these peaks has a major influence over the subjective character or tone of the vocal.

In the enlarged portion of the La sample FFT in fig 4 above, the relative levels of some of the overtones within the sample are shown. The first peak, the fundamental or 'first harmonic', defines the pitch or 'key' of the note. In this case the note corresponds to 550Hz, or the first C above middle C on the piano keyboard. The subsequent overtones combine together to create the character or tone of the vocal. When the frequency of the overtones are integer multiples of the fundamental frequency they are called harmonics. The non-harmonic overtones are often called partial tones, or partials.

Sounds like bells or drum membranes have many complex vibrations; the majority of these will not be exact multiples of the fundamental frequency. The frequency content of a synthesized square wave contains harmonics that are exclusively even multiples of the fundamental. A clarinet will produce a sound that has predominantly odd harmonics.

The harmonic character may be described in many ways. It may be thought of as shrill or thin as in the case of a violin sample, or rich and smooth closely resembling a flute.

The overtones in the 'La' sample are equally spaced and so are true harmonics of the fundamental, the 2nd harmonic being double the fundamental at 1100hz, and the third occurring at 1650Hz. The harmonic content of the sample in this case shows a variation between the 2nd and 3rd harmonic of 8dBV, making the 3rd harmonic over 2.5 times the level of the 2nd.
In musical terms, the first harmonic is the fundamental. The second harmonic is an octave above. The third harmonic is an octave and a fifth above the fundamental. The fourth harmonic is two octaves above the fundamental. The fifth harmonic is a major third higher, the sixth is another minor third higher, and the series continues.

Harmonic Transform

An in-depth analysis of the relative levels between harmonics within the sampled sound will give a mathematical description of the character of the recorded sound. The variations between different recordings of the same vocal lines or phrases can then be compared and a mathematical transformation constructed to describe them.

Harmonic	Ratio	Transform	Harmonic	Ratio
1	1	0	1	1
2	1.2	-0.1	2	1.1
3	2.5	0.3	3	2.8
4	0.7	-0.3	4	0.4
5	0.4	-0.1	5	0.3
6	0.2	0.5	6	0.7
7	0.8	-0.5	7	0.3
…		0	…	
…		0	…	
12	0.2	0.4	12	0.6
13	0.1	0.5	13	0.6
Sample 1 (Before)		Transform 1	Sample 2 (After)	

Fig 5. Harmonic transformation diagram showing the effect of the transformation on the first 13 harmonics of a vocal sample.

The transforms calculated form a selection of recordings that have 10 or more harmonics that can be combined to generate an average transform associated with the treatment or vocal lesson or other activity that took place between the collection of the vocal samples.

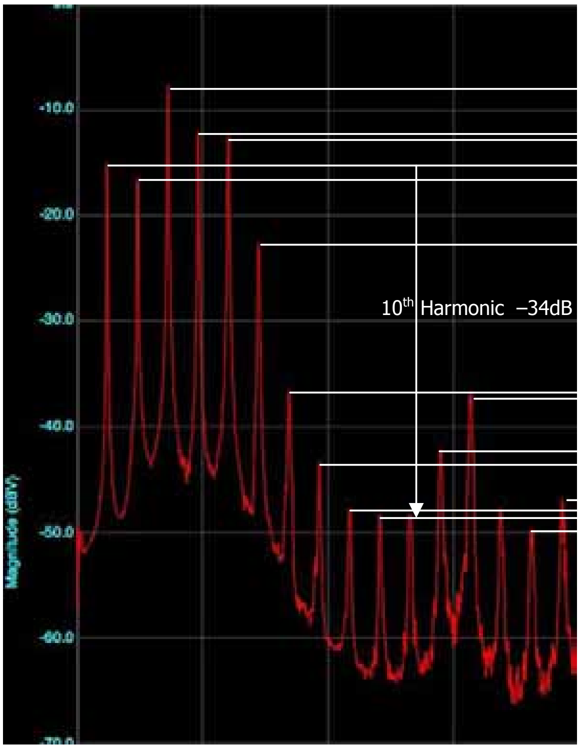
Harmonic Transform: Analysis of 'La' Sample

In fig 6. below are the FFT displayed for the first 15 harmonics of the 'La' sample recorded Before & After the vocal transformation. The figures in the far left & far right tables correspond to the difference in level (in dBV) between the fundamental and the corresponding harmonic. The central column shows the difference between these values.

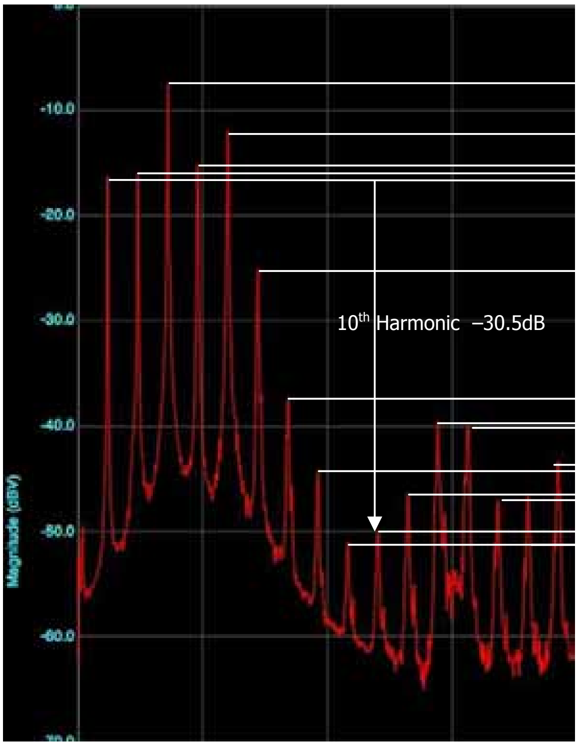
For example, the 10th Harmonic in the 'La' Before table is –34dBV down from the fundamental.
The same harmonic in the 'La' After is –30.5dBV down from the fundamental.
The harmonic has been shifted in level by 3.5dBV, the harmonic's level has increased by a factor of 1.5.

If this process is repeated for several samples taken from a range of different sung 'La' notes, an average transform value can be calculated. If it could be shown that this Average Transform is similar across a range of vocalists then it can be inferred that the training effect is a consistent and significant phenomenon that produces predictable effects across a range of different vocalists.

'La' Before



'La' After



Harmonic	dB	Transform dB	Harmonic	dB
1	-1.4	2.3	1	0.9
2	7.4	2.2	2	9.6
3	3	-1.4	3	1.6
4	2.5	2.2	4	4.7
5	-7.7	-1.1	5	-8.8
6	-21.9	0.8	6	-21.1
7	-28.9	0.8	7	-28.1
8	-33.3	-1.9	8	-35.2
9	-34	0	9	-34
10	**-34**	**3.5**	**10**	**-30.5**
11	-27.6	4	11	-23.6
12	-22.5	-1.4	12	-23.9
13	-33.3	2.4	13	-30.9
14	-35.3	4.4	14	-30.9
15	-32.3	4.7	15	-27.6

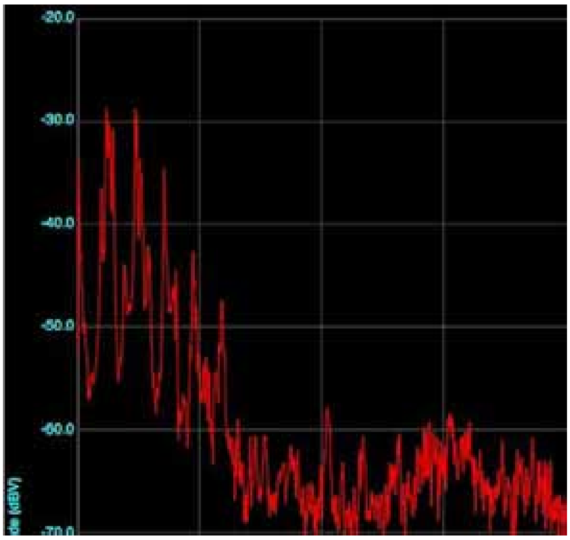
Fig 6. The 10th Harmonic is selected to show the shift in level between the Before & After 'La' samples is 3.5dBV or increased by a factor 1.5

Harmonic Transform: Analysis of 'Line' Vocal Sample

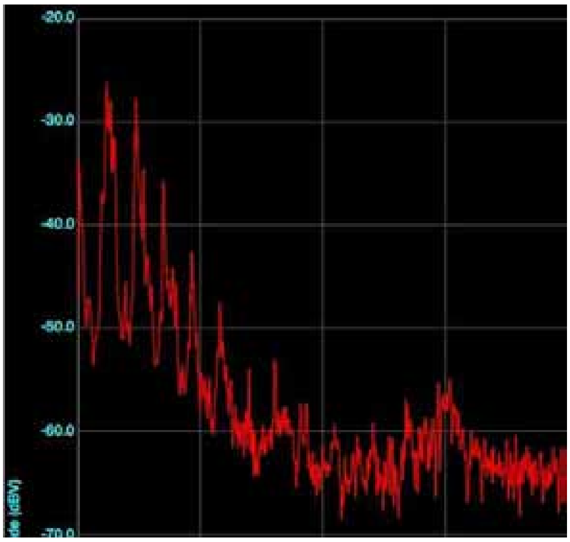
In fig 7. below are the FFT displayed for the first frequency range of 20Hz to 4Khz. Line 1 was a short melody comprised of 7 words, and, unlike the 'La' sample, which is a single note comprised mostly of harmonics of the fundamental frequency, the sample here is made up of a combination of harmonics and partials. Partials are frequencies that are a non-integer multiple of fundamental frequency. These partials can be much closer together in the frequency spectrum and can dramatically increase the complexity of the FFT display.

Although some general features are observable, it is clear that to use the harmonic transform technique analysis here we will need to isolate the sung notes of the line 1 and analyse them separately.

'Line 1' Before



'Line 1' After



From here on it was decided that we would use only individually sung notes as samples for the analysis. This was achieved by recording a scale covering one octave, starting at middle c on the piano keyboard. The scale was played to the participant via headphones and they were asked to copy as closely as possible the notes from the scale.

Harmonic Transform: Analysis of the sample of a sung scale

The spectrum analyser data was collected and analysed for the octave scale of 2 participants, both of which had asked Spring Beirer to help them enhance their tone and tuning. They specifically requested an enhanced or more attractive tone in their vocals, one which would retain its original basic character but smooth and sweeten the tone while removing any harshness and any perceived dullness. Any change in the vocal tone fitting these parameters would require a significant change in the relative levels of harmonics present within the singer's vocal sound.

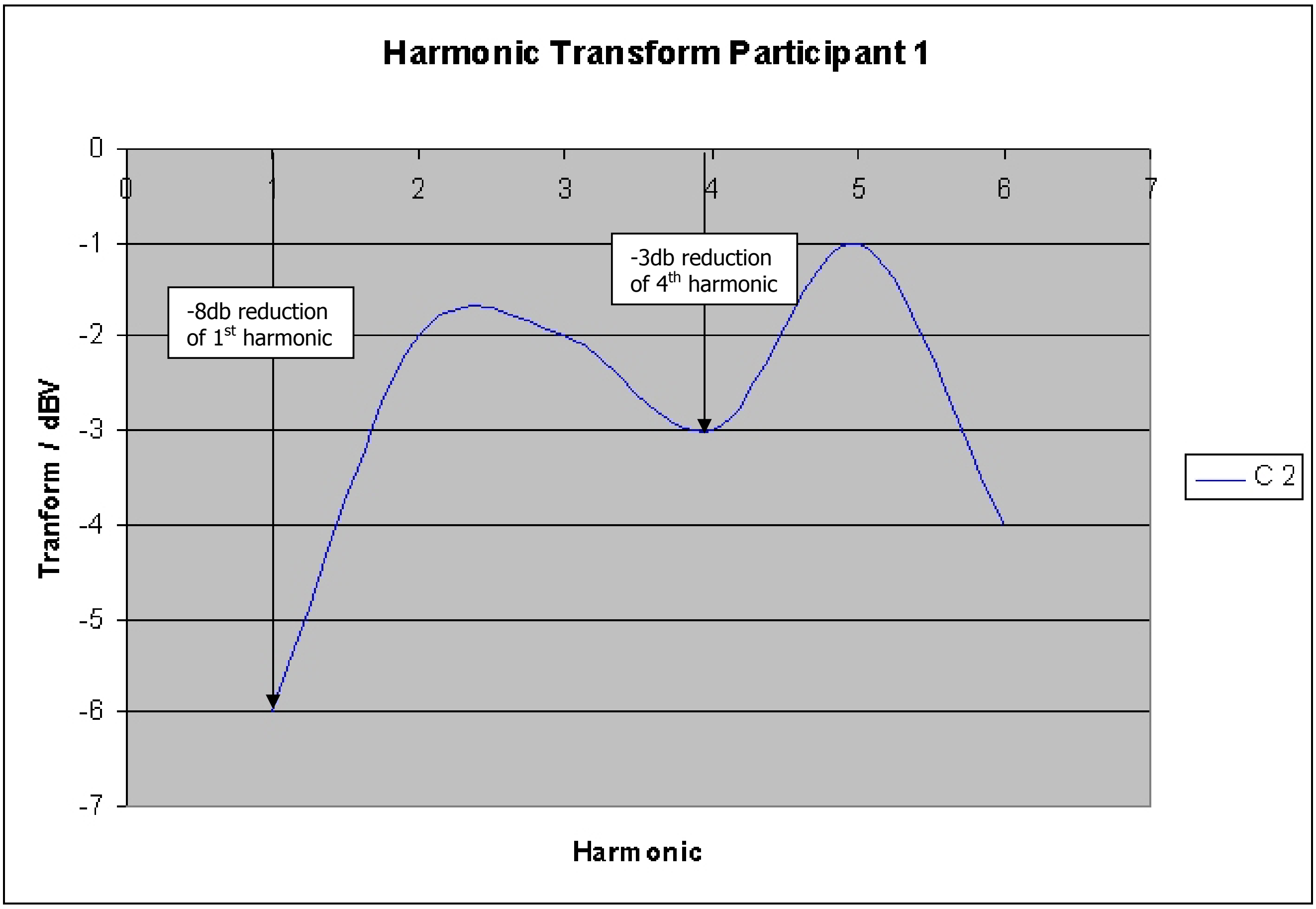
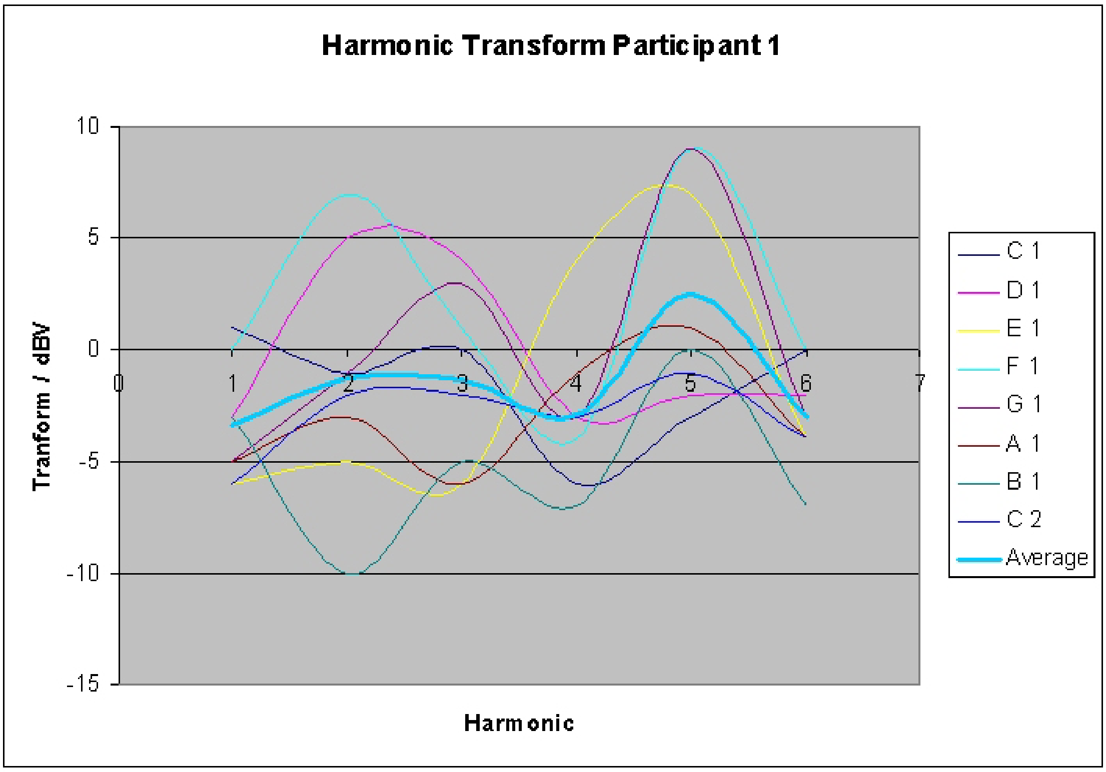
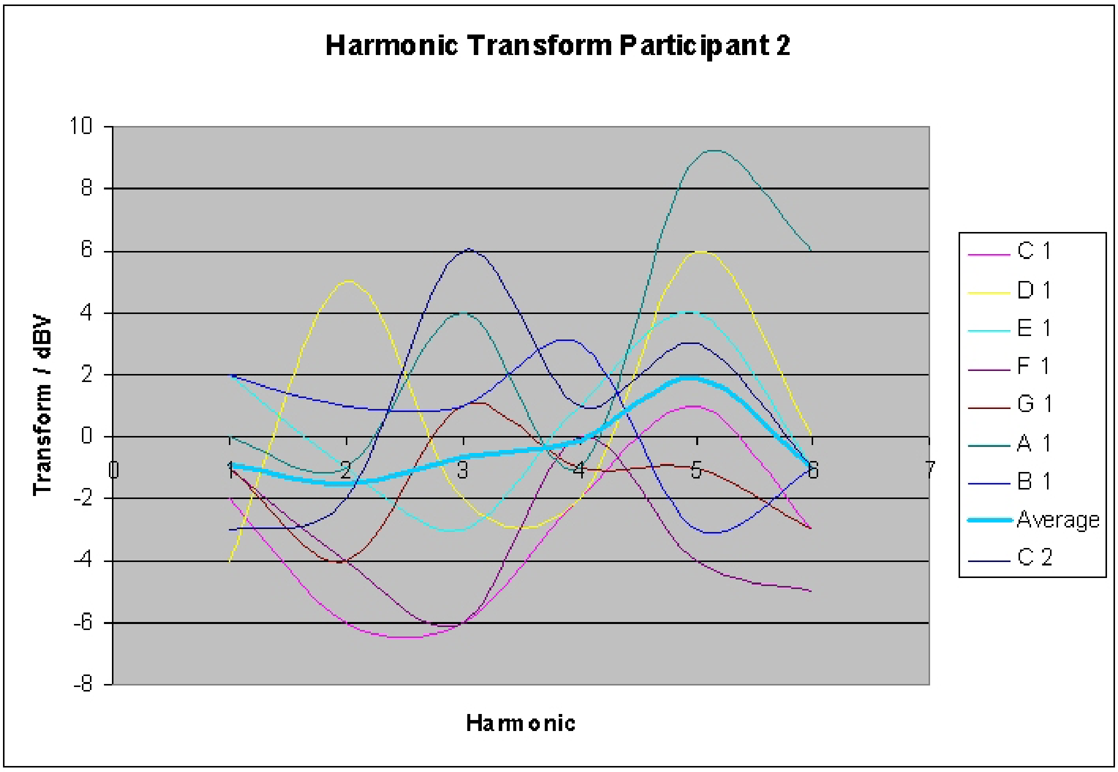


Fig 8. The results were compiled for each note sung starting at Middle C on the keyboard. Fig 8 above shows the last note of the scale, C above middle C. It shows that relative to the 'before' scale the note has a reduction in harmonics with a greater reduction at the 1st and 4th harmonic.

The results from all the sung notes from the scale were then combined to produce the graph shown in fig 9 below. For simplicity only the first 6 harmonics were used. The thick blue line shows the average of all the data. On average the first few harmonics are reduced, with the 5th harmonic being slightly increased.



The results for a second participant have been used to produce the graph shown in fig 10 below. The thick blue line shows the average of all the data. The graph shows similar trends in that, on average the early harmonics are reduced, with the 5th harmonic being increased by about 2dBV.



Harmonic Transform: Conclusion

The changes in tone of the vocals appeared as a shift in the relative levels of harmonics in the voice samples, with the lower harmonics being suppressed, while the 5^{th} harmonic, a frequency five times that of the fundamental, increased. The participant vocalists from the trial agreed that the variation in the fifth harmonic relative to the others seemed to give their vocals a richer and more appealing sound.

Spring Beirer

John Robinson

Written in January 2010 in London, U.K.
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To email John Robinson, send and an email to cliqueuk@hotmail.com or visit www.myspace.com/cliqueuk

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