SCIENTIFIC ANALYSIS OF SINGING ATTRIBUTION IN THE CASE OF THE ALBUM "MICHAEL"

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0. INTRODUCTION

GOAL

This treatise will illustrate objective analysis methods as applied to the examination of a posthumously released Michael Jackson recording in which it is questioned whether the voices on all of the songs on the recording are actually the voice of Michael Jackson. For the most part, litigation regarding musical material has appealed to so-called "golden ears" – listeners with allegedly special listening abilities. We will suggest that those opinions can be supplanted by scientific methods such as those elucidated here.

Singer identification has much in common with speaker identification. However, they are not the entirely the same. Singers use the lungs, the vocal folds, the vocal tract -- as do speakers. Yet they use them differently. In addition, neural control of singing may differ from neural control of speaking as evidenced by the observations that it is easier to memorize songs than equivalent spoken materials and that it seems easier to imitate foreign dialects while singing than speaking.

From this perspective, analysis of singing opens fundamental issues in identification of people by their voices.

Analysis of commercially recorded music is also special because it is usually modified electronically. This has to be taken into account, which we will do in the analysis presented here.

Everybody talks, but not everybody sings, at least not well. Skilled singing offers characteristics to examine that are not available to examine in ordinary speech. In this analysis, we will examine those special characteristics.

THE ALBUM MICHAEL, ALLEGEDLY FIRST ORIGINAL MATERIAL

The album ***Michael*** was released in 2010, following the death of the "King of Pop," recording artist Michael Jackson. The album was the first release of allegedly all new Michael Jackson material in the nine years since *Invincible* in 2001.

CONTROVERSY

It has been suggested by many of Jackson's fans and others that three of the songs on **Michael**, namely, "Breaking News," "Keep Your Head Up" and "Monster," are not the voice of Michael Jackson. According to the release notes, these three songs were produced by Eddie Cascio, James Porte and Michael Jackson. They are often referred to as the Cascio recordings. These three songs have been ascribed to a singer named Jason

Malachi; however, it is not our intention to prove that the singer is in fact Jason Malachi. Rather, it is only to decide whether it is Jackson. Nonetheless, if it is Malachi, it cannot be Jackson.

According to Howard Weitzman, an attorney for Jackson's estate, skilled listeners affirmed that all the voices on the album Michael were the voice of Jackson. (However, from public statements of people who attended the listening session, we have learned that not all the listeners agreed that the voices on all the songs were those of Michael Jackson.) Additionally, Weitzman claimed that musicologists performed "waveform analysis" that confirmed that the voices were those of Jackson. In order to assess the credibility of the waveform analysis, it would be necessary to know exactly what was done.

It would also be useful to know the identity and credentials of those musicologists. In any event, the analyses we have performed are very much more detailed and accurate than waveform analysis, as will become clear in the material that follows. Weitzman's letter can be found as an Appendix to this report.

Our goal is to provide a definitive analysis and conclusion based on objective criteria.

1. DIALECTS –

GLOTTAL STOP AS AN ALLOPHONE

A glottal stop is a consonant sound made by holding the vocal folds together so that they occlude the vocal tract.

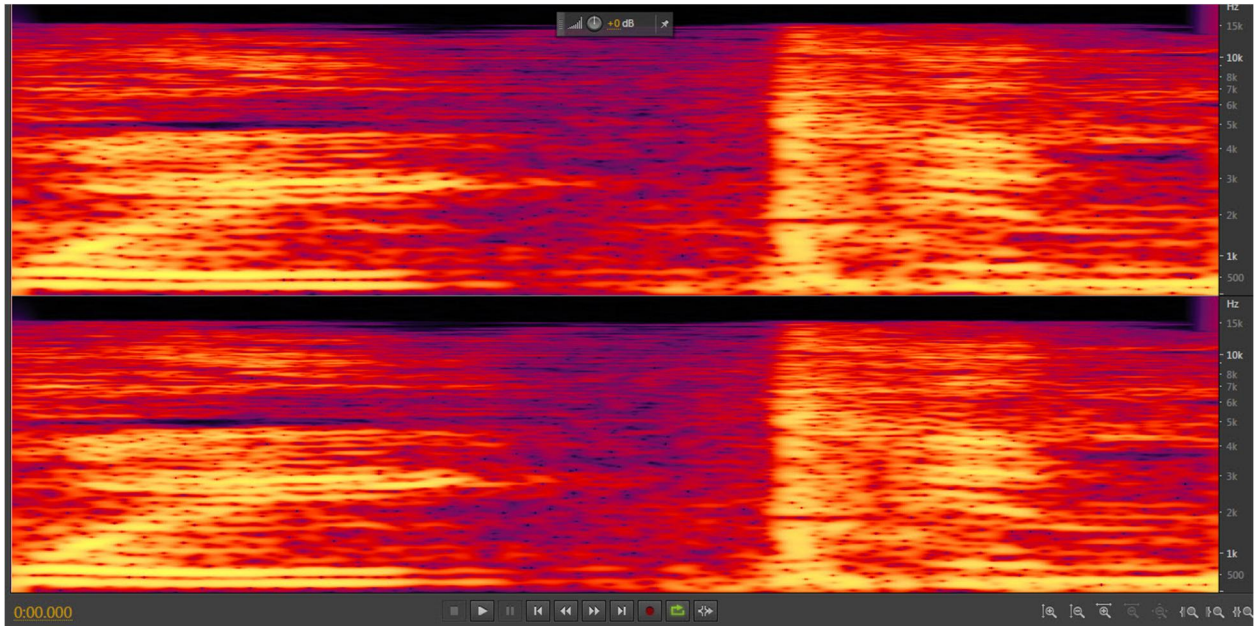
In some languages, such as the African language Hausa or the American Indian language Nez Perce, the glottal stop is a fundamental distinctive sound, known as a *phoneme*. In English, the glottal stop sound occurs in some dialects as a variant of the /t/ sound. In that case, it is described as an *allophone* of the /t/ sound.

In the recording of Monster, the sound in the middle of the word "waiting" is a glottal stop. The singer pronounces it as [wai'in].

A review of Jackson's recordings over his entire career, spanning 39 years, (1969-2008) shows that he does not use the glottal stop allophone in this position. By contrast, the singer Jason Malachi uses the glottal stop routinely in this position.[i]

The glottal stop allophone in this position is characteristic of the speech of Brooklyn, New York. [ii] Quoting Malachi's bio: "I was born in Silver Spring, Maryland; however, my family is originally from Brooklyn, New York." Assuming he learned to talk from his parents, or at least was

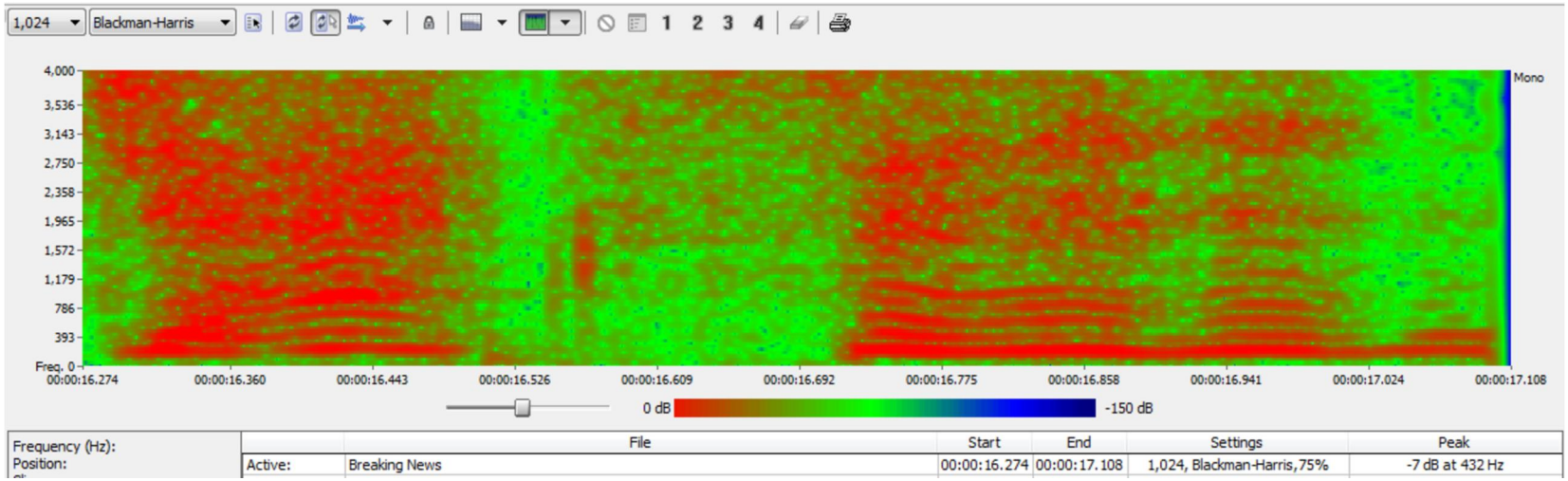
influenced by them, the glottal stop in this position would be expected from him. However that may be, the fact is he uses it, whereas Michael Jackson does not.



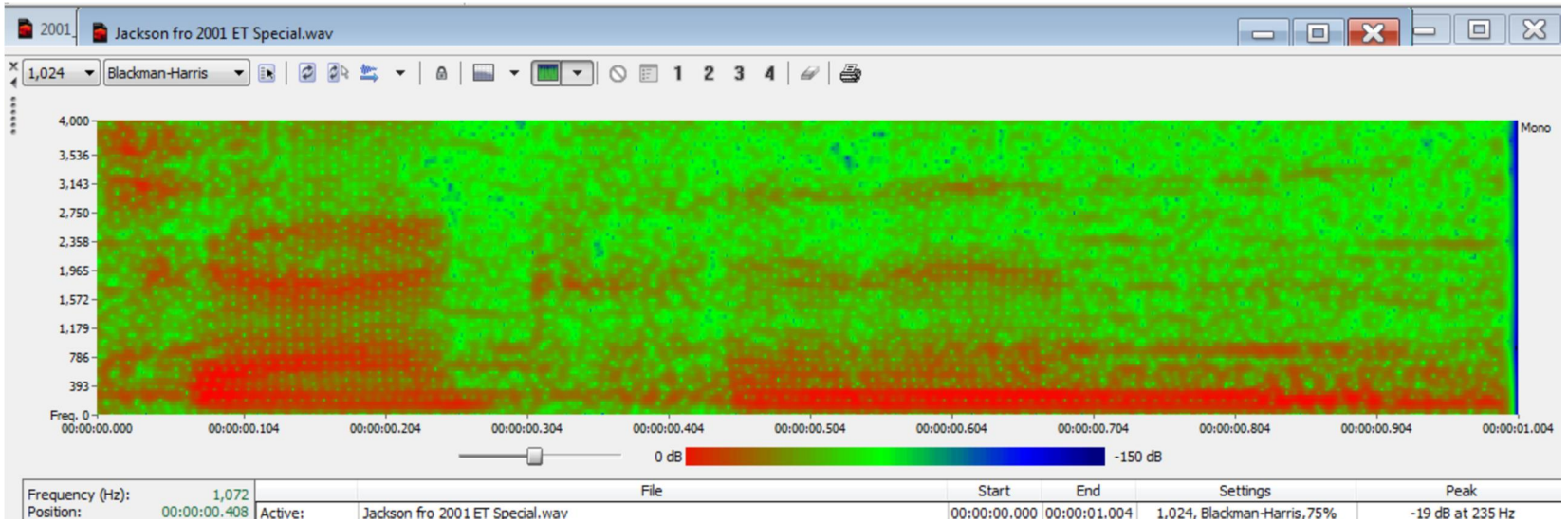
Spectrogram of wai'in from "patience wai'in," (Malachi song "What does it take"), drum reduced.

PRONUNCIATION OF "JACKSON"

In Breaking News, the final syllable of *Jackson* is pronounced [sEn] with the vowel as in send. This is shown in the following spectrogram from about the 16.7 mark through about the 16.9 mark.



By contrast, When Michael Jackson pronounces his name he uses what phoneticians call the “schwa” sound, a neutral vowel sound. An example is provided here from his pronunciation of Jackson in an interview in an ET special in 2001. This is seen in the following spectrogram from about the 0.5 mark to about the 0.7 mark.



Other examples of speech with the schwa sound include:

Name	Type	Modified	Size	Ratio	Packed
2003_Living With Michael Jackson.wav	WAVE Audio File	4/10/2014 9:50 PM	235,664	1%	233,607
1983_Diane Collins interview.wav	WAVE Audio File	4/10/2014 9:54 PM	409,352	19%	333,473
1993_Michael Jackson talks to Oprah.wav	WAVE Audio File	4/10/2014 9:05 PM	334,998	4%	320,848
1993_Michael Jackson talks to Oprah-2.wav	WAVE Audio File	4/10/2014 9:08 PM	79,362	4%	76,098
1995_PrimeTime with LMP and Diane Sawyer.wav	WAVE Audio File	4/10/2014 9:27 PM	85,194	3%	82,862
1995_PrimeTime with LMP and Diane Sawyer-2.wav	WAVE Audio File	4/10/2014 9:31 PM	72,558	3%	70,552
1997_20-20 with Barbara Walters.wav	WAVE Audio File	4/10/2014 9:35 PM	21,889	4%	21,083
2001_ET Special.wav	WAVE Audio File	4/10/2014 9:37 PM	131,856	4%	126,386

2. VIBRATO

JASON MALACHI'S PRODUCER'S OPINION

On listening to the vibrato in the song "Breaking News," Jason Malachi's former producer Tony Kurtis offered the following opinion:

> I am saying as a sound expert this recording is without a doubt Jason. […] they pitched the vocals to try and make [Jason] sound more like Michael. We have Michael Jackson's *a cappella* vocals as well. You can pitch MJ vocals all day; they won't sound anything like that [voice on "Breaking News"]. MJ's vibrato isn't as fast as Jason's, plus Jason over uses his. Michael can really sing; he doesn't use it as much. I [produced] the Jason Malachi records, which is why I know the vocals [on "Breaking News"] are him.[iii]

This is clearly an important claim, which it behooves us to assess carefully. Therefore, in order to objectively assess the validity of this comment we analyzed the characteristics of the vibrato in Breaking News and compared it with the characteristics of the vibrato in uncontested Michael Jackson recordings.

VIBRATO is a rapid variation of pitch used to enhance the richness of tone and expressiveness of instrumental and singing music. It is an important and distinctive characteristic of singer's voices. Although technically speaking vibrato is only a variation of pitch, it is usually accompanied by variations in other factors such as intensity and harmonic ratios, which merge with pitch into a single perceptual effect. In common usage, the term vibrato is often applied to the combined effect.

From an artistic point of view it seems brutal to tear apart the several aspects of vibrato. Nonetheless, in the analyses that follow we will analyze them separately, which will allow us to see how singers produce vibrato effects and will give us information about individual singers.

For clarity in presentation, we will label our analysis of the pitch aspect of vibrato '*pitch vibrato'*. For our analyses, pitch is measured as the rate of vibration of the vocal folds.[iv] The perceptual quality of pitch may involve other factors, which we will mention when they are relevant. The technical measure of pitch is the number of cycles per second, which is denominated by *Hz*. For those who are more accustomed to think in musical notation, we have included measures in semitones, (as well as mels and ERBS, which are measures that are useful in audiology).

In looking at graphs of vibrato, we can observe the smoothness of the curves, which correspond to the smoothness of the variation in the vibrato. We can also see other important qualities such as how tightly it is controlled, how long and smoothly it is sustained and whether it stays true to the note being sung.

We will calculate the average pitch, which varies according to the note being sung. More importantly, we will calculate the range of the pitch; that is, the difference between the peak pitch and the minimum pitch. We will also calculate the standard deviation of the pitch, which is a measure of how variable the pitch is. It takes into account the extent of the vibrato as well as whether the vibrato wanders off the note being sung.

We also calculate the mean absolute slope per second, which shows how fast the pitch changes. In musical terms, it is related to glissando.

The vibrato rate is the duration of vibrato divided by the number of cycles that occur in the duration of the vibrato.

Prior research has shown that the ideal vibrato rate tends to be about 6.5 through 7 Hz. (See Chapter 4, "Vibrato," in Seashore, C.E. The Psychology of Music, Dover, 1967, first published by McGraw-Hill, 1938; Ward, W.D. 1970. Musical Perception in Foundations of Modern Auditory Theory, Ed. J.V. Tobias, New York, Academic)

TREMOLO is a rapid variation in intensity. Perceptually, it is related to loudness. The technical measure of intensity is decibels, which is abbreviated dB. We calculate the average level of intensity as well as the standard deviation of the intensity. (Tremolo also has other meanings in music. It can refer to rapid back and forth strokes of a violin bow or rapid alternation between two musical notes. However, in this treatise we use it only to refer to rapid variation in intensity.)

HARMONICITY is the ratio of harmonic components to uncorrelated components. It is related to the smoothness of the action of the vocal folds. Perceptually, it measures the smoothness or roughness of a voice. In the extreme, smokers or people with vocal cancer have very low harmonicity. Higher numbers of harmonicity correspond to more harmonious voices.

In a subsequent section, we present detailed graphs and calculations of the vibrato of Breaking News and Speechless. Readers may wish to read the Brief Interim Commentary before examining the graphs and calculations in detail.

BRIEF INTERIM COMMENTARY ON VIBRATO RESULTS

PITCH VIBRATO GRAPHS

In comparing the pitch vibrato of the selections of Breaking News as opposed to those of Speechless, three differences are very apparent: Smoothness, sustained quality and adherence to the note being sung.

1. The curves of the Speechless graphs are dramatically smoother than those for Breaking News. They are much better and more consistently sustained.

2. The adherence to the note being sung is shown by the extent to which the graph is level along the horizontal axis. The curves for Breaking News wander off a level path, whereas those for Speechless do not.

CALCULATIONS

We now turn to the numerical calculations, which are summarized in the tables Breaking News and Speechless.

Breaking News

	PITCH VIBRATO					TREMOLO		HARMONICITY	
	Average (Hz)	Range (Hz)	Standard Deviation (Hz)	Rate (Hz)	Mean Abs Slope (Hz/s)	Average (dB)	Standard Deviation (dB)	Average (dB)	Standard Deviation (dB)
"PIECE"	218.38	37.42	12.38	12.00	445.60	67.40	2.30	8.33	2.54
"JACKSON"	197.60	49.69	11.93	13.27	523.70	64.37	2.67	5.73	1.36
"MOVES"	218.24	45.95	13.13	13.30	445.20	68.36	4.40	10.06	3.97
AVERAGE	211.41	44.35	12.48	12.86	471.50	66.71	3.12	8.04	2.62

Speechless

	PITCH VIBRATO					TREMOLO		HARMONICITY	
	Average (Hz)	**Range (Hz)**	**Standard Deviation (Hz)**	**Rate (Hz)**	**Mean Abs Slope (Hz/s)**	**Average (dB)**	**Standard Deviation (dB)**	**Average (dB)**	**Standard Deviation (dB)**
"MAGICAL"	230.38	14.82	3.15	6.79	101.50	58.79	2.29	22.01	2.21
"FEEL"	219.99	16.76	4.35	7.08	154.80	59.81	2.39	22.03	2.61
"EXPLAIN"	261.06	20.80	5.01	7.76	183.40	64.11	1.97	27.40	3.63
Averages	237.14	17.46	4.17	7.21	146.57	60.90	2.22	23.81	2.82

PITCH VIBRATO

Pitch averages provide a reference point that is used in the calculation of standard deviation.

The pitch vibrato range is greater for Breaking News than for Speechless. This shows that, as is apparent from the graphs, that the pitch vibrato is better controlled in Speechless. The standard deviation takes the average into account, and is therefore more comparable across different notes. Again, it shows the tighter control in Speechless.

The mean absolute slope is a numerical characterization of the concept of musical glissando. It is more tightly controlled in Speechless than in Breaking News.

As we can see from the Rate calculations, Jason Malachi's former manager is correct when he says that the rate of vibrato is higher in Breaking News (average12.86 cycles per second) than in the known Jackson recording Speechless (average 7.42 cycles per second). Moreover, the rate in Speechless is essentially what is regarded as ideal according to prior music commentary.

TREMOLO

As shown by the standard deviations, the tremolo of Speechless is more tightly controlled than that of Breaking News.

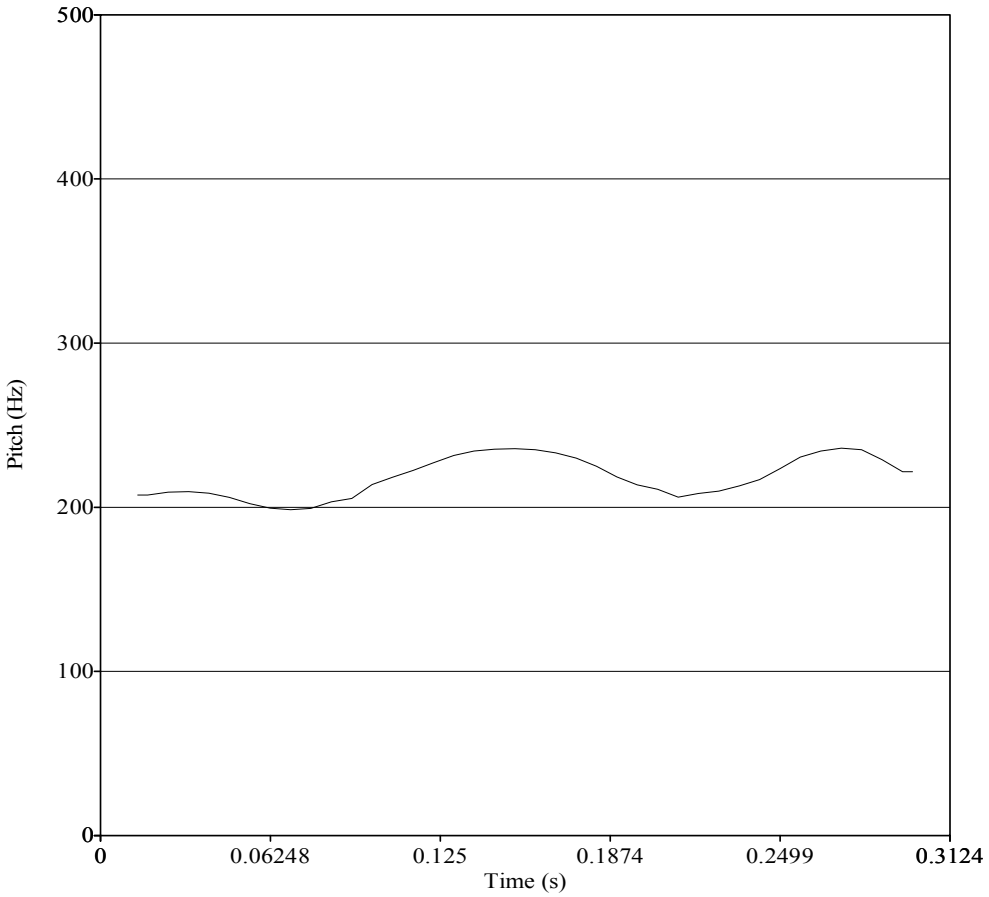
HARMONICITY

Recall that higher harmonicity implies more harmonious voices. Average harmonicity is greater for Speechless than for Breaking News.

VIBRATO EXAMPLES: BREAKING NEWS

BREAKING NEWS VIBRATO IN THE WORD “PIECE” 15.014-15.327.

GRAPH OF PITCH VIBRATO:



Calculations:

Minimum: 198.53864 Hz = 169.512501 Mel = 11.8730378 semitones above 100 Hz = 5.33242806 ERB

Maximum: 235.957612 Hz = 196.341521 Mel = 14.8623326 semitones above 100 Hz = 6.09444325 ERB

Range: 37.42 Hz = 26.8290198 Mel = 2.989 semitones = 0.762 ERB

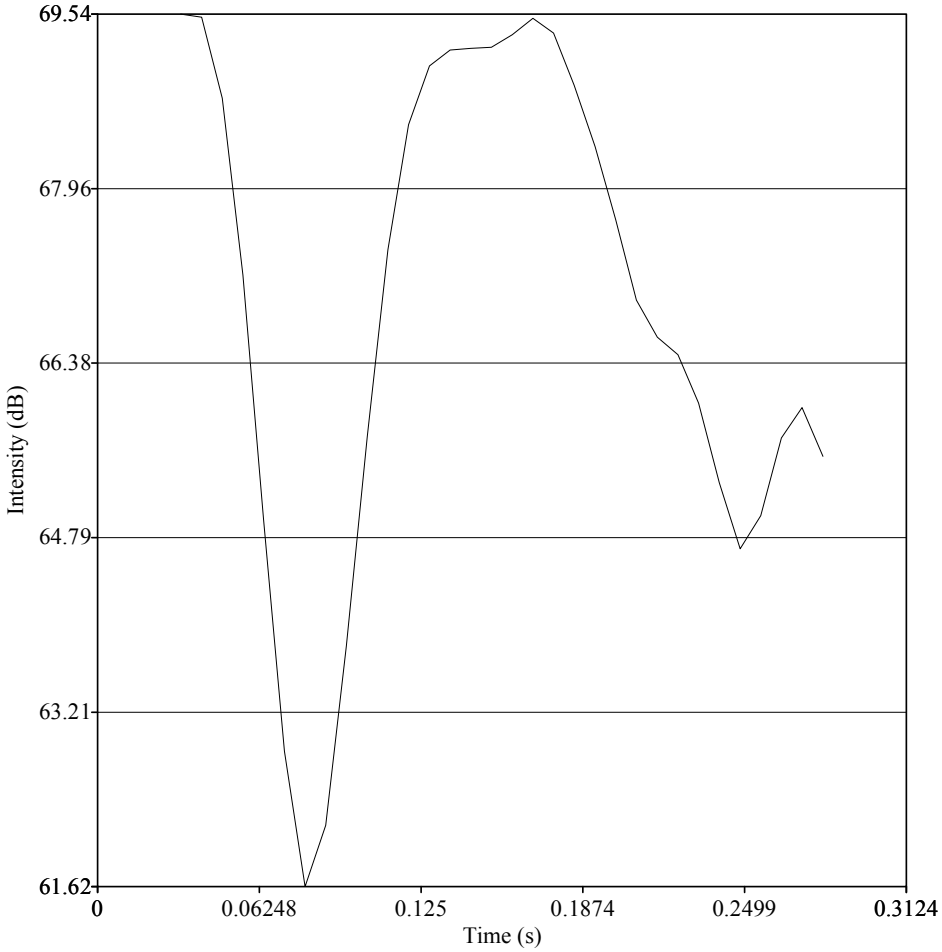
Average: 218.380356 Hz = 183.832117 Mel = 13.4950021 semitones above 100 Hz = 5.74047355 ERB

Standard deviation: 12.38 Hz = 8.861 Mel = 0.9822 semitones = 0.2514 ERB

Mean absolute slope: 445.6 Hz/s = 318.8 Mel/s = 35.3 semitones/s = 9.043 ERB/s

Rate: 3cycles/0.25 secs. ≈12.0 cycles per second.

GRAPH OF TREMOLO:

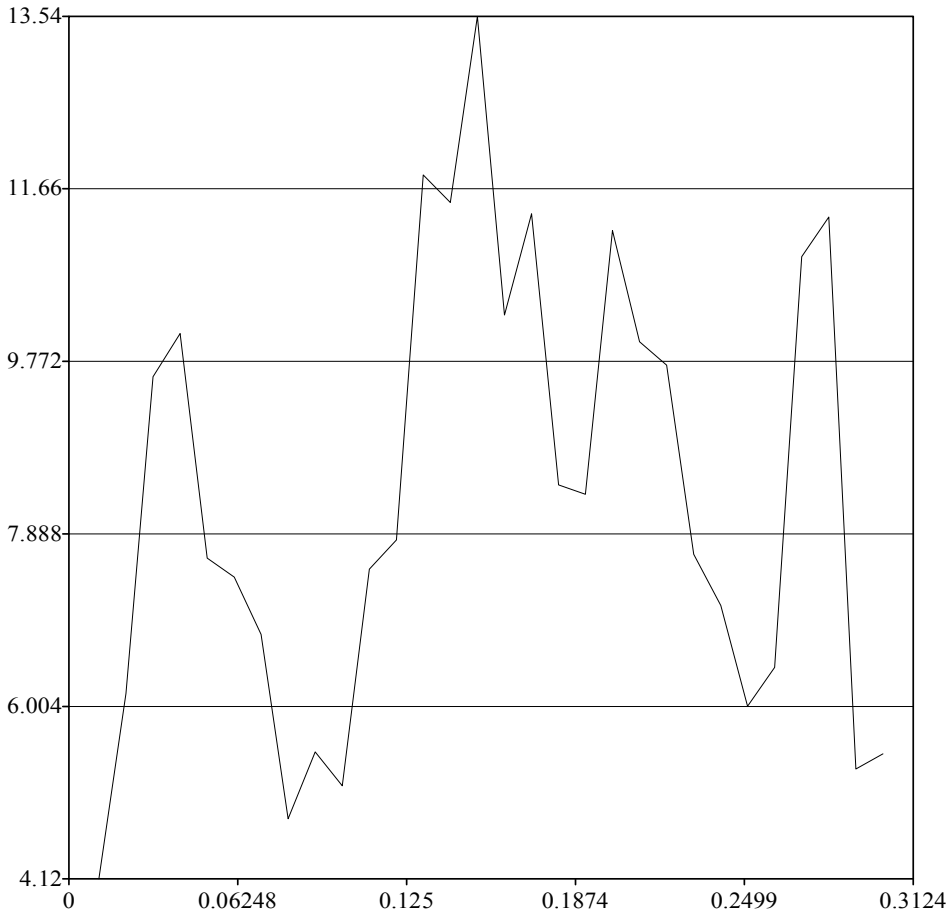


Calculations:

Average: 67.40810978161369 dB

Standard deviation: 2.3046920921861087 dB

GRAPH OF HARMONICITY:



Calculations:

Minimum: 4.23862128 dB

Maximum: 13.5349886 dB

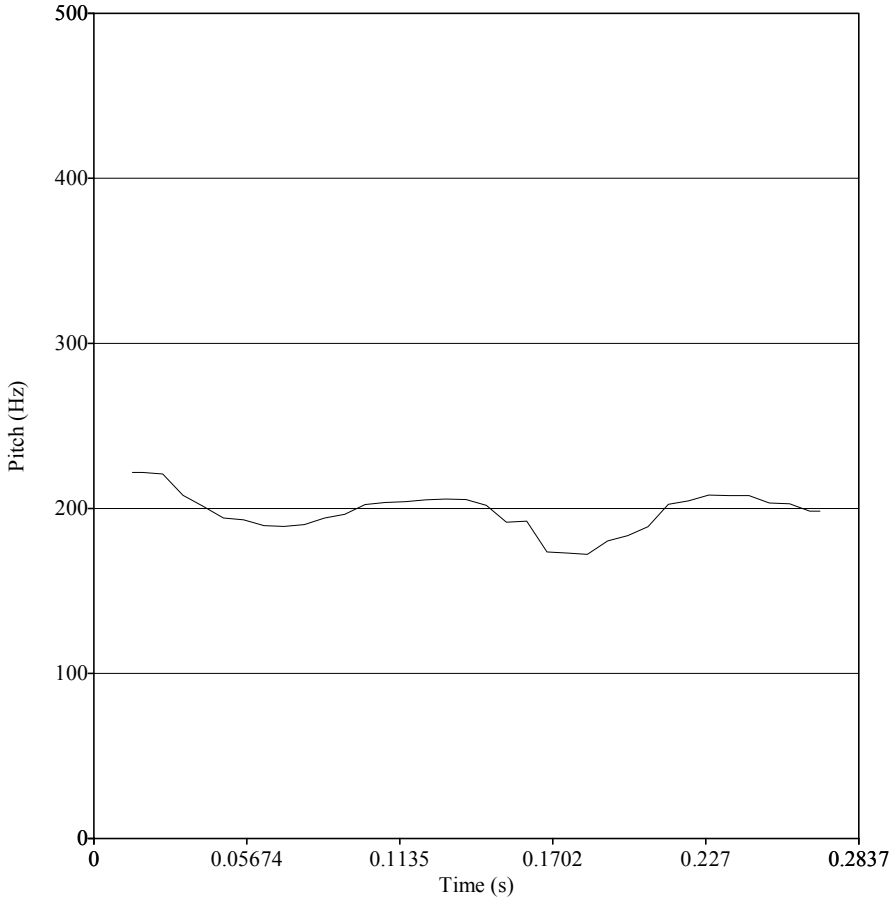
Average: 8.33060441 dB

Standard deviation: 2.54809584 dB

BREAKING NEWS VIBRATO IN THE SECOND SYLLABLE OF THE WORD “JACKSON” 16.737-17.020.

[Note that it is pronounced like /sen/]

GRAPH OF PITCH VIBRATO:



Calculations:

Minimum: 172.146934 Hz = 149.770693 Mel = 9.40368586 semitones above 100 Hz = 4.75937917 ERB

Maximum: 221.838128 Hz = 186.371114 Mel = 13.7940882 semitones above 100 Hz = 5.81342593 ERB

Range: 49.69 Hz = 36.6004216 Mel = 4.39 semitones = 1.054 ERB

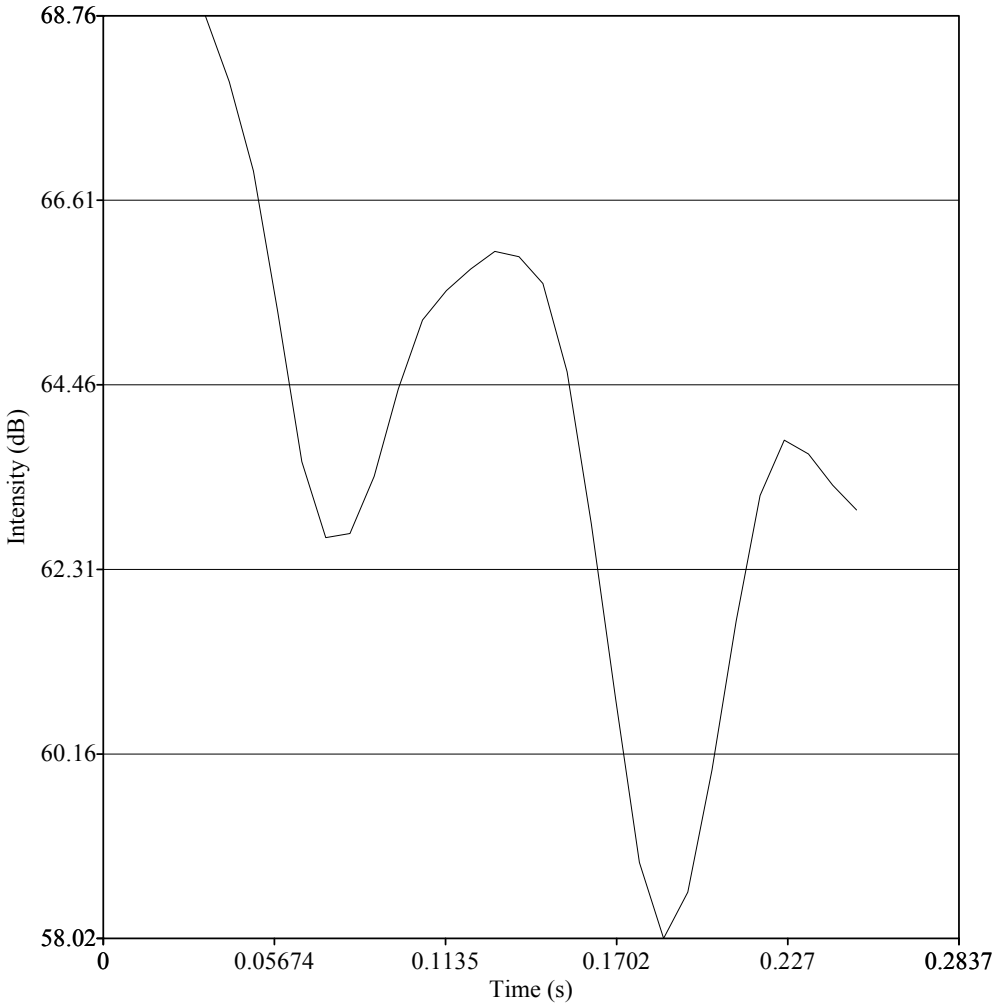
Average: 197.607857 Hz = 168.759882 Mel = 11.7604096 semitones above 100 Hz = 5.3097556 ERB

Standard deviation: 11.93 Hz = 8.807 Mel = 1.062 semitones = 0.2539 ERB

Mean absolute slope: 523.7 Hz/s = 386.4 Mel/s = 46.51 semitones/s = 11.14 ERB/s

Rate: 3 cycles/0.225 secs. ≈ 13.27 Hz.

GRAPH OF TREMOLO:

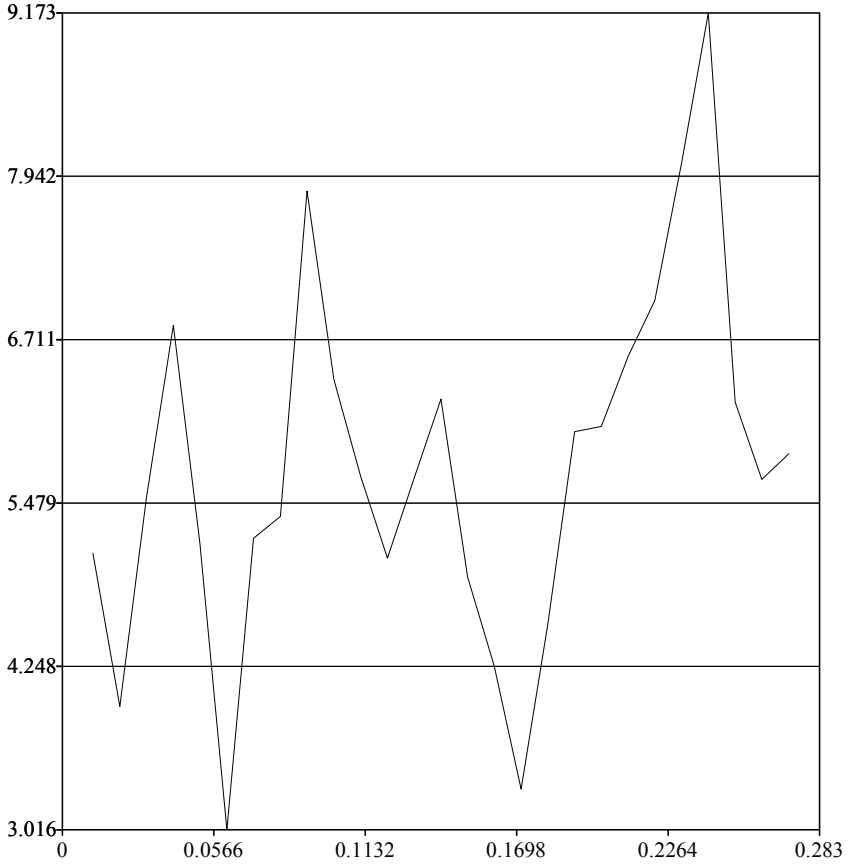


Calculations:

Average: 64.37906487620953 dB

Standard deviation: 2.6764784628670366 dB

GRAPH OF HARMONICITY:



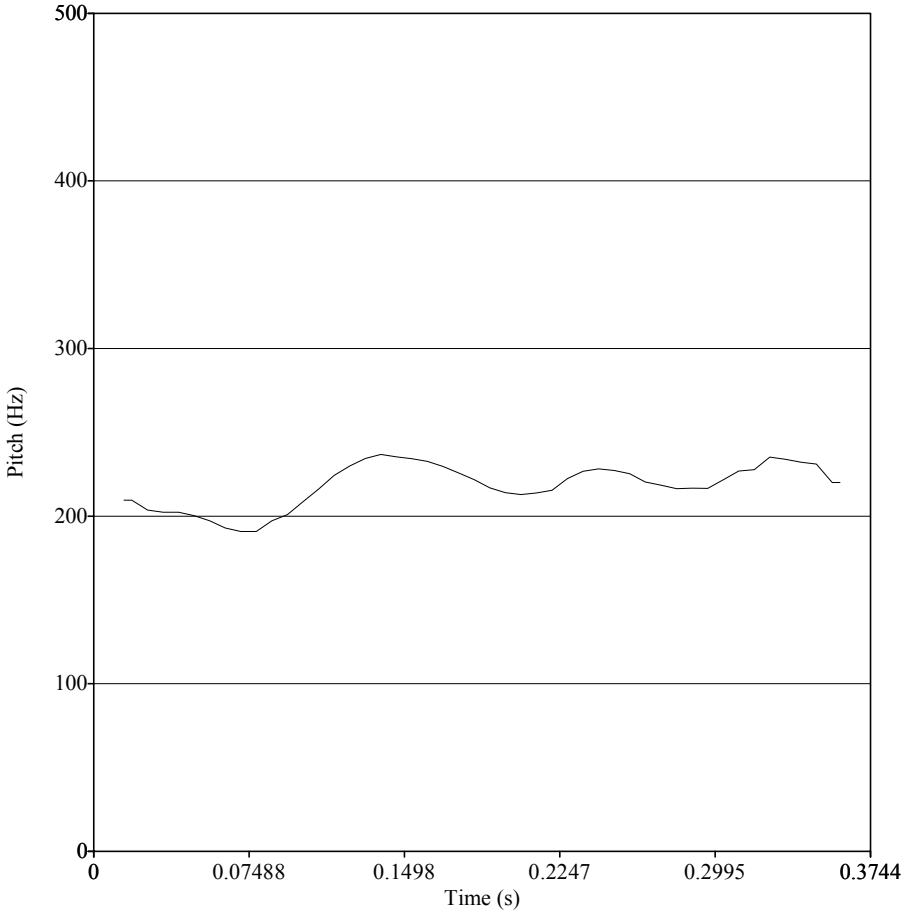
Calculations:

Average: 5.732343336914942 dB

Standard deviation: 1.366063843480308 dB

BREAKING NEWS VIBRATO IN THE WORD “MOVES” 19.228-19.602

GRAPH OF PITCH VIBRATO:



Calculations:

Minimum: 190.889099 Hz = 163.862969 Mel = 11.1928166 semitones above 100 Hz = 5.16954271 ERB

Maximum: 236.839535 Hz = 196.95833 Mel = 14.9269191 semitones above 100 Hz = 6.11174619 ERB

Range: 45.95 Hz = 33.0953608 Mel = 3.734 semitones = 0.9422 ERB

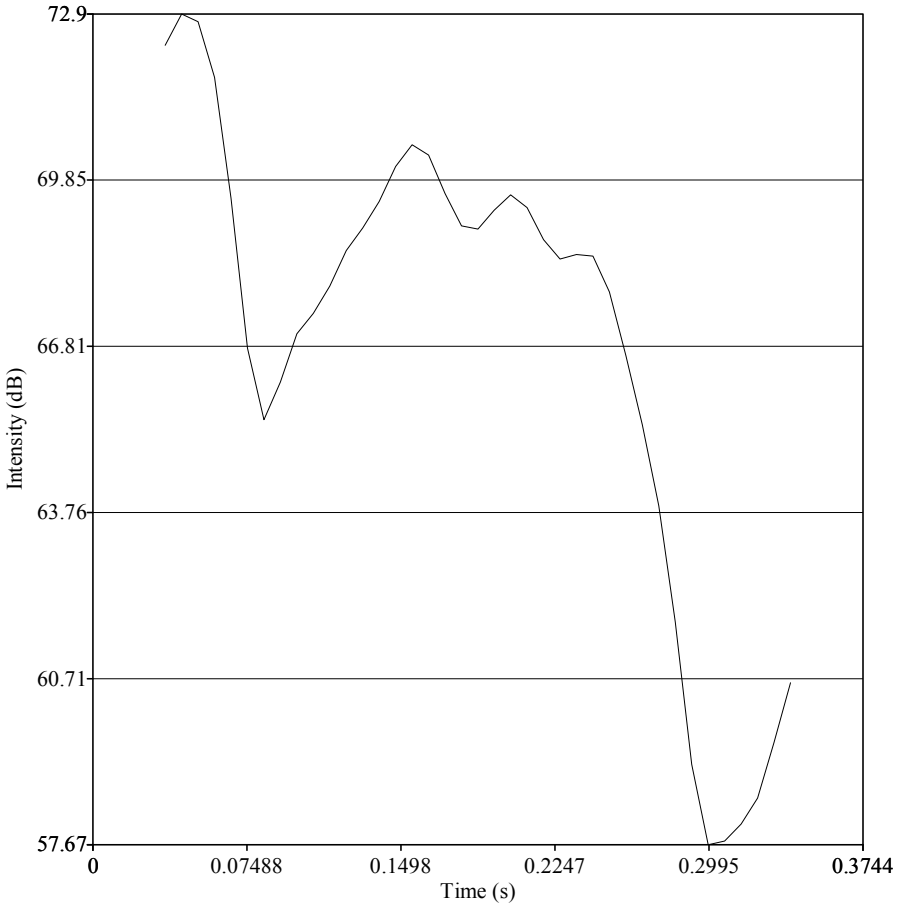
Average: 218.241294 Hz = 183.722969 Mel = 13.4796383 semitones above 100 Hz = 5.73722899 ERB

Standard deviation: 13.13 Hz = 9.447 Mel = 1.062 semitones = 0.2688 ERB

Mean absolute slope: 445.2 Hz/s = 318.8 Mel/s = 35.44 semitones/s = 9.05 ERB/s

Rate: 4 cycles/0.3 secs. ≈13.3 Hz.

GRAPH OF TREMOLO:

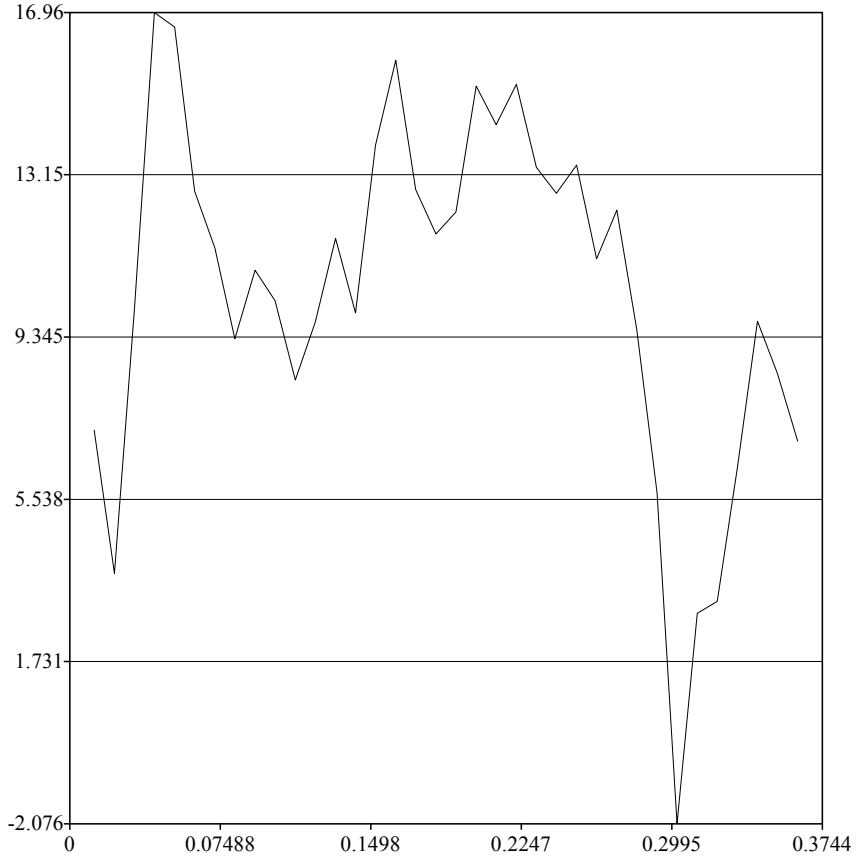


Calculations:

Average: 68.36604336288121 dB

Standard Deviation: 4.407275009163855 dB

GRAPH OF HARMONICITY:



Calculations:

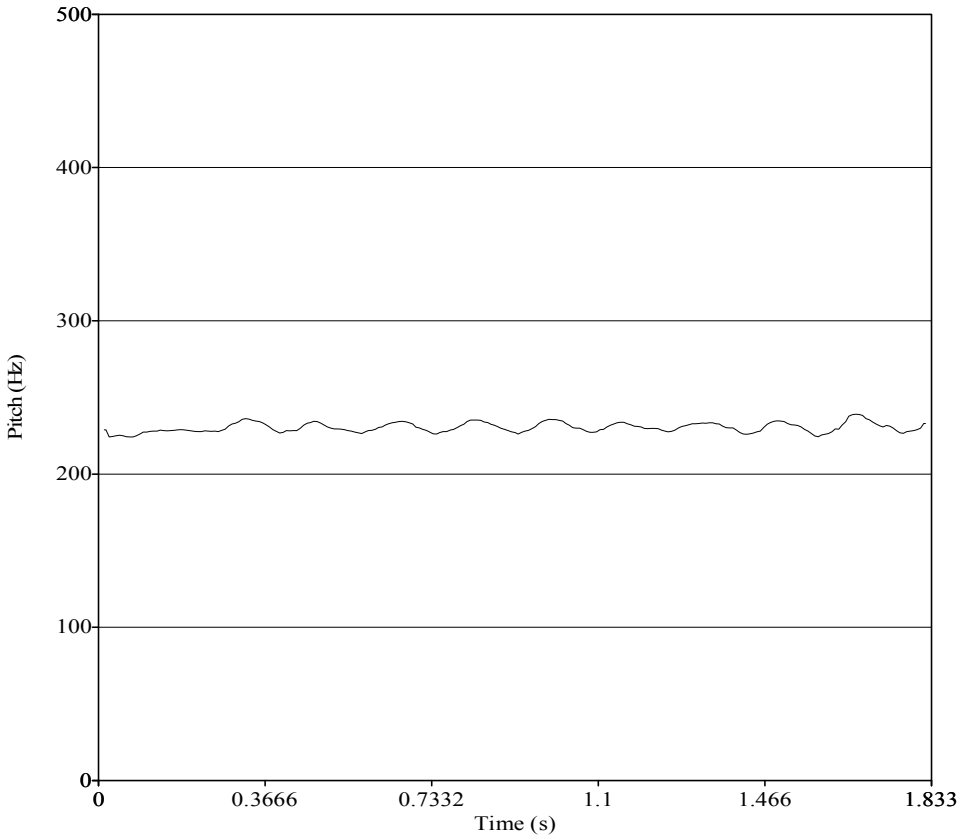
Average: 10.0671324 dB

Standard deviation: 3.97972645 dB

VIBRATO EXAMPLES: SPEECHLESS

SPEECHLESS VIBRATO IN THE WORD “MAGICAL” 3.567-5.400.

GRAPH OF PITCH VIBRATO:



Calculations:

Minimum: 224.256458 Hz = 188.091685 Mel = 13.9817944 semitones above 100 Hz = 5.8621001 ERB

Maximum: 239.077983 Hz = 198.520781 Mel = 15.0897753 semitones above 100 Hz = 6.15553444 ERB

Range: 14.82 Hz = 10.4290964 Mel = 1.108 semitones = 0.2934 ERB

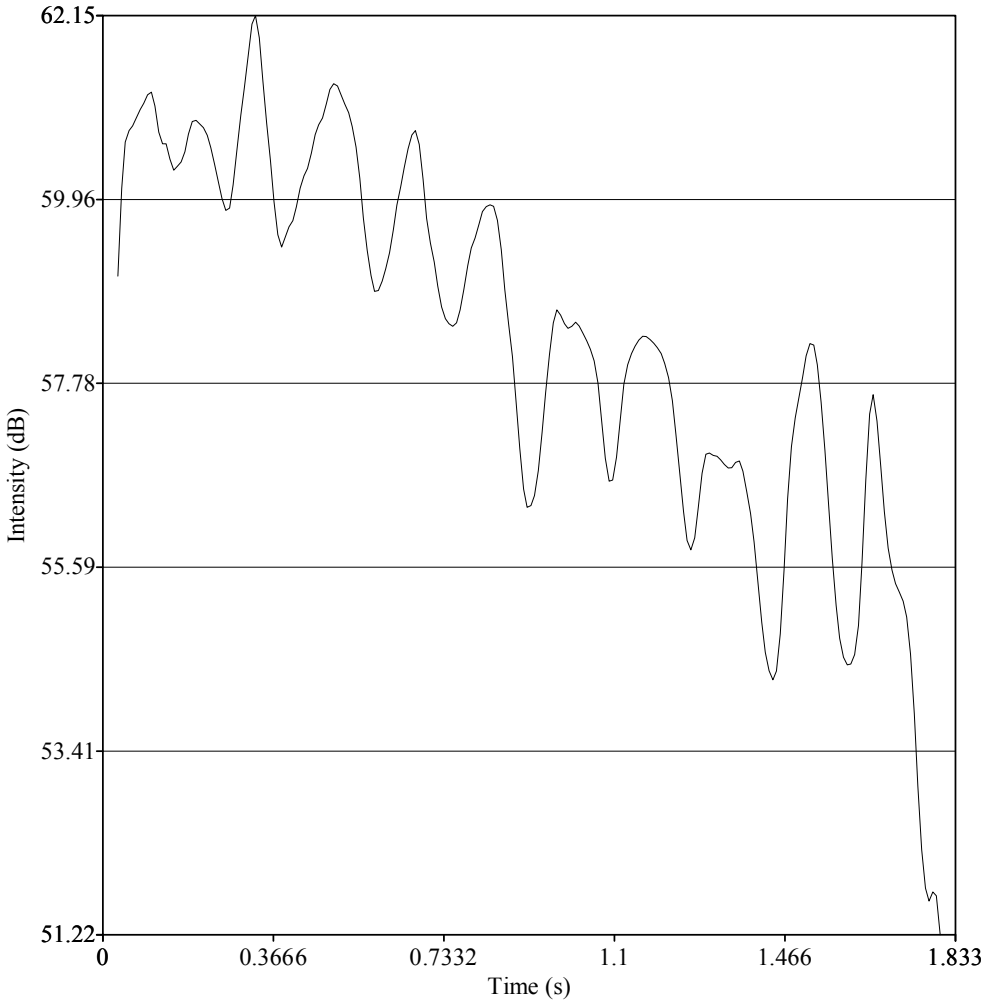
Average: 230.386404 Hz = 192.424531 Mel = 14.4470563 semitones above 100 Hz = 5.98427938 ERB

Standard deviation: 3.154 Hz = 2.221 Mel = 0.2365 semitones = 0.06252 ERB

Mean absolute slope: 101.5 Hz/s = 71.53 Mel/s = 7.624 semitones/s = 2.014 ERB/s

Rate: 10 cycles/1.473 secs. ≈6.79 Hz.

GRAPH OF TREMOLO:



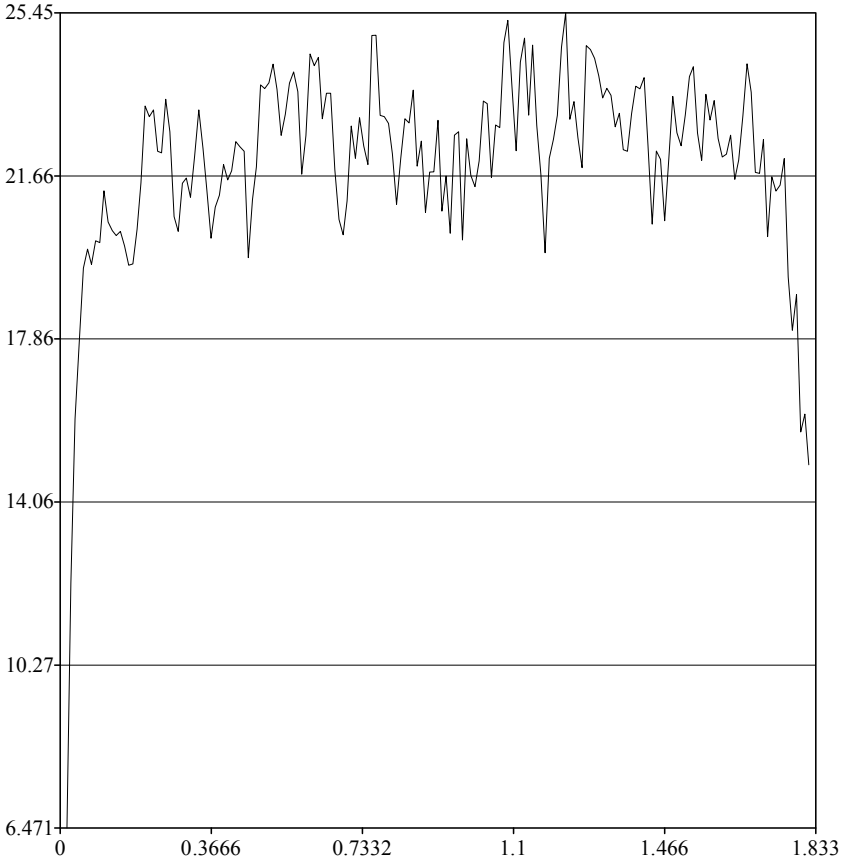
Calculations:

Average: 58.79517974084955 dB

Standard deviation: 2.2956709552610786 dB

The intensity falls off in a smooth and controlled manner. In classical music terms, this would be called diminuendo.

GRAPH OF HARMONICITY:



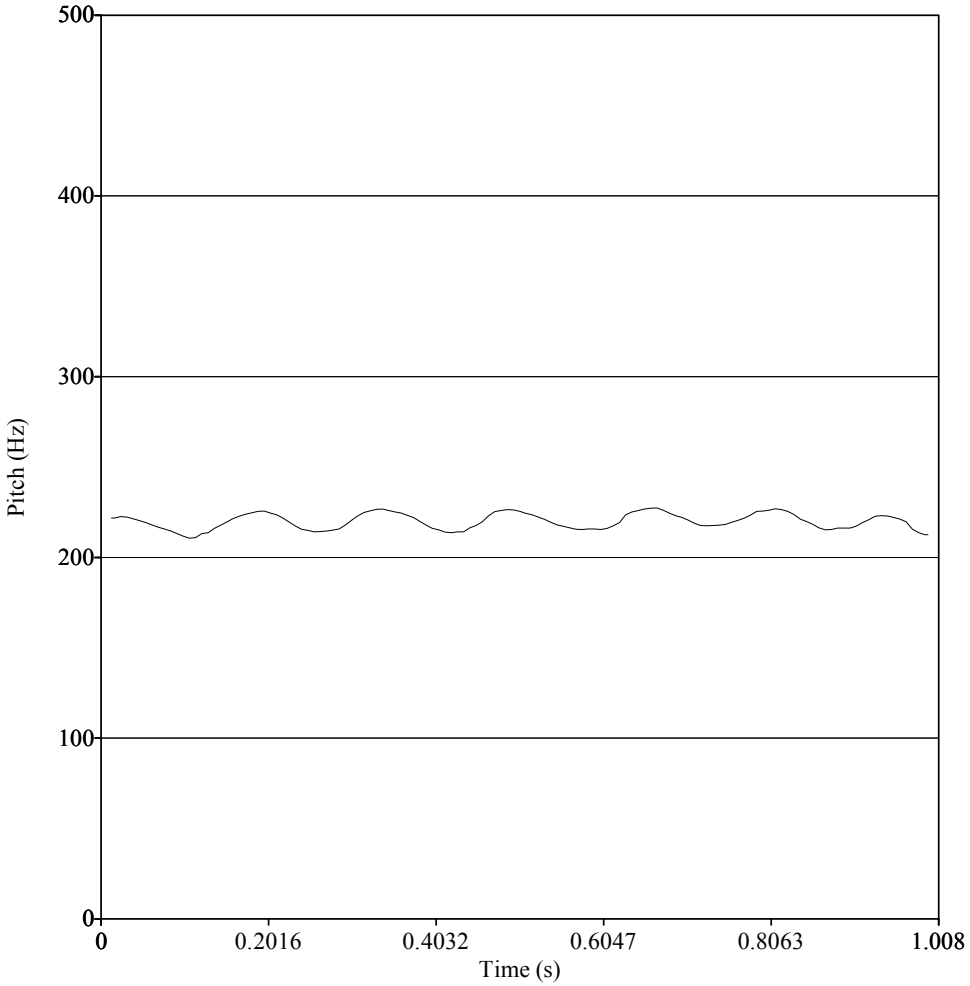
Calculations:

Average: 22.0166048 dB

Standard deviation: 2.21404148 dB

SPEECHLESS VIBRATO IN THE WORD “FEEL” 8.026-9.034.

GRAPH OF PITCH VIBRATO:



Calculations:

Minimum: 210.627243 Hz = 178.323824 Mel = 12.8963046 semitones above 100 Hz = 5.58475835 ERB

Maximum: 227.390298 Hz = 190.313343 Mel = 14.2220484 semitones above 100 Hz = 5.92483829 ERB

Range: 16.76 Hz = 11.9895195 Mel = 1.326 semitones = 0.3401 ERB

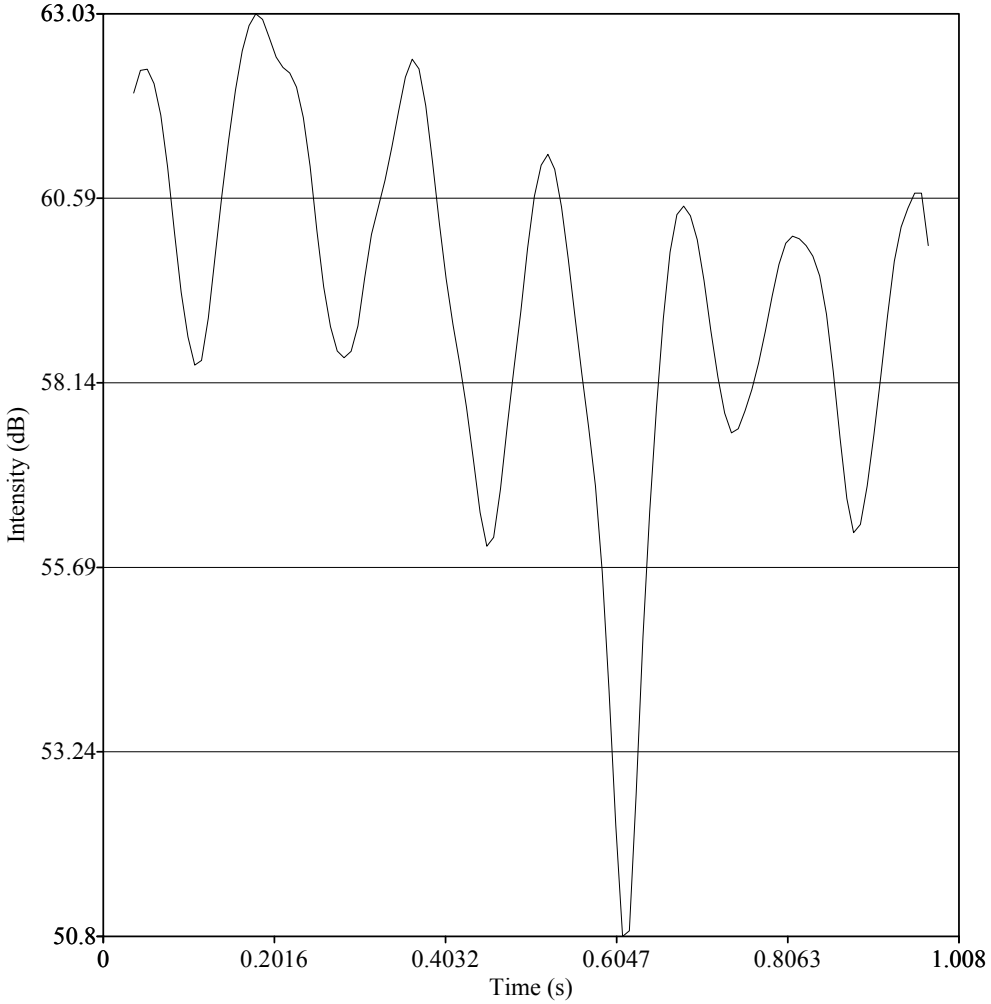
Average: 219.99721 Hz = 185.048994 Mel = 13.6464491 semitones above 100 Hz = 5.77584854 ERB

Standard deviation: 4.358 Hz = 3.113 Mel = 0.3432 semitones = 0.08825 ERB

Mean absolute slope: 154.8 Hz/s = 110.6 Mel/s = 12.19 semitones/s = 3.134 ERB/s

Rate: 7 cycles/0.988 secs. ≈7.08 Hz.

GRAPH OF TEMOLO:

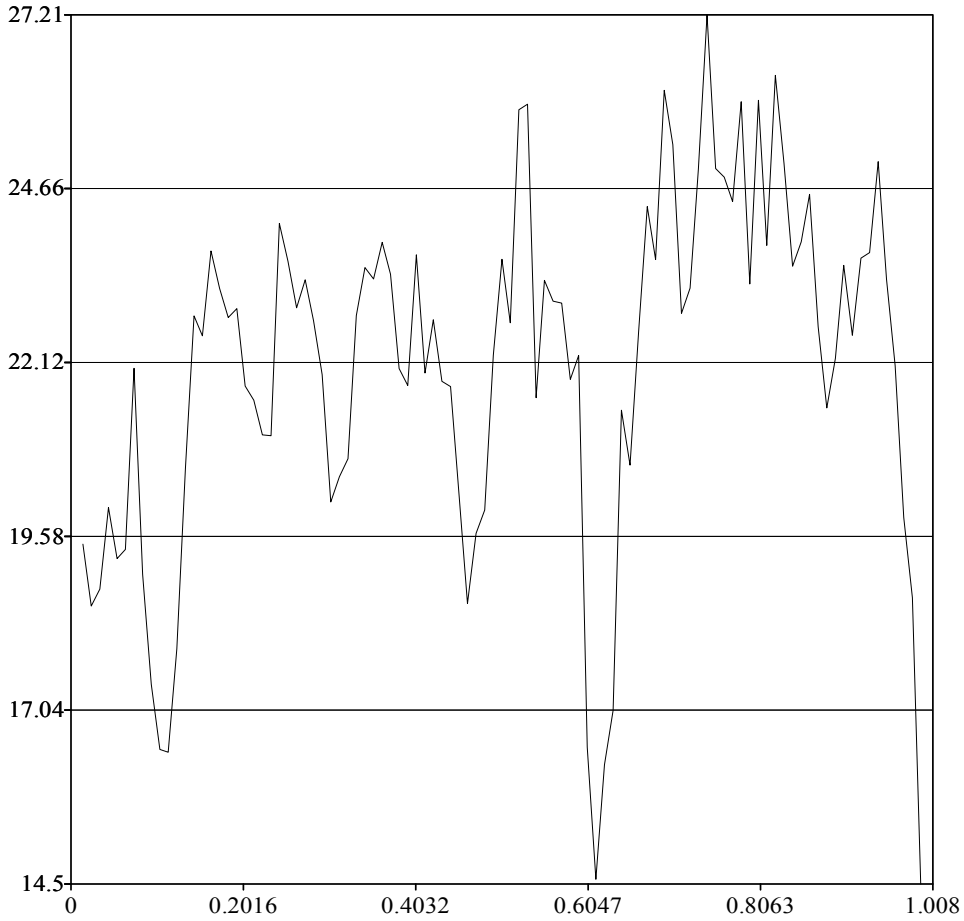


Calculations:

Average: 59.81031397547251 dB

Standard deviation: 2.392242091246259 dB

GRAPH OF HARMONICITY:



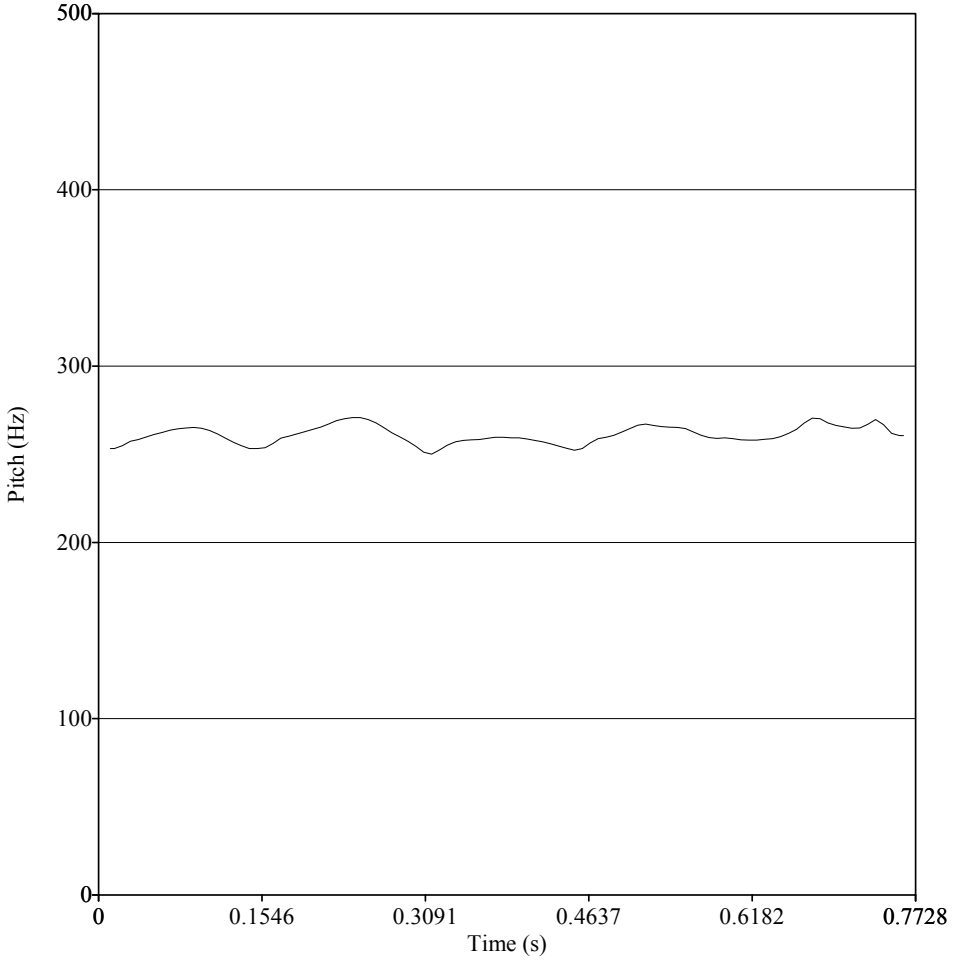
Calculations:

Average: 22.0394657 dB

Standard deviation: 2.61518766 dB

SPEECHLESS VIBRATO IN THE WORD “EXPLAIN”14.786-15.569.

GRAPH OF PITCH VIBRATO:



Calculations:

Minimum: 250.091411 Hz = 206.144239 Mel = 15.8694661 semitones above 100 Hz = 6.36832542 ERB

Maximum: 270.888246 Hz = 220.257786 Mel = 17.2523736 semitones above 100 Hz = 6.75859419 ERB

Range: 20.8 Hz = 14.1135479 Mel = 1.383 semitones = 0.3903 ERB

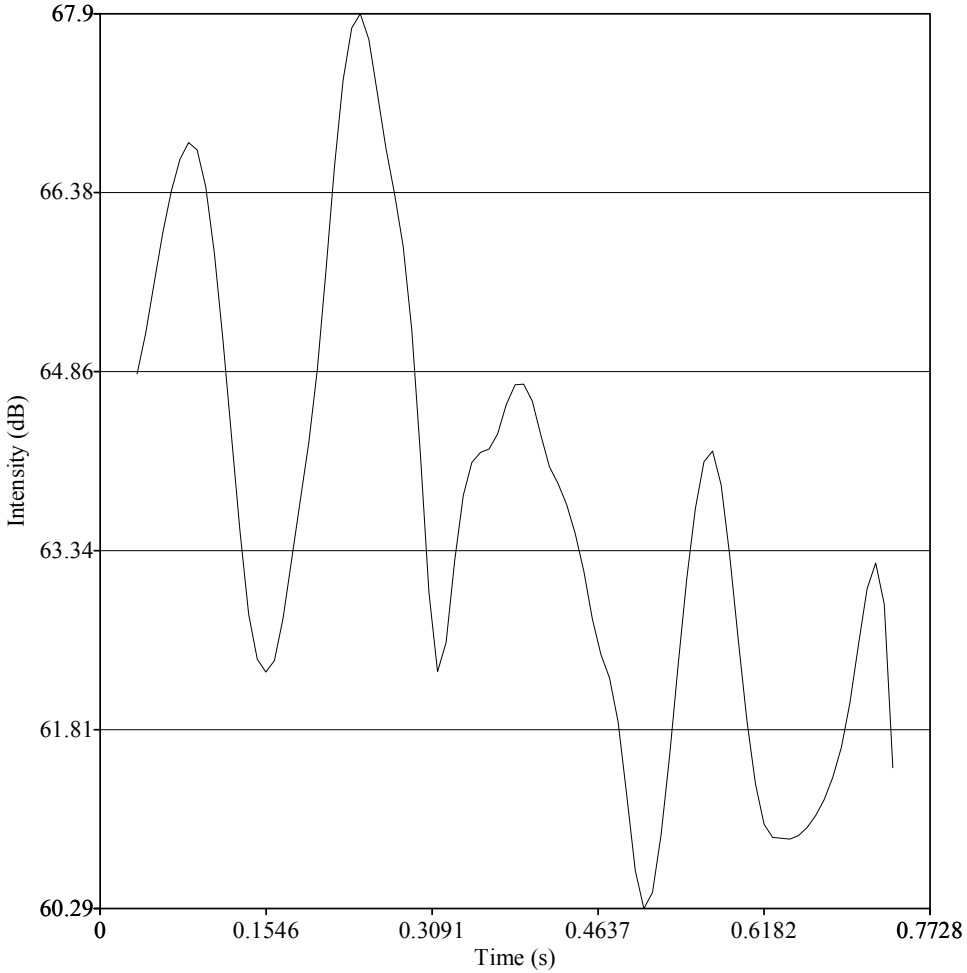
Average: 261.069634 Hz = 213.629201 Mel = 16.6100575 semitones above 100 Hz = 6.57575117 ERB

Standard deviation: 5.013 Hz = 3.399 Mel = 0.3323 semitones = 0.09394 ERB

Mean absolute slope: 183.4 Hz/s = 124.4 Mel/s = 12.17 semitones/s = 3.438 ERB/s

Rate: 6 cycles/0.7728 secs. ≈7.76 Hz.

GRAPH OF TREMOLO:

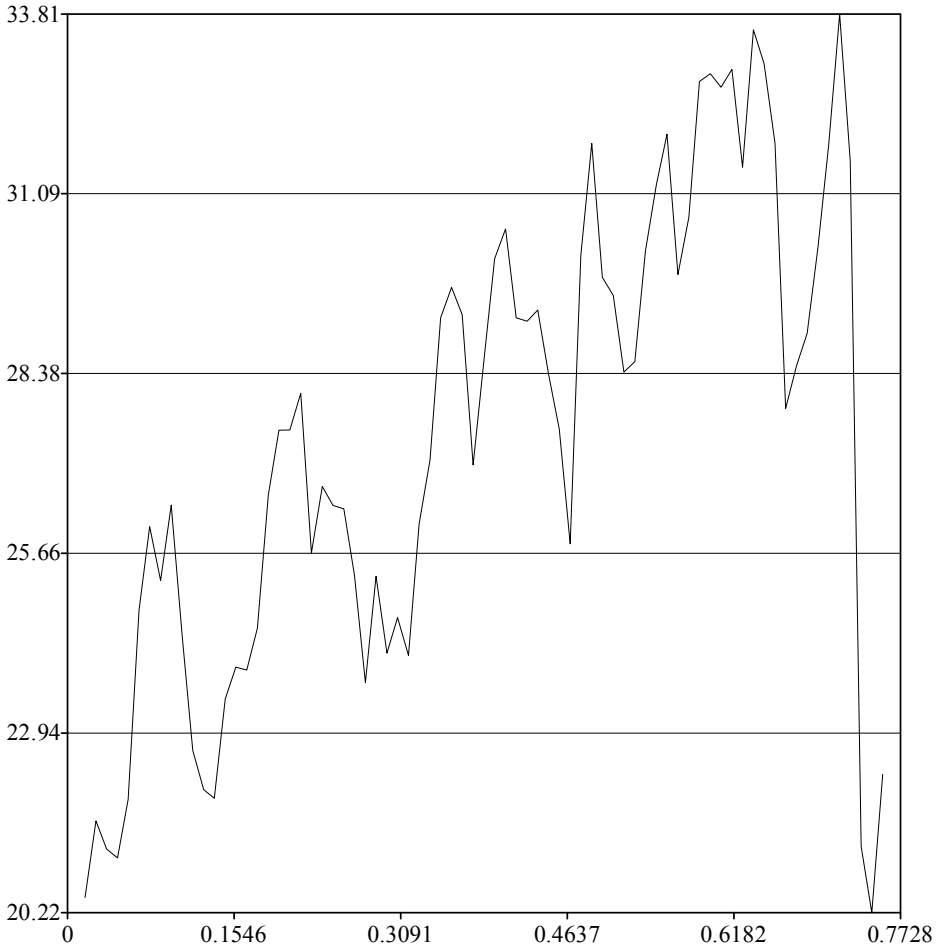


Calculations:

Average: 64.11027740004113 dB

Standard deviation: 1.9728636650333824 dB

GRAPH OF HARMONICITY:



Calculations:

Average: 27.4005686 dB

Standard deviation: 3.63761396 dB

PATTERNS AND FREQUENCY OF VIBRATO USAGE

In addition to the technical characteristics of vibrato, we can consider the frequency and distribution of vibrato usage in uncontested Jackson songs, Malachi songs and the Cascio songs.

VIBRATO PATTERNS

Cascio songs are said to have been recorded in year 2007. For fair vocal comparison, we will analyze them against released Jackson songs with solo lead vocal track recorded in the time period between 1998 and 2009. We will look only at the vibrato usage in the lead vocal track.

Only three of the Cascio songs, "Breaking News," "Monster," and "Keep You Head Up," were released on *Michael* album. However for the purpose of establishing patterns, in addition to these songs we will look at the rest 9 Cascio songs that remain unreleased, but are available online: "All I Need," "All Right," "Black Widow," "Burn Tonight," "Carry On," "Fall In Love," "Ready 2 Win," "Soldier Boy," and "Water."

The following Jackson solo tracks are included in the analysis:

1. "Beautiful Girl" (1998, released on *The Ultimate Collection*)
2. "Best of Joy" (2008-2009, released on *Michael*)
3. "Break Of Dawn" (1998-2001, released on *Invincible*)
4. "Butterflies" (1998-2001, released on *Invincible*)
5. "Cry" (1998-2001, released on *Invincible*)
6. "Don't Walk Away" (1998-2001, released on *Invincible*)
7. "Fall Again" (1999, released on *The Ultimate Collection*)
8. "Heartbreaker" (1998-2001, released on *Invincible*)
9. "Heaven Can Wait" (1998-2001, released on *Invincible*)
10. "Hollywood Tonight" (1999-2008, released on *Michael*)
11. "Invincible" (1998-2001, released on *Invincible*)
12. "Lost Children" (1998-2001, released on *Invincible*)
13. "One More Chance" (2001, released on *Number Ones*)
14. "Privacy" (1998-2001, released on *Invincible*)
15. "Shout" (2000, released on single *Cry*)
16. "Speechless" (1998-2001, released on *Invincible*)
17. "The Way You Love Me" (2000, released on *The Ultimate Collection*)
18. "Threatened" (1998-2001, released on *Invincible*)

19. “Unbreakable” (1998-2001, released on *Invincible*)
20. “We’ve Had Enough” (2000, released on *The Ultimate Collection*)
21. “Whatever Happens” (1998-2001, released on *Invincible*)
22. “You Are My Life” (1998-2001, released on *Invincible*)
23. “You Rock My World” (1998-2001, released on *Invincible*)

UNCONTESTED MICHAEL JACKSON SONGS

Michael Jackson’s vibrato techniques are diverse and vary from song to song. His vibrato may be practically non-present (“Lost Children”), may be minimal and applied to a few lines only (“Break of Dawn”), or may be quite extensive (“We’ve Had Enough”). It may range from very subtle (“Unbreakable”) to very prominent (“Butterflies”). Michael Jackson’s vibrato patterns are generally consistent throughout a song. When vibrato is used, it almost always falls on line endings.

- **“Beautiful Girl”** – subtle vibrato is featured on all line endings;
- **“Best Of Joy”** – subtle vibrato is used in the end of the first two lines of each tercet;
- **“Break Of Dawn”** – almost no vibrato, except subtle vibrato on the word “dawn” repeated in the chorus;
- **“Butterflies”** – prominent vibrato in the end of each verse line;
- **“Cry”** – prominent vibrato in the end of each verse line and bridge line;
- **"Don't Walk Away"** – the only Jackson song that features mid-line vibrato in verses in addition to vibrato on line endings. Vibrato is used consistently through the verses and choruses;
- **“Fall Again”** – subtle vibrato added on verse line endings, except for the last line in each verse;
- **“Heartbreaker”** – subtle vibrato is only used in the end of on the 4th and 8th line of each verse and once in the bridge;
- **“Heaven Can Wait”** – almost no vibrato in the lead vocal part, except the word “alone” in the final adlibs;
- **“Hollywood Tonight”** – vibrato is added only on the word “again” in the end of each chorus.
- **“Invincible”** - features vibrato on all verse line endings; it is less prominent on the first part of each verse and more prominent on the second part;
- **“Lost Children”** – no vibrato;
- **“One More Chance”** – subtle vibrato is added on all verse line endings and chorus adlibs;
- **“Privacy”** – vibrato is added in the end of the 2nd and 4th lines of each verse. In the first quatrain it is consistently more prominent than in the second quatrain. Additionally vibrato falls on “oh no” adlibs in the choruses;
- **“Shout”** – subtle vibrato is used only in the end of the 2nd and 4th lines of the bridge;

- **“Speechless“–** vibrato falls on all line endings in a cappella intro and outro and on majority of the verse line endings. The vibrato pattern in the second verse is slightly different from the first and third verses – with the additional vibrato on the end of the 4th line and a mid-line vibrato on “real”;
- **“The Way You Love Me”** – vibrato is used on all line endings except the first two lines of each verse;
- **“Threatened”** – vibrato is used on the endings of the 9th and 10th lines in both verses;
- **“Unbreakable”** – very subtle vibrato is used in verses in the end of each line of the first quatrain;
- **“We’ve Had Enough”** – vibrato falls on all line endings;
- **“Whatever Happens”** – very subtle vibrato is added on the line endings. The pattern in verses is different because the verses are slightly different in rhythm;
- **“You Are My Life"** – prominent vibrato is added on all verse line endings in verses except the last lines; also in bridge.
- **“You Rock My World”** – has a complex and precise vibrato pattern. In both 11-line verses it falls on the endings of lines 1, 2, 6, 7 and 11 (the 1st line serves as into; lines 2-6 and 7-11 form two rhythmic stanzas within the verse). Additionally vibrato is used on chorus adlibs.

CASCIO SONGS

In all Cascio songs, vibrato is heavily present. In most of the songs, it is very prominent too. In most cases, vibrato falls on line endings, however there is occasional usage of vibrato in the middle of lines in multiple songs (“Breaking News,” Keep Your Head Up,” “All I Need,” “Burn Tonight,” “Fall In Love,” “Ready 2 Win,” “Water”).

- **“Breaking News”** – vibrato falls on the last word of each line in verses and is also used in adlibs. In verses it also is occasionally used in the middle of lines – The pattern is inconsistent: in the first verse the mid-line vibrato appears in both lines 1 and 2, while on the second verse which has the first two lines in the same rhythm, it only they appears in line 2;
- **"Keep Your Head Up"** – vibrato is used on almost all line endings. There are also two occasions when it appears in the middle of a line: on the word “moment” in the second verse, and on the word “dare” in the bridge.
- **“Monster”** – vibrato is applied to the line endings on verses (1st and 3rd lines in the first verse; 1st and 2nd lines in the second verse) and the chorus adlibs;
- **“All I Need”** – verses start with subtler vibrato on the first lines, but towards the end of the verse it becomes more prominent. It also starts occurring twice per line (on the words “closer, closer” and “though”). There is no pattern to the vibrato in verses, but the verses themselves are different in rhythm and have different number of lines in them. In the first chorus vibrato on the first lines is very subtle; in the second chorus, however, it becomes a lot heavier. Jackson was known for a very consistent delivery of choruses[v].
- **“All Right”** – features prominent vibrato on line endings. Verses have different rhythm, so it’s impossible to trace a pattern.
- **“Black Widow”** – vibrato is used on the endings of all verse lines except for the first line of the first verse;

- **“Burn Tonight”** – prominent vibrato is used on the endings of verse lines and in adlibs. The pattern is not consistent through the verses, but the verses are different in rhythm. Occasional mid-line vibrato on “mine” in the second verse;
- **“Carry On”** – prominent vibrato on line endings, consistent through verses.
- **“Fall In Love”** – prominent vibrato on line endings. Occasionally vibrato appears in the middle of lines without a consistent pattern. It should also be noted that this song borrows words “You're beautiful, you’re wonderful, I love you so” from Jackson’s song “Heaven Can Wait”, but unlike “Heaven Can Wait”, here these words are repeated for the second time with vibrato.
- **“Ready 2 Win”** – features vibratos on line endings and mid-line vibratos in the first verse only. No consistent patters, the verse rhythm also changes.
- **“Soldier Boy”** – subtle vibrato is used on most of the verse line endings. The pattern is not consistent.
- **“Water”** – prominent vibrato on the line endings. In the second verse, an additional vibrato is introduced in the middle of the first two lines, on the words: “start of something” and “world of me”. There is also a mid-line vibrato in the bridge on the words “I cry.” The end of the song again reuses lyrics from “Heaven Can Wait” (“Tell the angels **no**, I don't wanna leave my baby **alone**… Leave us **alone**”) with adlibs.

STATISTICAL DATA

Let’s look at the average density of the vibrato usage in the uncontested Michael Jackson songs versus the Cascio songs and the consistency of the vibrato usage.

The table below shows that in the uncontested Michael Jackson songs, the vibrato usage is less dense. 44% of the uncontested Jackson songs have vibrato on less than half of the verse lines if at all, and among the Cascio songs there are only 16% of those. 22% of the Jackson songs don’t use vibrato at all, while in the Cascio songs it’s always present.

At the same time, the vibrato usage in the uncontested Michael Jackson songs is more consistent. 26% of his songs have consistent vibrato on all lines, while among the Cascio songs there is only one such song (8%). In the Cascio songs, we often encounter occasional lines with missing vibrato which leads to the high percentage of songs with vibrato on more than half lines (75%), but almost no songs that show absolute consistency.

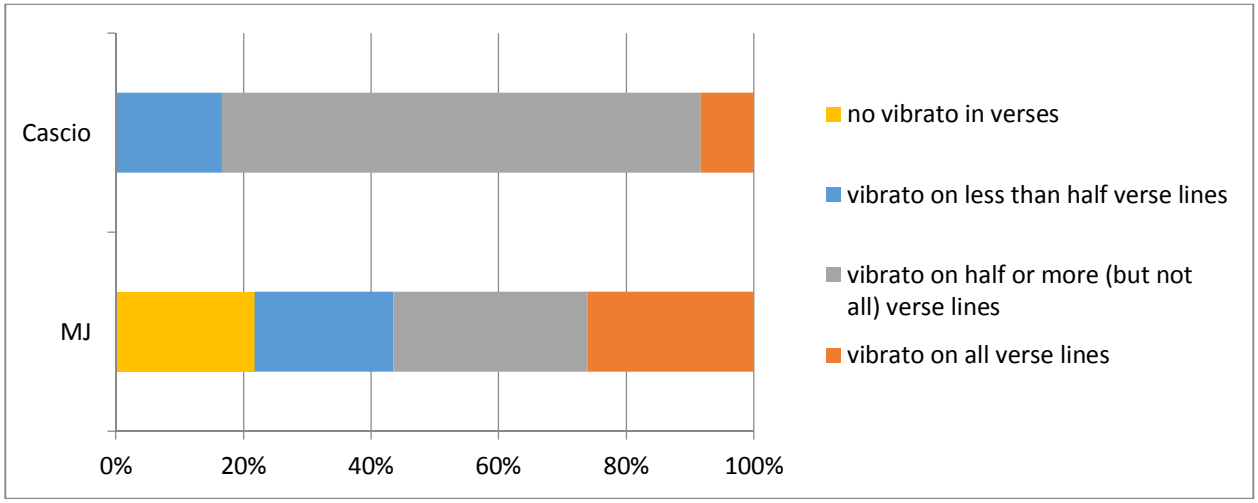
Another indicator of lower vibrato consistency in the Cascio songs is that in a higher portion of them the vibrato pattern changes from verse to verse (83% vs. 9% among the MJ songs). It should be noted that almost all of the uncontested Michael Jackson songs (bar “Whatever Happens”) have consistent structure – the same number of lines in each verse and the same rhythm, which makes it easy to notice patterns of vibrato usage. Most of the Cascio songs have inconsistent structure – the verses are different rhythmically and in length, and this brings additional inconsistency

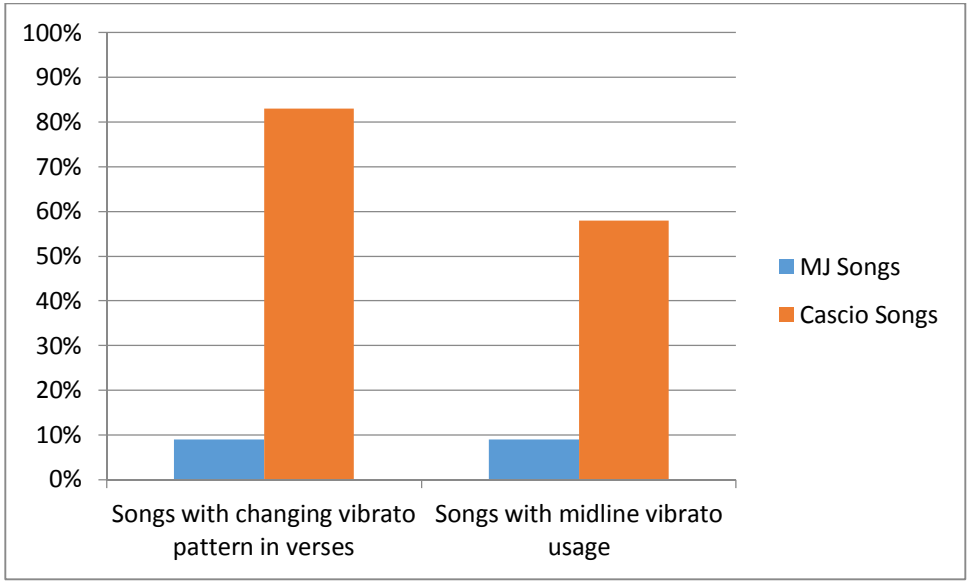
into the vibrato usage which cannot be attributed entirely to the vocalist's "mistakes." However, in the majority of these Cascio songs ("Breaking News," "Monster," "Black Widow," "Fall In Love," "Soldier Boy," "Water"), the inconsistencies appear even in those lines in different verses that are rhythmically similar.

Finally, the usage of mid-line vibrato is a lot more frequent in the Cascio songs than it is in the Michael Jackson songs (58% vs. 9%).

	Uncontested MJ songs	**Cascio songs**
Total songs	23 (100%)	12 (100%)
No vibrato in verses	5 (22%)	0 (0%)
Vibrato on less than half of verse lines	5 (22%)	2 (16%)
Vibrato on half or more (but not all) verse lines	7 (30%)	9 (75%)
Consistent vibrato on all verse lines	6 (26%)	1 (8%)
Songs with changing vibrato pattern in verses	2 (9%)	10 (83%)
Songs with midline vibrato usage	2 (9%)	7 (58%)

These results are illustrated in the following graphs.





CONCLUSION

The singer in *Monster* that is considered to be the same singer who sings *Breaking News* uses a dialect form not known to occur in any Michael Jackson song over a span of 39 years – his entire recorded history. This observation is especially significant because the form used is an allophonic variation of the type that is a basic feature of someone's dialect, not normally subject to conscious variation.

The pronunciation of the name "Jackson" in *Breaking News* (as [sEn]) differs from the pronunciations of "Jackson" as spoken by Michael Jackson in interviews over many years. Again, this is almost certainly not a conscious variation.

Jason Malachi's former producer Tony Kurtis claims that the singer in *Breaking News* is Jason Malachi rather than Michael Jackson in part because Malachi's vibrato is faster than Jackson's and that Malachi uses vibrato more than Jackson does. Acoustic analysis shows that the vibrato in *Breaking News* is faster than the vibrato in a sample of Jackson recordings. Moreover, the vibrato in a sample of known Jackson recordings is smoother and more closely adheres to the note being sung.

The vibrato in a sample of Malachi recordings as well as the vibrato in *Breaking News* is more frequent than the vibrato in known Jackson recordings.

The tremolo in known Jackson recordings is smoother and better controlled than the tremolo of the singer in Breaking News.

The harmonicity (harmonics to noise ratio) of a sample of known Jackson recordings is higher than the harmonicity of the singer in Breaking News.

For these reasons, I am led to reject the hypothesis that the singer in Breaking News is Michael Jackson. That singer appears to more likely be Jason Malachi, though that conclusion is less certain.

APPENDIX: WEITZMAN LETTER

Howard Weitzman, Esq.
Attorney for the Estate Of Michael Jackson
Santa Monica, CA

November 11, 2010

Jeff:

I am writing you in response to your questions regarding "Breaking News," and your reports of fan comments and concerns. There is nothing more important to the Estate than Michael's music, his legacy and his fans. WE hope the information below is helpful and responsive to your concerns.

As the MICHAEL album was being put together, it was decided to bring Teddy Riley on board to work on several songs, including "Breaking News," a song Michael recorded with Eddie Cascio and James Porte in late 2007 while living at the Cascio family home with his children. Riley produced and submitted "Breaking News" to Sony for inclusion on the album. At that time, no one ever mentioned that the vocals we heard on the Cascio songs, which were basically in demo format, might not be Michael. It was known, however, that the background vocals were a combination of Michael and James Porte.

After the tracks were submitted to Sony, three of these Cascio songs were selected to be on the album, and "Breaking News" was one of the three. The day after the submission and selection of the album tracks, for the very first time, the authenticity of Michael's vocals on the Cascio tracks was questioned.

Because of these questions, I was immediately asked by co-Executors John Branca and John McClain to conduct an investigation regarding the authenticity of the lead vocals on the Cascio tracks.

Six of Michael's former producers and engineers who had worked with Michael over the past 30 years – Bruce Swedien, Matt Forger, Stewart Brawley, Michael Prince, Dr. Freeze and Teddy Riley – were all invited to a listening session to hear the raw vocals of the Cascio tracks in question. All of these persons listened to the a cappella versions of the vocals on the Cascio tracks being considered

for inclusion on the album, so they could give an opinion as to whether or not the lead vocals were sung by Michael. They all confirmed that the vocal was definitely Michael.

Michael's musical director and piano player on many of his records over a 20-year period, Greg Phillinganes, played on a Cascio track being produced for the album, and said the voice was definitely Michael's. Dorian Holley, who was Michael's vocal director for his solo tours for 20 plus years (including the O2 Concert Tour) and is seen in the THIS IS IT film, listened to the Cascio tracks and told me the lead vocal was Michael Jackson.

These are all engineers, producers and musicians who worked on tours and/or in the studio with Michael when he was recording BAD, THRILLER, OFF THE WALL, DANGEROUS, INVINCIBLE, HISTORY and BLOOD ON THE DANCE FLOOR, and they all reconfirmed their belief that the lead vocals were Michael's voice on the Cascio tracks.

The Estate then retained one of the best-known forensic musicologists in the nation to listen to the vocals without any instrumental accompaniment ("a cappella"), and to compare them with a cappella vocals from previous Michael songs. This expert performed waveform analysis, an objective scientific test used to determine audio authenticity, on the Cascio tracks, as well as previously released tracks with Michael's voice, and reported that ALL of the lead vocals analyzed (which included Cascio tracks) were the voice of Michael Jackson.

Sony Music conducted their own investigation by hiring yet a second well-respected forensic musicologist who also compared the a cappella lead vocals from Cascio tracks against previously released vocals of Michael's, and found that Michael's voice was the on all sets of the raw vocals. The Cascio tracks were also played for two very prominent persons in the music industry who played crucial roles in Michael's career. Both of these individuals believed that the lead vocals were Michael's.

Just to be absolutely certain, I also contacted Jason Malachi, a young singer who some persons had wrongfully alleged was a "soundalike" singer that was hired to sing on the Cascio tracks, and I confirmed that he had no involvement with this project whatsoever.

Sony decided that, given the overwhelming objective evidence resulting from the exhaustive investigations outlined above, they wanted to release a record that included three of the Cascio-Porte tracks – because they believed, without reservation, that the lead vocal on all of those tracks were sung by Michael Jackson.

Although there still seem to be concerns being expressed in some quarters about the authenticity of the lead vocals, notwithstanding the opinion of those who worked with Michael, and two independent forensic analysts, ultimately, Michael's fans will be the judges of these songs, as they always are. We take all fan comments very seriously, and as I'd stated above, there is nothing more important to the Estate than Michael's music, his legacy and his fans.

Michael's fans are extraordinary in their quest for accuracy and their passions to raise their voices in a search for truth! We join with them in our care and concern for Michael. We are continuing to follow up with those who have worked in the studio or on tours with Michael, and if any new information comes to light, we will keep you and the fans advised.

Thanks,
Howard

ENDNOTES

[i] Following are examples of 'waiting' sung by Michael Jackson:

TWENTY-FIVE MILES (1969)

But I got a girl waitin' for me

LOVE IS HERE AND NOW YOU'RE GONE (1971)

That was waiting there

ONE DAY IN YOUR LIFE (1974)

When you find that you're always waiting

SOMEONE IN THE DARK (1982)

Waiting for you to find me

NIGHTLINE (1982)

And I'll be waiting

SAY,SAY, SAY (1981/1983)

Waiting for you, baby

SCARED OF THE MOON (1984)

Alone she lays waiting

ANOTHER PART OF ME (circa 1985)

Waitin' for you

DO YOU KNOW WHERE YOUR CHILDREN ARE (1990)

She gets off from a train station, a man is waiting there

YOU ARE MY LIFE (circa 2001)

Love was always here waiting for me

HOLD MY HAND (2008)

So tell me what we're waiting for

[ii] Gordon, Matthew (2004) "New York, Philadelphia and other Northern Cities" in Kortmann, Bernd & Schneider, Edgar W. (Eds.) A Handbook of Varieties of English: Volume 1: Phonology Walter de Gruyter ISBN 3-11-017532-0 pp. 288-289.

[iii] Kurtis left that comment on December 14, 2010 on his You Tube account tonykurtistv, which may no longer exist, as a comment on Breaking News. The video of Breaking News was deleted because of copyright infringement: http://www.youtube.com/watch?v=KRfzf8KT2sc. Consequently, the original source doesn't exist anymore; unfortunately, only the copied YouTube conversations that can be found online.

[iv] From the perspective of speech production, we are measuring fundamental frequency, the perceptual correlate of which is pitch, though, as we mention in the text, other characteristics of the signal may affect the perceived pitch.

[v] Sound engineer Dave Way praised Jackson's notable flawless delivery of multiple chorus hooks:
"I've been lucky enough to have recorded vocals with Michael a number of times. Always amazing but I'll always remember the first time...
We had just finished tracking the music to the song "Remember The Time" (appropriately enough). Inspired to get to work, Michael asked if he could sing the hook, which was all that was written of the lyrics at that point and he went out and sang the first chorus, first note (melody).
Now, the producer (Teddy Riley) and I were in the habit of singing the chorus once with all its parts and then flying it in to the other choruses. So when the first chorus was finished I stopped the tape and Michael, startled by this said "Why'd you stop?" to which we explained the flying in etc. He said "Well, I'd just like to sing each part all the way through". So we went back, started the song from the beginning and watched Michael sing each note and harmony, double it, triple it and then maybe quadruple (I can't remember) - each time singing it perfectly, vibratos perfectly matched, perfectly in tune, rhythmically dead on knowing exactly what he wanted to do the whole time.
We were done with all the hooks faster than if I'd have flown them in. Flawless. That was day 1." -gearslutz.com