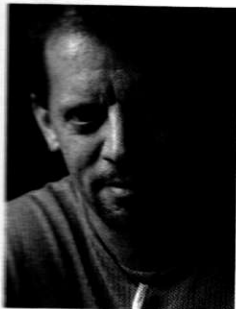


Vocal Vibrato: New Directions

Nicholas Isherwood



Nicholas Isherwood

VOICE TEACHERS OFTEN BELIEVE that only two types of vocal vibrato exist: good and bad. In fact, there is a plethora of different vibratos. Some of these have been described (sometimes as flaws) in treatises going back several centuries with quaint names such as *flatté* (flutter), *balancement* (balance), *chevrottement* (bleat),¹ *petits tremblements de feu* (little fiery tremblings),² *aspirations douces* (soft aspirations), *suono flautato* (fluted sound), *trillo cavallino* (horse trill), or *trillo caprino* (goat trill).³ Others have been borrowed from non-Western vocal techniques. Fine interpreters of all periods and cultures consistently have modified their vibrato rates. Western composers have been notating specific vibratos in their scores since Edgar Varèse's revolutionary work *Ecuatorial*, composed in 1927.⁴ Varèse writes *sans vibrer* (without vibrating). This corresponds to "straight tone" in the terminology of this article.

Sonograms used in this article are examples of distinct vibrato types demonstrated by this author with the assistance of Dr. Marc Yana, one of France's leading otolaryngologists. The analyses were done with the program Soundscape.

Vocal vibrato is a periodic fluctuation, which includes variations of frequency amplitude (Hz), rhythm (vibrations per second), intensity (dB), timbre (formants), and/or the relationship between sound and breath. It is perceived as one pitch, unlike the trill, which is perceived as a fluctuation between two pitches. Sonograms allow us to analyze the individual components of the vibrato.

There are fifteen discrete types of vibrato used in twentieth and twenty-first century Western music: straight tone, *bel canto* vibrato, *molto* vibrato, tremolo, head shake, gentle glottal vibrato, hard glottal vibrato, goat vibrato, horse vibrato, lip vibrato, tongue vibrato, harmonics vibrato, diaphragmatic vibrato, finger vibrato, and hand vibrato (see chart, "Physiology of the Vocal Vibrato," at the end of this article).

Non vibrato singing is characterized by a virtually flat fundamental and formants (Figure 1) and has an irregular intensity vibrato with a small amplitude (Figure 2). The singing formant is clearly present (Figure 3). This is the case even in the most extreme modifications of the vibrato. Research by John Large and Dr. Benoît Amy de la Bretèque shows that deliberate straight tone singing is produced by inhibiting the free vibration of the vocal folds by tensing the abdominal muscles and/or applying glottal pressure.⁵

Straight tone often is used by singers for its expressive value. By using spectrograms to analyze recordings, Large found that Dietrich Fischer-Dieskau sings forty percent of Schumann's *Liederkreis* with straight tone.⁶ In the same article, Large reprints a letter from Fischer-Dieskau stating that singers com-

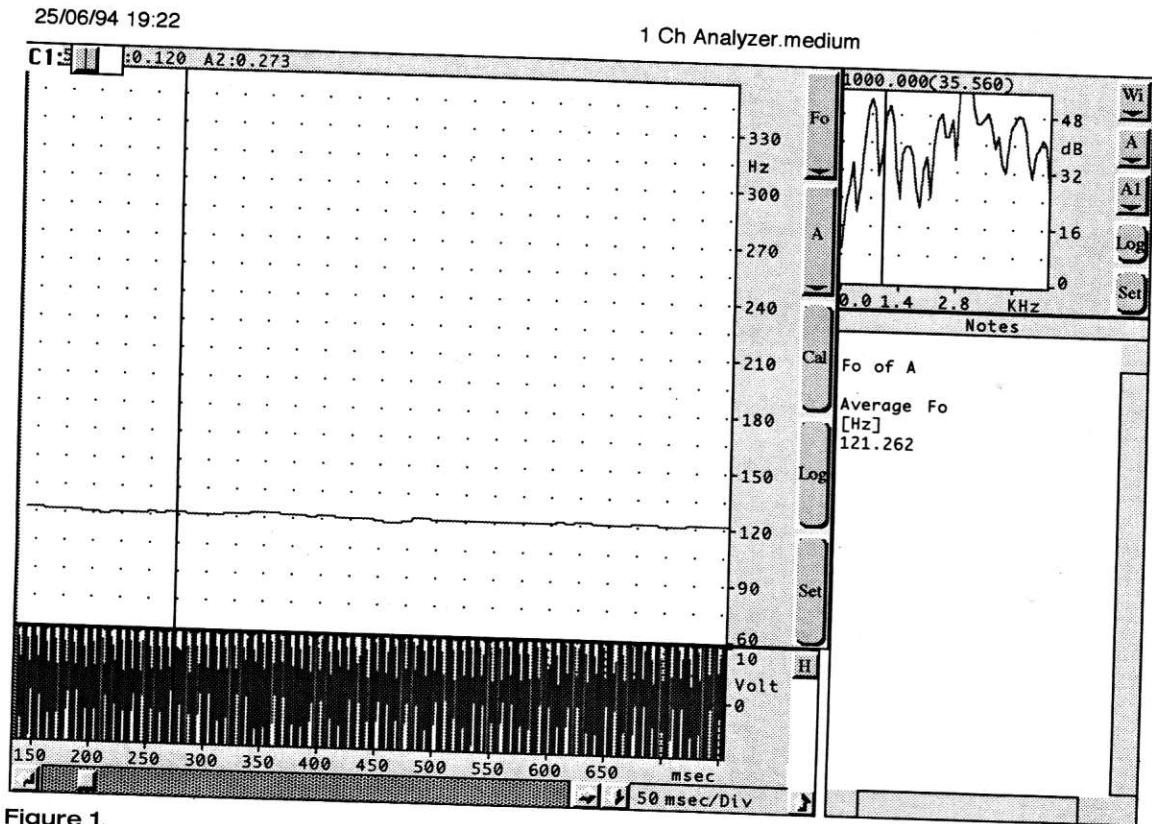


Figure 1.

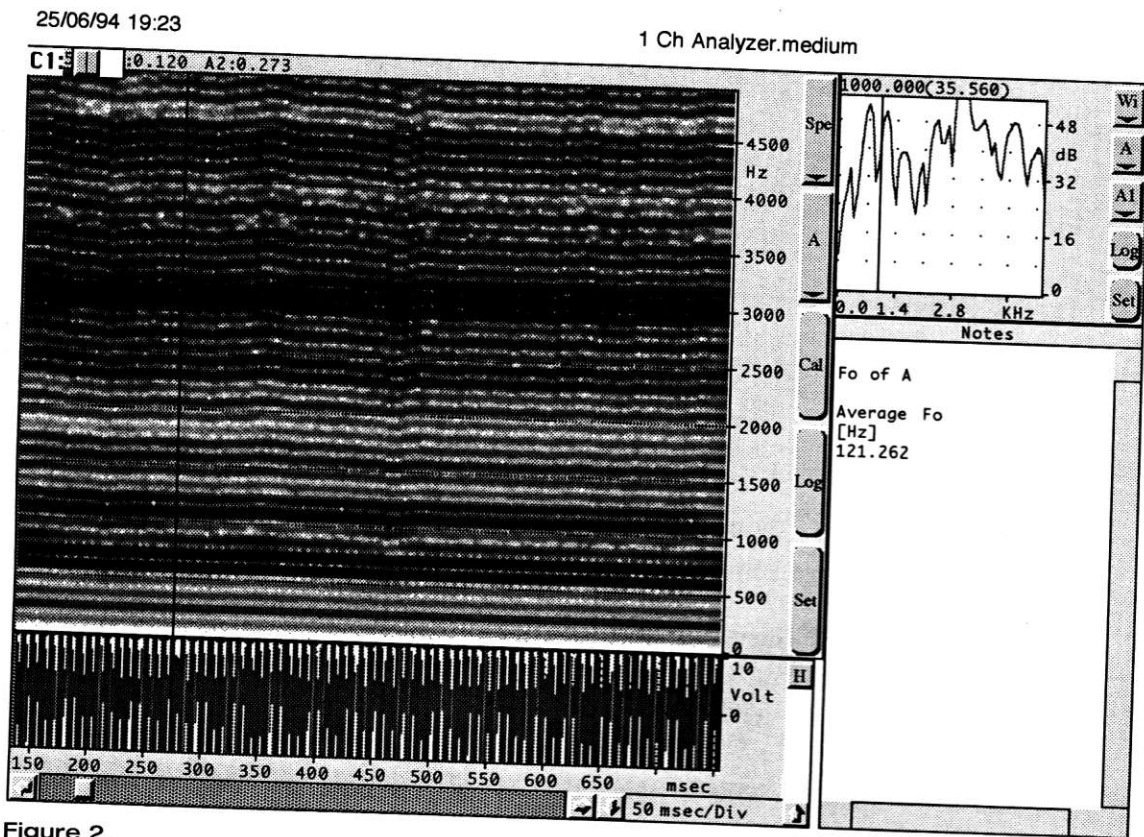


Figure 2.

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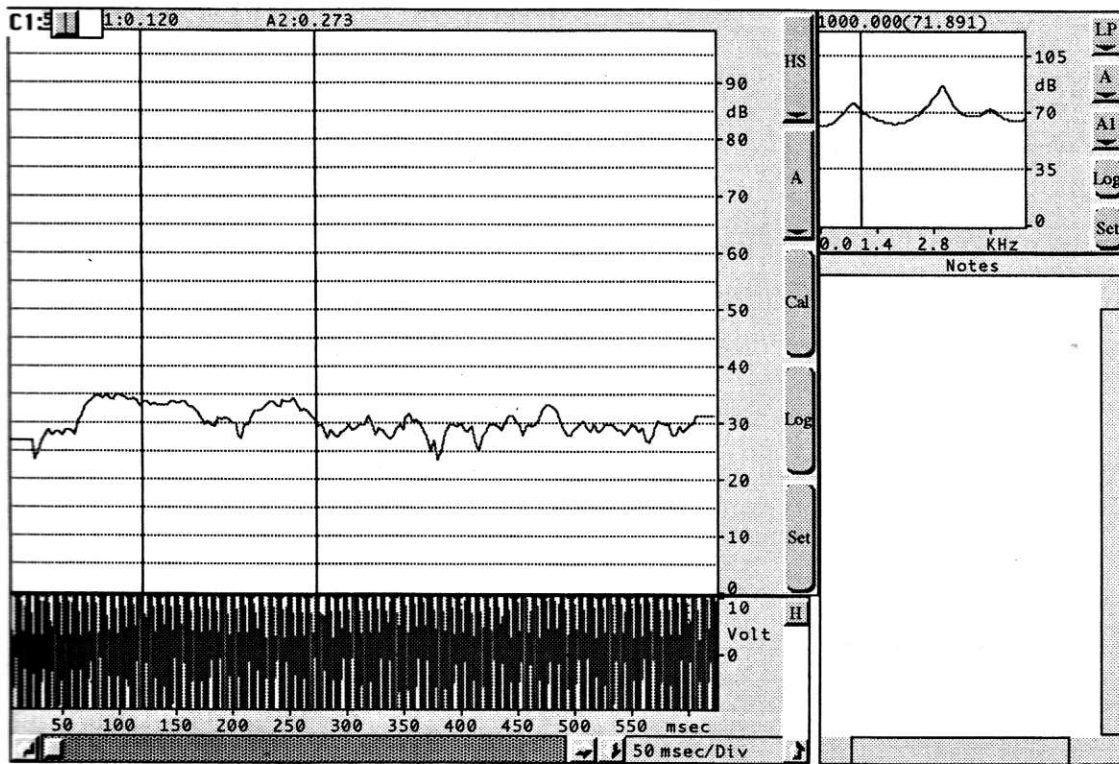


Figure 3.

monly use straight tone.⁷ Historically informed performance practice has brought widespread awareness of the expressive possibilities of straight tone. Many living composers favor a generalized use of non vibrato sound in order to create a timbre more akin to ethnic music (Iannis Xenakis) or folk music (John Cage). The use of non vibrato singing also can ensure a correct perception of microintervals. Given that the ear is accustomed to hearing diatonic music in equal temperament, singing microintervals with straight tone can encourage the perception of the actual pitch rather than simply one that is out of tune. By eliminating the vibrato, the singer leads the listener to listen in an analytic rather than an affective manner.

Analytic perception of pitch is dynamic perception of pitch contour and location in one-dimensional space of high/low pitch judgments. My use of the term “analytic” includes both perception of residue or fundamental pitch of complex tones (distinguished as analytic and synthetic respectively by Terkarat, 1974, 1977). My term “analytic pitch perception” contrasts with “affective pitch perception” by which I mean perception of pitch relations and changes as qualities—whether of texture, timbre, association, or of feeling.⁸

An amusing description of a rather common attitude among contemporary composers and their early music guru counterparts (for more on the correlation here, see Richard Taruskin’s fascinating article on the subject)⁹ can be found in the score to young French composer Pascal Dusapin’s piece *To God*: “The vibrato is ‘allowed’ if it is discreet and intelligent.”¹⁰

The most commonly used vibrato is the *bel canto vibrato*. This is the only one allowed or even acknowledged by many voice teachers, although William Vennard (citing Metfessel, Kwalwasser, and Johnson) has shown that only one child in five has a natural vibrato (by this he means what I define as a *bel canto vibrato*).¹¹ Moreover, extensive travels by this author have confirmed that singers from virtually all cultures outside of Europe and North America sing with no vibrato, as do North American natives.¹² The most typical reaction to a *bel canto vibrato* in non-Western cultures is laughter, a bit like a typical Westerner experiencing Peking Opera for the first time.

The amplitude of a *bel canto vibrato* ranges from a quarter tone to a half step, and its rhythm is 5 to 7.5 vibrations per second. In this author’s voice, its rhythm

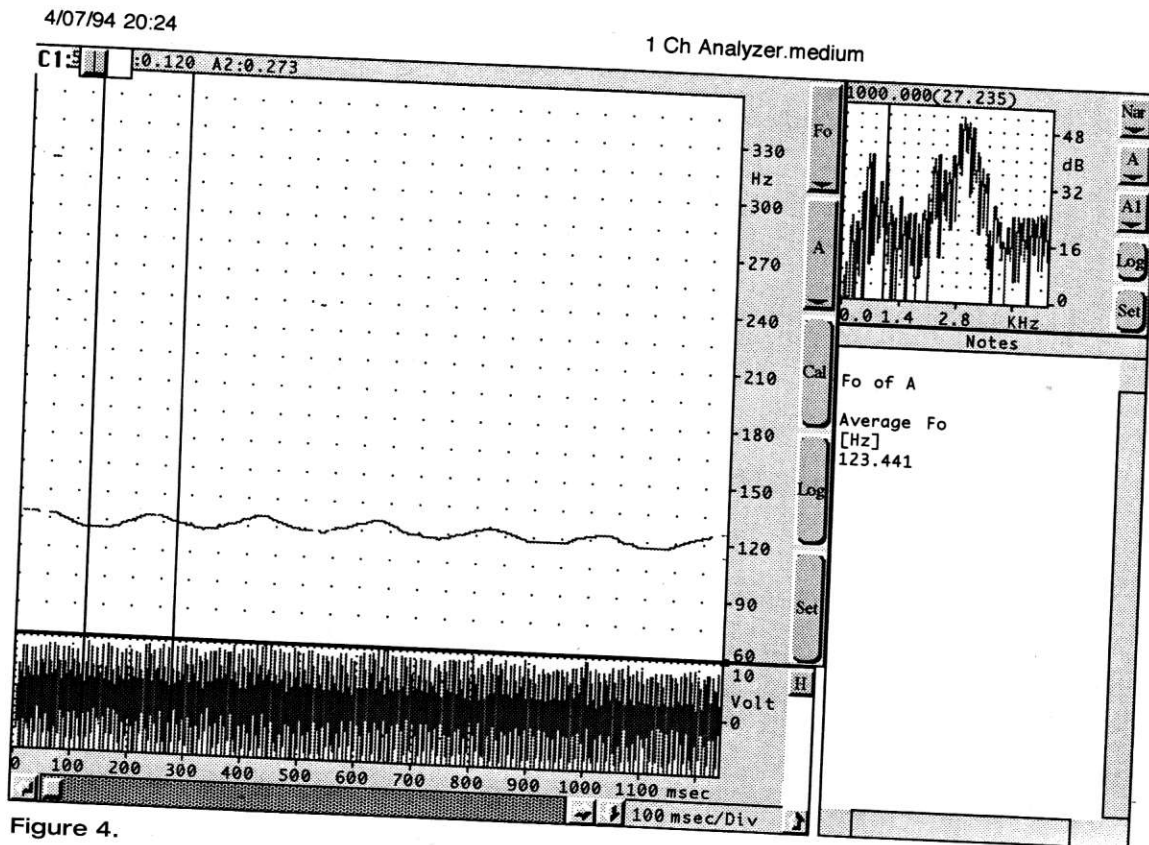


Figure 4.

is approximately 6 beats per second and its amplitude is a quarter tone (Figure 4). The bel canto vibrato has been described abundantly in studies on the voice; it has remained the norm in twentieth and twenty-first century music rooted in the Western tradition (most non-Western composers of so-called "contemporary music" have been trained in the West at some point in their education).

Whereas straight tone is produced primarily by the partially impeded functioning of the vocal folds, bel canto vibrato occurs as a result of the free synergistic contraction and relaxation of the intrinsic muscles of the larynx due to subglottic breath pressure. If the index finger and third finger are placed on the larynx while singing with a bel canto vibrato, a vibration somewhat like that of an electric razor might be felt, but the larynx does not noticeably move up and down. *Molto vibrato*, on the other hand, is produced primarily by the extrinsic muscles of the larynx.

Molto vibrato often is used by singers of romantic music to communicate heightened emotion and a perception of increased volume. Studies of electronic sounds

with and without vibrato at IRCAM have shown that the vibrato noticeably augments the perception of volume independently of the presence of the singing formant and other questions of timbre.¹³ William Vennard has analyzed recordings of songs as opposed to arias by historical singers such as Galli Curci, as well as the evolution of the vibrato rate during a crescendo by singers such as Caruso. The results confirm that the wider and slower the vibrato, the louder the voice is perceived and as a result, the same singer may use a slower, wider vibrato rate for opera than for song.¹⁴

A *molto vibrato* sound sung by the author of this article corresponds to an amplitude of a minor second and six oscillations per second (Figure 5). There is a corresponding increase in the intensity vibrato (time/decibels as opposed to time/hz in the case of the amplitude) from a peak at 30dB to one at 35dB (Figure 6). The periodicity of the intensity vibrato is more difficult to see, but this is most likely due to the limitations of Soundscape.

When shifting from the bel canto vibrato to the *tremolo*, changes in vibrato rhythm are negligible and the intensity vibrato increases with the amplitude (0–30 dB for

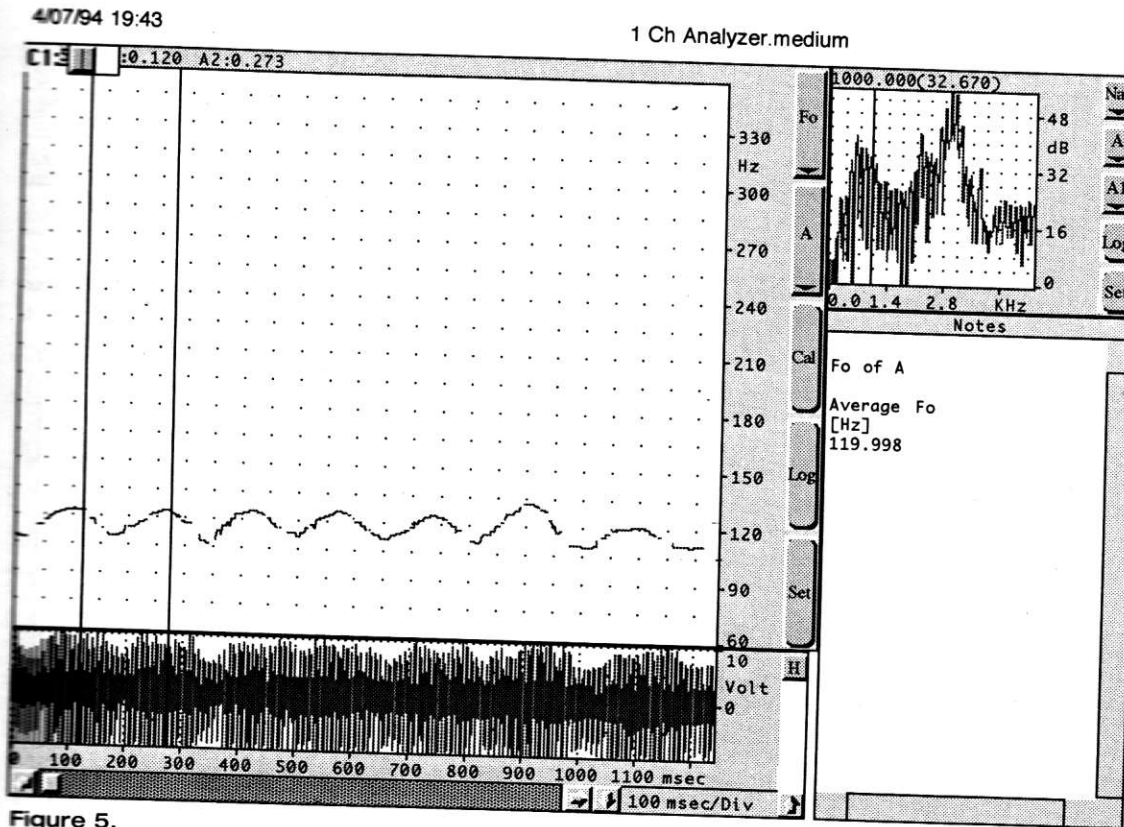


Figure 5.

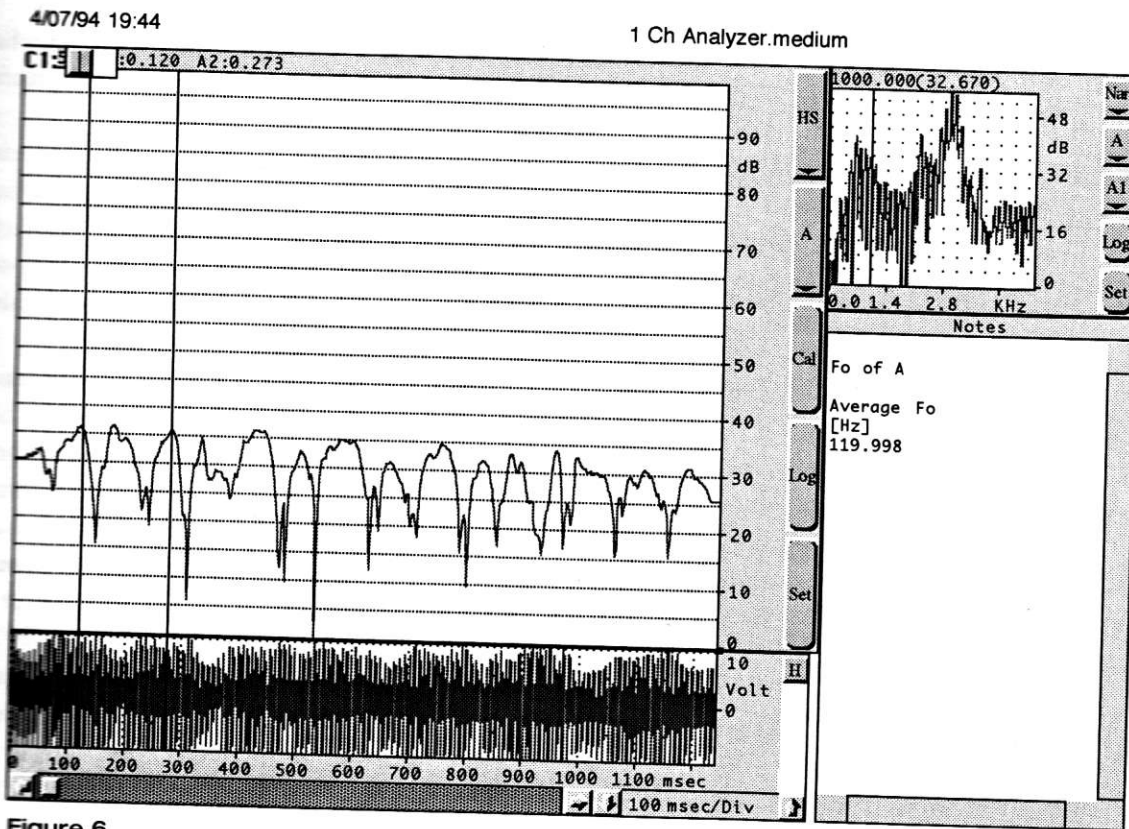


Figure 6.

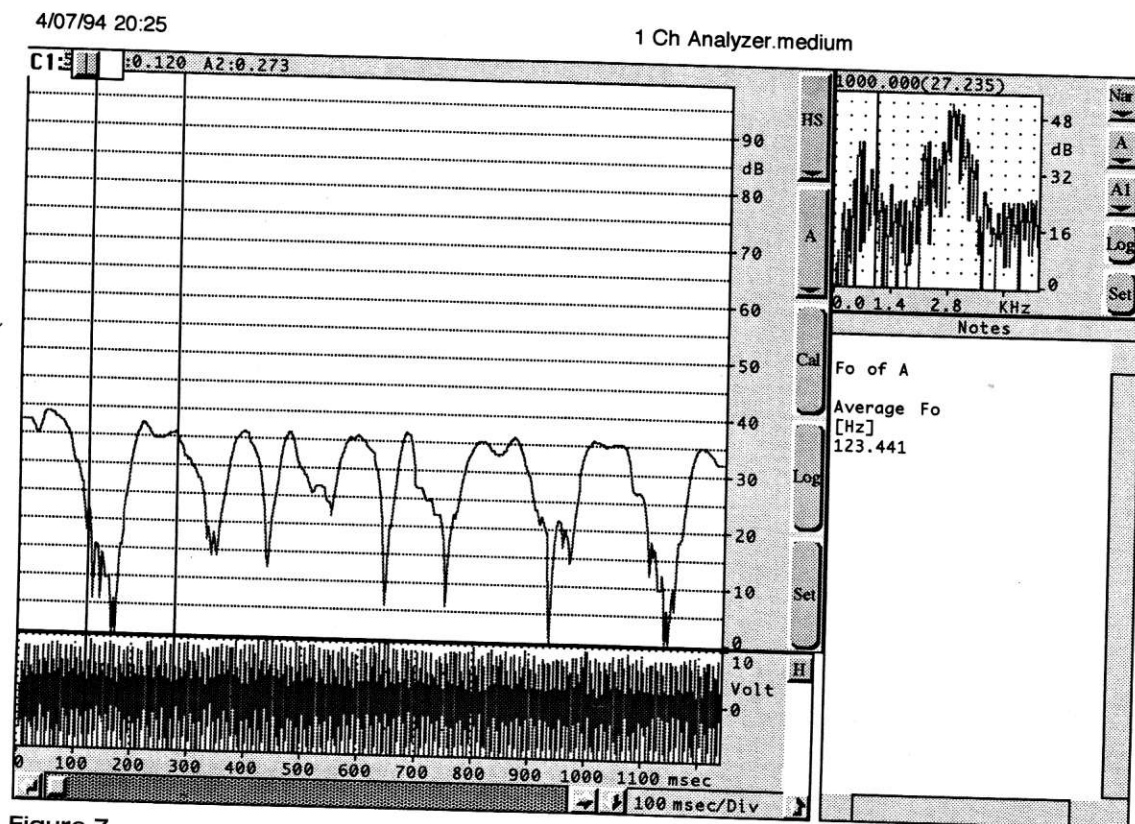


Figure 7.

the bel canto vibrato, 0–35 for molto vibrato, and 0–40 for tremolo, as can be seen in Figures 6, 7, 8, and 9). The extrinsic support muscles of the larynx participate increasingly as the larynx vibrates perceptibly, with a vertical movement similar to a well executed trill.

The term *tremolo* has a variety of meanings with regard to the voice. It is defined here with regard to amplitude, vibrating at a whole step in the example in Figure 9. Tremolo is the first type of vibrato mentioned here which rarely, if ever, is notated in pre-twentieth century voice literature. Many living composers ask for it, and it is the only effect of vocal vibrato specifically demanded by Pierre Boulez (e.g., in his writing for the choir in *Cummings ist der Dichter*).¹⁵ Some composers who have been influenced by Asian singing like to use tremolo. Giacinto Scelsi worked closely with the Japanese singer Michiko Hirayama and uses both molto vibrato and tremolo extensively.¹⁶ Sonograms performed on Japanese singers have identified vibratos with amplitudes of up to a major third.¹⁷ Hans Werner Henze uses molto vibrato and tremolo often, especially in *El Cimarrón* and *Wir kommen am Fluß*. Mauricio Kagel, György Kurtág,

Peter Maxwell Davies, Harrison Birtwhistle, Jean Barraqué, and Penderecki (*Dies Irae, The Devils of Loudon*) use this family of vibratos.

The entire vocal mechanism shakes, producing a vibrato, with the *head shake*. Peter Maxwell Davies is one of several composers who make use of this technique. The resulting movement of the extrinsic support muscles of the larynx produces this vibrato. In this example, the entire vocal mechanism shakes.

Straight tone and bel canto vibrato are produced primarily by the free or constricted vibrations of the intrinsic muscles of the larynx, whereas molto vibrato and tremolo incorporate the movement of the extrinsic muscles of the larynx. The four types of vibrato that follow are produced primarily by the epiglottis. Acoustically, spectral analysis reveals that they are the result of alternating breath and sound (Figures 10, 11, and 12).

The first of these is a *gentle glottal vibrato*, which Montclair referred to as a *flatté* in his treatise written in 1700.¹⁸ It is a soft fluttering of the epiglottis involving a softening of the sound by vocal placement in the nasal pharynx. Twentieth century composer Mauricio Kagel

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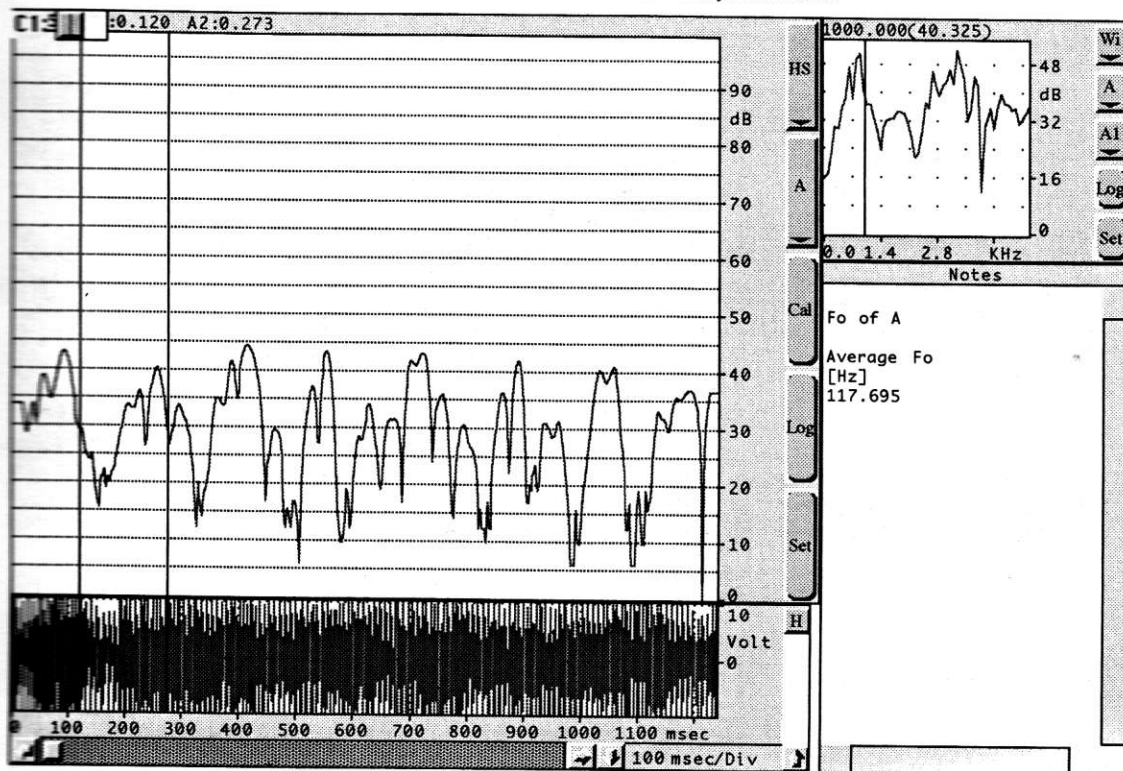


Figure 8.

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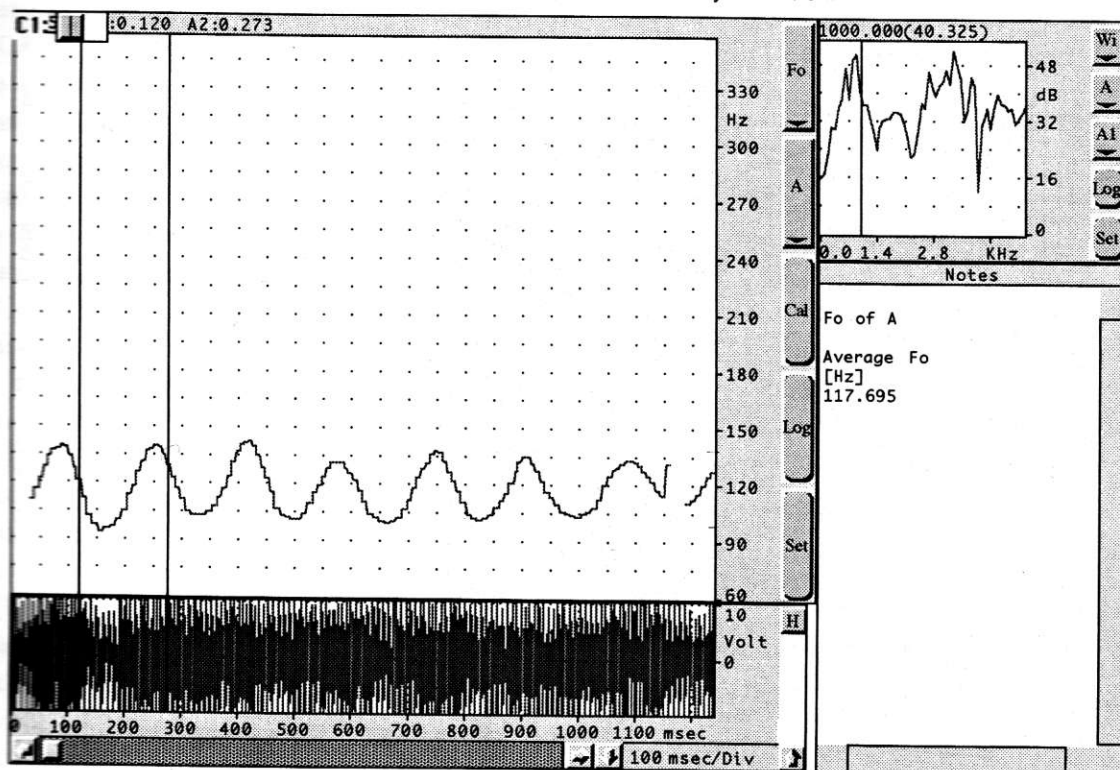


Figure 9.

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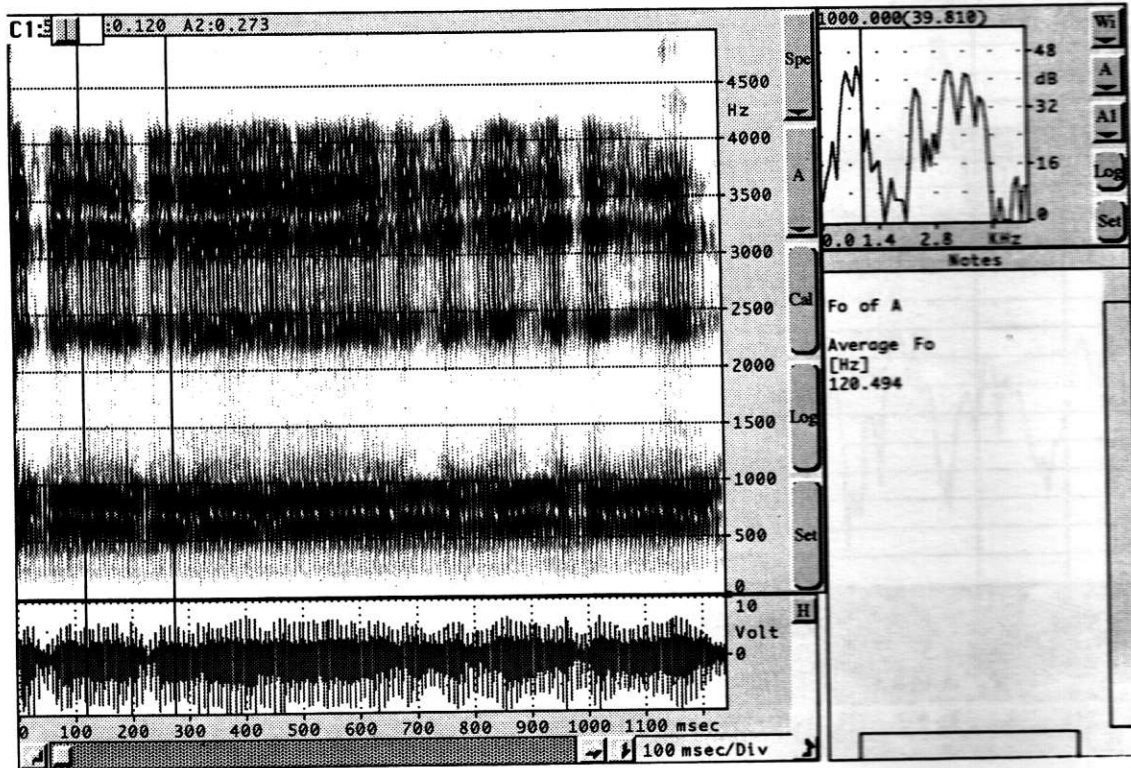


Figure 10.

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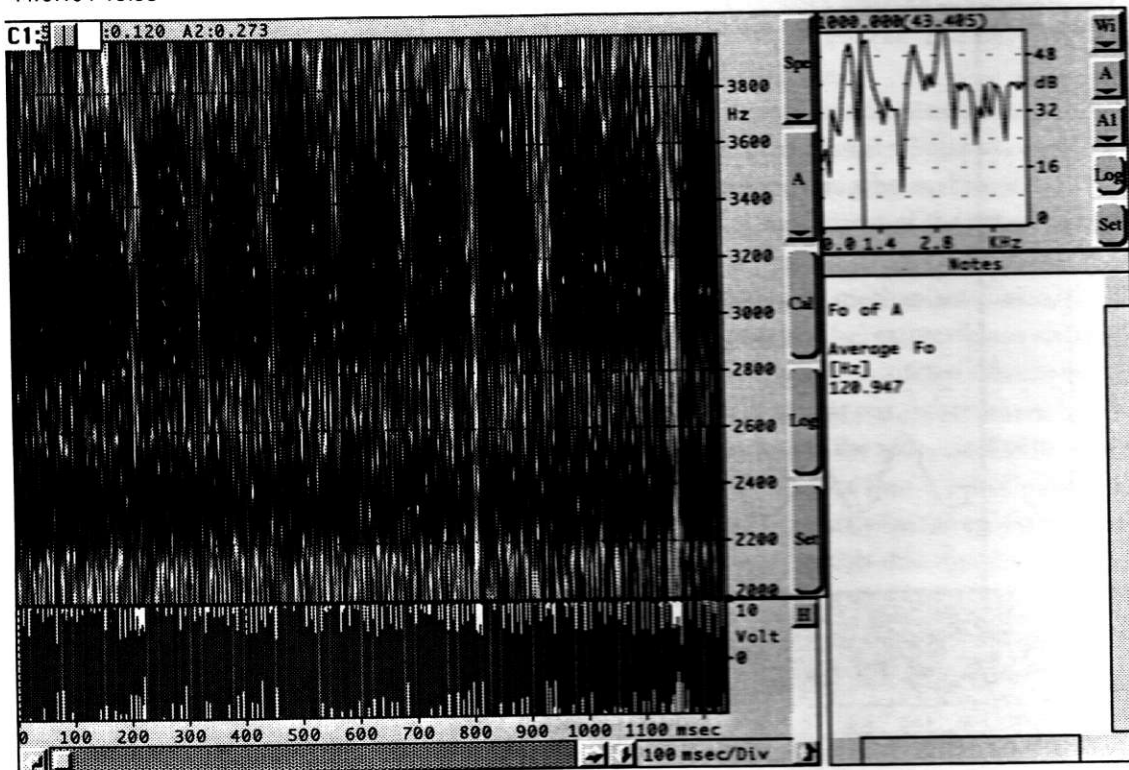


Figure 11.

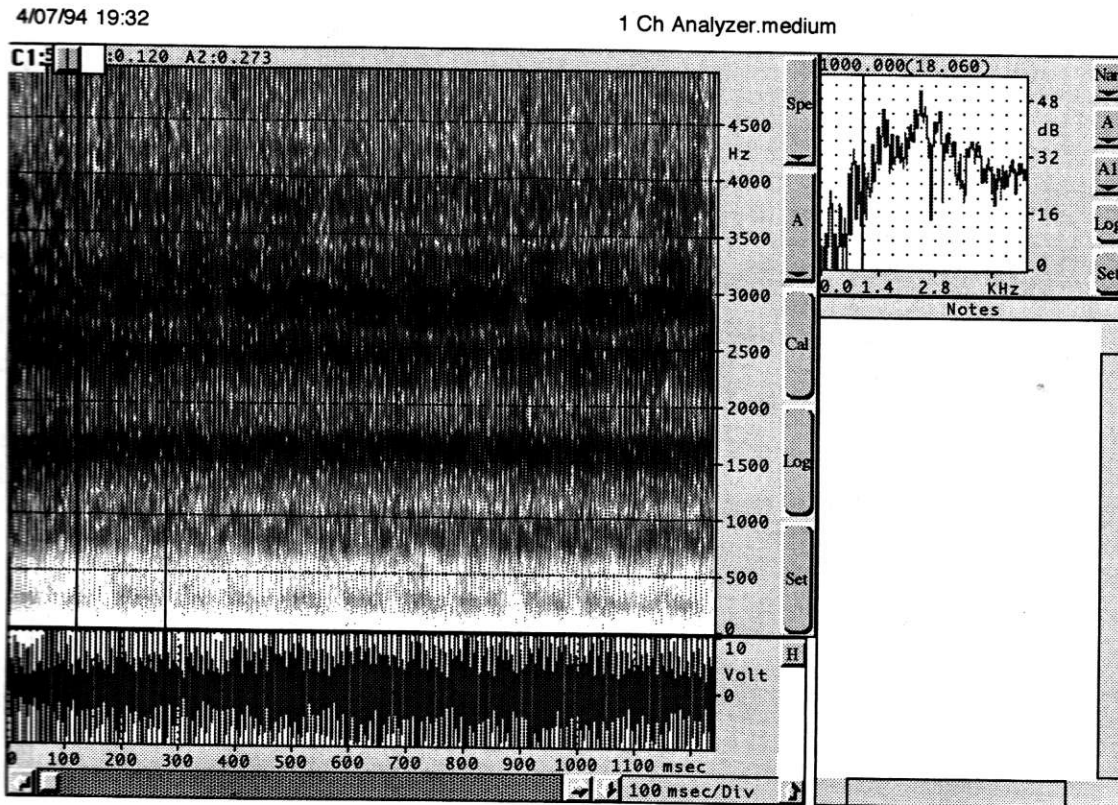


Figure 12.

uses it extensively in his work *Fürst Igor*, Stravinsky, and George Crumb quaintly calls it the “turtle dove effect” in his piece *Apparition* for female voice and piano.

A somewhat harder glottal vibrato can be obtained by singing more open vowels to produce what Montclair called a *balancement*.¹⁹ This *hard glottal vibrato* is favored by such composers as Iannis Xenakis, who perhaps was influenced by its frequent use in North Indian music.²⁰ Henri Pousseur correctly compares it to the instrumental *Flatterzunge* which it closely resembles in sound.²¹ It is often compared to laughter, a frequently used vocal effect in nineteenth century music. Both the *fiatté* and the *balancement* are present in the *trillo* used commonly in seventeenth century Italian music.

Interruptions of the sound by the breath are more frequent in the soft glottal vibrato than in the hard glottal vibrato (Figures 10 and 11).

The most amusing of the glottal vibratos are the *goat vibrato* and the *horse vibrato*. The former was described as a vocal flaw (“bleating like a goat”) in historic eighteenth century treatises by Mancini and Montclair,²² and Garcia criticized both in the nineteenth century.²³ Kagel uses the

goat vibrato in his piece *Anagramma*. Crumb asks for the horse vibrato (neighing like a horse) in his “Songs, Drones and Refrains of Death.”²⁴

Controlling parts of the vocal mechanism other than the larynx and the epiglottis also can produce vibratos. The tongue is a powerful filter of vocal harmonics. Diphonic singing in Mongolia and the Tuva Republic demonstrates how the tongue can create melodies of harmonics. Timbre vibratos can be created using a variety of techniques.

The periodic movement of the lips and tongue can create a rapid adjustment of the resonating cavities. Sonograms reveal that this leads to a fluctuation of the timbre as the formants pulsate at a rate of eight times (*tongue vibrato*) or nine times (*lip vibrato*) per second, depending on how quickly the lips and tongue are moved. This is especially visible at the level of the singing formant (Figures 13 and 14).

The lip vibrato, produced by a rapid vibration of the lips, which can be written in IPA as [ua] [ua] [ua] [ua] [ua], has been used by Luciano Berio in *Sequenza III*, as well as by Peter Maxwell Davies (*8 Songs for a Mad*

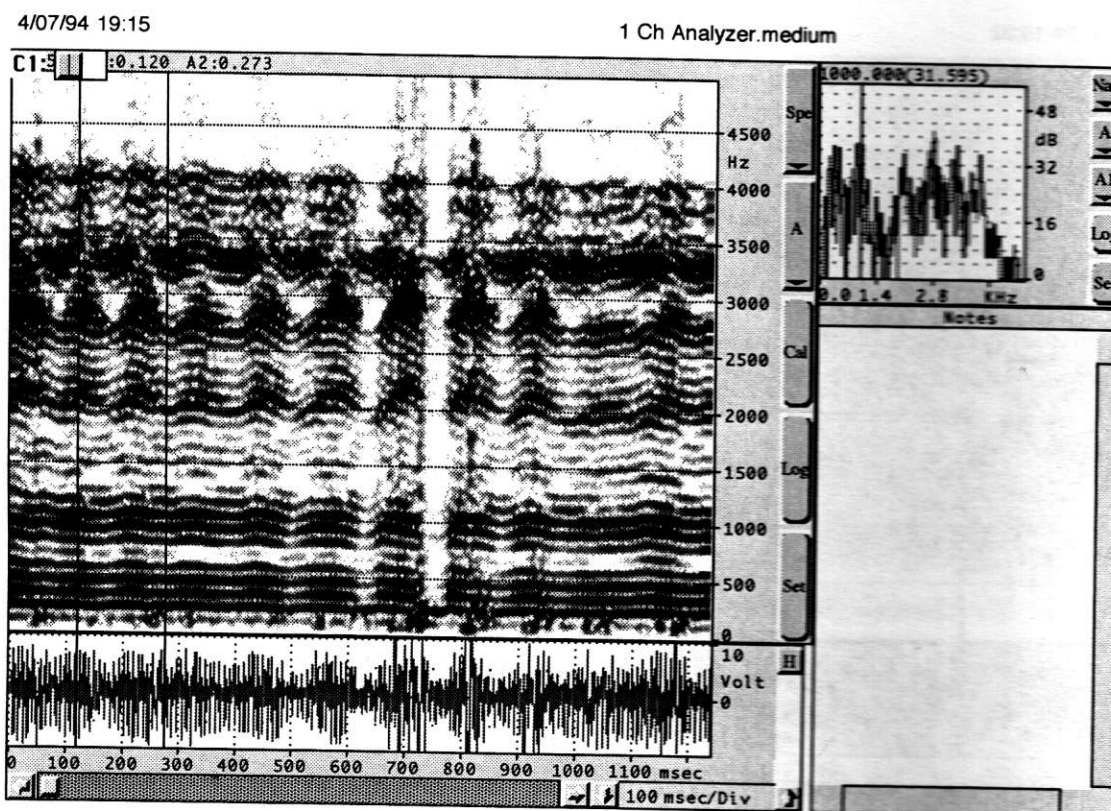


Figure 13.

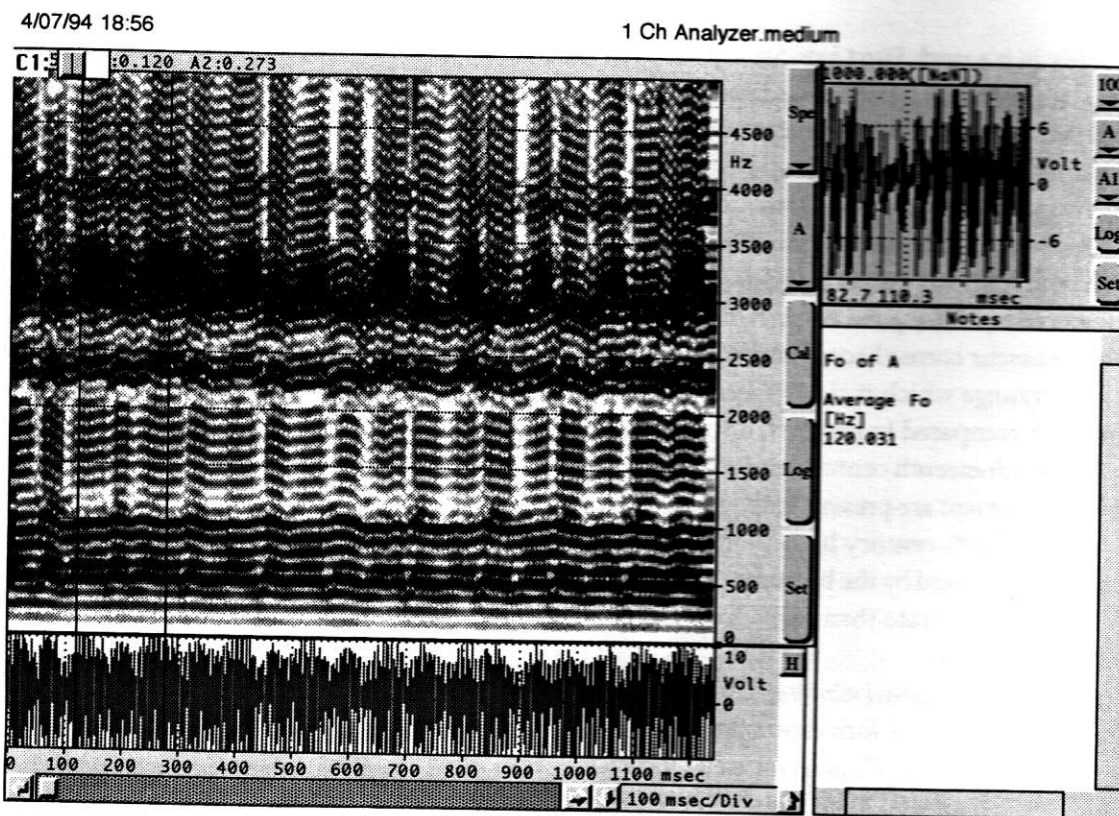


Figure 14.

King), Henri Pousseur (*Syllabaire pour Phèdre*), and Brian Ferneyhough (*Time and Motion Study III*).

The rapidly wagging tongue creates a timbre vibrato as well as a shaking of the entire larynx not unlike that of the tremolo, due to the fact that the tongue is attached to the larynx by the hyoid bone. A tongue vibrato can be found in Berio's *Sequenza III*, Stockhausen's *Lucifers Zorn*, and Ferneyhough's *Time and Motion Study III*.

The vibrato that is the most linked to timbre is the *harmonics vibrato*. It combines diphonic singing and the lip vibrato. As in the aforementioned ethnic singing in Central Asia, filtering the voice with the tongue produces a diphonic sound, producing high, whistling harmonics. A lip vibrato is then added, making the harmonics oscillate.

In *The Structure of Singing*, Miller discusses a pathological vibrato, which afflicts singers who have failed to master the *appoggio* technique of breath management. These singers sing with a vibrato that is manufactured by means of an oscillation of the umbilical-epigastric area.²⁵ Trevor Wishart asks singers to deliberately produce this sound in his *Anticredos*, as does Crumb in *Apparition*. Stockhausen notates this vibrato in his opera *Donnerstag aus Licht* by requesting the singer to "tremble as if you were cold." This vibrato could be called a *diaphragmatic vibrato*.

Singers can produce a vibrato by physically moving the larynx with the fingers. Stockhausen uses this theatrically and musically in a solo version of a scene from his opera *Montag aus Licht*.²⁶

Another mechanical vibrato can be obtained by interrupting the sound by tapping lightly on the lips with a flat hand while singing (like Native Americans in cowboy films). This is used in Berio's *Sequenza III* for voice, for example (see chart, "Physiology of the Vocal Vibrato").

In addition to these vibratos, there are numerous hybrids that have been created by combining them. One of the most common of these can be called "variable vibrato rates." A curved line indicating different rapidly changing amplitudes and rhythms of vibrato is often drawn in twentieth century scores such as *El Cimarrón* by Hans Werner Henze.

Another hybrid is the *Asian vibrato*, which begins slow and wide and becomes increasingly fast and narrow. This technique is common in Chinese music and

throughout Southeast Asia and has been imported by such composers as Chen Qigang and Tan Dun.

Similarly, the seventeenth century *trillo* evolves over time, starting slowly and becoming faster. As mentioned earlier, it makes use of the gentle glottal vibrato and the hard glottal vibrato. Twentieth century composers sometimes call it a "Monteverdi trill," although Caccini deserves the paternity more, having described it painstakingly in his treatise *Le nuove musiche*.²⁷ George Crumb uses it, as do younger composers such as Luca Francesconi (in *La Vita è Sogno*).

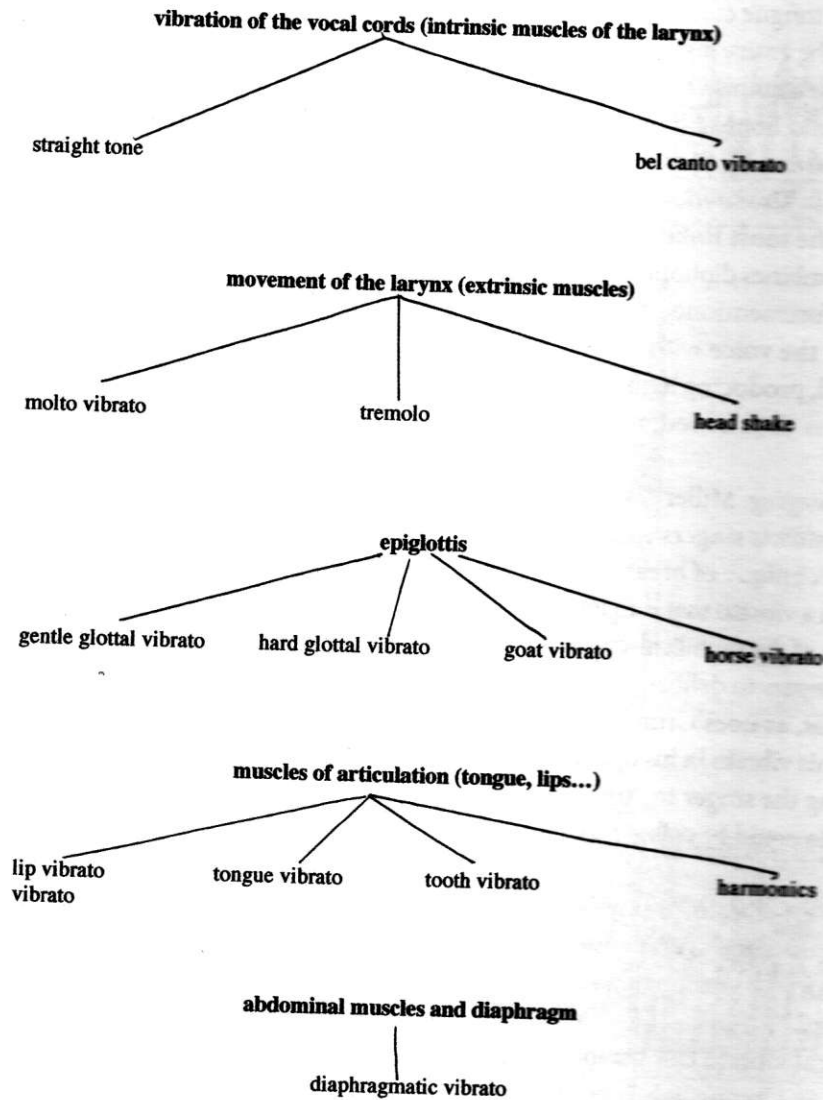
By combining the lip and tongue vibratos on [ju] [ju] [ju], [jo] [jo] [jo], etc., one achieves an interesting effect similar to that used by female singers in North Africa. Stockhausen uses this technique often in *Donnerstag aus Licht*. In his work *They*, Paul Mefano combines a crescendo, accelerando of vibrato rhythm, hard glottal vibrato, and combined lip and tongue vibrato on an amplitude of a quarter tone!

Although many of the vibratos described above may seem quite extreme, sonograms have revealed that the basic acoustic quality of the voice is altered surprisingly little. For example, the singer's formant is virtually unaltered.

Wherefore the vocal vibrato? We have seen that a vibrant sound is perceived as being louder than straight tone, perhaps explaining the slow, wide vibrato rates of many singers of nineteenth century opera, as theaters get bigger, comfortable chairs deaden acoustics, and orchestras play louder and louder. The *bel canto* vibrato is aesthetically pleasing to Western ears, which no doubt explains why it still predominates in works composed today. Musicians outside the Western classical music world often find it odd or even humorous. Vibrancy is often a vector of emotion, and both performers and composers use *molto vibrato* for the more passionate moments. Miller even asks students with a tendency towards straight tone to speak or sing in a highly emotional way in order to induce a more vibrant sound.

The primary function of the vibrato is expressiveness. This explains Fischer-Dieskau's comments and it sheds light on the explosion of different vibratos in the scores of twentieth century composers. Few techniques can color a single pitch in as rich a way as a carefully applied vibrato. An enormous palette of timbres springs

PHYSIOLOGY OF THE VOCAL VIBRATO



forth from this rich source. Without a new openness and understanding, we will be unable to train singers who can meet the demands of early music and contemporary music and sing romantic and classical music in an exciting, vital manner.


NOTES

1. Michel Pignolet de Montéclair, *Nouvelle méthode pour apprendre la musique* (Paris, 1709).
2. Bénigne de Bacilly, *Remarques curieuses sur l'art de bien chanter* (Paris, 1668/1679).

3. Manuel Garcia, *Traité complet de l'art du chant* (Paris: Schott, 1847).
4. Edgar Varèse, *Ecuatorial* (Milano: Ricordi, 1961; originally composed in 1927).
5. John Large, "An air flow study of the vocal vibrato," *Transcripts of the Eighth Symposium on Care of the Professional Voice* (New York: Juilliard, 1979); Benoit Amy de la Bretèque, *Le Chant: Contraintes et Liberté* (Paris: Fuzeau, 1991).
6. Large.
7. Ibid.
8. Scott Makeig, "Affective Versus Analytic Perception of Musical Intervals," *Music, Mind and Brain* (New York: Plenum, 1982).


9. Richard Taruskin, "The Pastness of the Present and the Presence of the Past," *Authenticity and Early Music* (Oxford: Oxford University Press, 1988).
10. Pascal Dusapin, *To God*, for soprano and bass clarinet (Paris: Editions Salabert).
11. William Vennard, *Singing, the Mechanism and the Technic* (New York: Fischer, 1967).
12. The recordings and spectral analysis in *Voices of the World* (Paris: CNRS/Musée de l'Homme, 1996) are a valuable source.
13. Conversations with psychoacoustician Steven Macadams (1992–1994).
14. *Ibid.*
15. Pierre Boulez, *Cummings ist der Dichter* (Vienna: Universal Editions, 1970/1986).
16. Giacinto Scelsi, *Canti del Capricorno, Wo Ma, Maknongan, Hô and other works* (Paris: Editions Salabert).
17. Akira Tamba, "La technique vocale du Nô et son esthétique," (Paris: *Ateliers d'Ethnomusicologie*, 1991).
18. Montéclair.
19. *Ibid.*
20. Conversations with the composer (1988–1992).
21. Henri Pousseur, *Mnemosyme II* (Milano: Suvini Zerboni, 1968).
22. Giovanni Battista Mancini, *Riflessioni pratiche sul canto figurato* (Milano, 1777).
23. Garcia.
24. Rehearsals for the piece with the composer (1994).
25. Richard Miller, *The Structure of Singing* (New York: Schirmer, 1986).
26. Karlheinz Stockhausen, *7 Lieder der Tage* for solo voice or voice and chordal instrument (Kürten: Stockhausen Verlag, 2002).
27. Giulio Caccini, *Le nuove musiche* (Florence, 1601).

Nicholas Isherwood is a bass baritone specializing in early and contemporary music. After receiving a BA and BM from Oberlin College and Conservatory (with Richard Miller), he continued his vocal study and research in Europe (Haskell and Watson Fellowships). He has performed as a soloist on five continents in the world's leading venues (La Scala, Covent Garden, Salzburg Festival, Châtelet, Concertgebouw, Konzerthaus Wien, all three Berlin opera houses, Moscow Conservatory, Tanglewood, Disney Hall) and made 52 CD recordings for labels such as Harmonia Mundi, Erato, Naxos, and Stockhausen Verlag. He has worked closely with composers such as Sylvano Bussotti, Elliott Carter, George Crumb, Hans Werner Henze, Mauricio Kagel, György Kurtág, Olivier Messiaen, Giacinto Scelsi, and Iannis Xenakis, and he collaborated with Karlheinz Stockhausen for 23 years, singing numerous world premieres. Isherwood frequently teaches master classes (Milan Conservatory, Paris Conservatoire, Salzburg Mozarteum, Stockhausenkurse, Institute for the Living Voice), and is writing a book *Techniques of Singing*, for Bärenreiter Verlag. Findings in this article are based on research conducted with otolaryngologist Dr. Marc Yana and composer Hugues Dufourt for his Diplôme d'Études Approfondies thesis at the Ecole des Hautes Etudes in Paris (1994). Isherwood has been invited to lecture on the subject of the vocal vibrato for academics (UCSB), composers (IRCAM), otolaryngologists (the Hôpital Foch), and psychoanalysts (seminar of Dr. André Brousselle). He is currently assistant professor of singing and opera at the University of Oregon.



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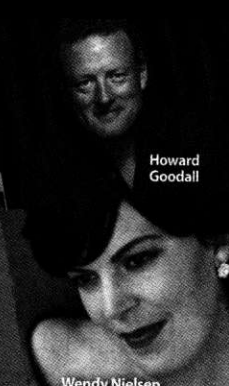


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