The Visual/Kinesthetic Effects of Melodic Contour in Musical Notation as it Affects Vocal Timbre in Singers of Classical and Music Theater Repertoire

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Summary: The purpose of this investigation was to obtain information from professional singers active in performing of both classical and music theater repertoire with regard to the visual/kinesthetic effect of melodic contour in musical notation as it affects vocal timbre. The evaluation of data gathered during the study indicates that there is reason to investigate the resulting postural shifts of the head and neck because they are guided by visual maps of melodic contour and its inversion. Significantly, it was discovered that the tone quality produced when a singer's head and neck postures followed the natural melodic contour of the melody was in no case considered to be the most pleasing of the conditions studied and that, in many cases, the tone quality produced when a singer's head and neck postures followed a map of the inversion of the melodic contour was judged to be much improved. The results of the study also indicate that the development of new technology for the general teaching studio, designed to address these effects, may be useful to these singers.

Key Words: Posture—Timbre—Melodic contour—Classical voice—Music theater voice—Head and neck—Tone quality—Visual/kinesthetic effect—Technology.

INTRODUCTION

Challenge

In June 2002, research was presented at the Voice Foundation's 31st Annual Symposium: Care of the Professional Voice that identified three primary criteria commonly recognized among singing pedagogues for the determination of talent in untrained singing voices. Along with accuracy in intonation and evidence of musicality, Watts et al[1] demonstrated that beauty of timbre or tone color was also determined to be essential in the recognition of untrained singing talent.

Within institutions dedicated to the development of elite singing voices, talented persons with the

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most consistent quality of pleasing tone color are prized and promoted. This is generally agreed to be true, both in classical voice and music theater voice training; it is the goal of most singing teachers to develop greater consistency in the tone quality of the student by use of the most healthy and efficient pedagogical means possible.

One of the most commonly observed pedagogical challenges to the achievement of this goal is the often-encountered visual/kinesthetic connection of the singer's body to the perceived motion of notes on a page of printed music. Because Western music is notated on a vertically fluctuating horizontal grid, students of singing may sometimes mimic the motion of those notes across the page, raising and lowering postures of the head and neck in response to the waveform seen in the melodic contour. That is to say, if one was to "connect the dots" of musical notation, an irregular waveform would emerge to reflect the intervallic movement of that melody through the pitches or fundamental frequencies of the desired sound. This waveform is known as melodic shape or contour and is evident in every motive, period, and phrase of a melody in music.[2] Figure 1 maps the melodic contour of a musical notation example with a continuous chain-like bubble line through the note heads, proceeding from left to right.

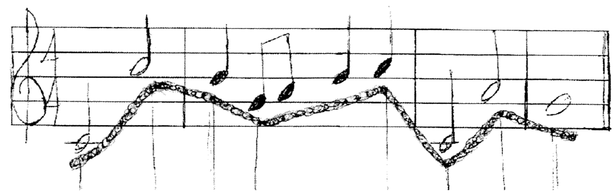

FIGURE 1. Melodic contour in standard musical notation.

This study focuses on the resulting vocal timbre produced by a singer when a nodding motion of the head and neck follows this contour as that singer produces each tone of the melody. It further investigates the possibility of a new pedagogical tool dedicated to the correction of this phenomenon.

Argument for investigation

For the most part, existing studies and pedagogical texts address the relationship between the postures of the head and neck and vocal tone quality or timbre in broad strokes. Meribeth Bunch[3] states that optimal vocal quality is the result of a "sense of balance rather than tension," despite the interplay of the antagonistic muscles of the breath, larynx, and resonators needed to produce a pleasing tone. Similarly, William Vennard's[4] famous marionette image of ideal posture for singing refers to the balance of the head suspended from its top, along with the chest comfortably elevated, and the pelvis hanging from the spine. To this general image, Bunch[5] adds that changes in the posture of the head and neck "alter the shape of the vocal tract." Vennard[6] then submits that changes in ideal singing posture may produce tension and that "sound that passes through a tense throat is different from one that comes from a relaxed throat." Following suit, Bunch[7] contributes that changes in postural shifts may very well result in "undesirable changes in vocal quality." Through this virtual discussion of two of the leading pedagogues of our era, and through further corroboration by fellow voice scientist Johann Sundberg,[8] we find the crux of the relationship between postural shifts of the head and neck with resulting variable tone colors in the singing voice. These shifts in posture may produce less-than-favorable results.

In the field of voice therapy, however, postural shifts have proven to be useful tools for singers. Researchers such as Dejonckere and Lebacq[9] have documented immediate improvement of voice quality simply by changing basic postural positions. Similarly, the leaders of music theater methods, such as Jeannette LoVetri and Jo Estill, who are still determining the standard use of these methods, use elevated postures of the head and neck for certain vocal and technical effects. Still, classically trained teachers of singing like James McKinney[10] and Oren Brown[11] follow in the tradition of warning against the "habit of raising the chin to 'reach' for high notes." Yet, both classical and music theater authorities tend to prize consistent sound production suitable to the artistic needs of the performance.

It is possible, then, that these seemingly opposing views of the positive and negative effects of postural shifts are facets of the same technical paradigm intended for easier use of the vocal mechanism by singers and consistent tonal output. As with Vennard's marionette image, apparently defying gravity

AUTHORITY PERCEPTUAL MEASURES CHART

Instructions:
Each subject will produce eight samples of singing – four (A-D) in Classical Singing Voice and four in Music Theatre Singing Voice.

1. Rate each sample for vocal timbre and record your findings on the chart below, following this numerical scale: 1= unacceptable, 2= acceptable, or 3= ideal.
2. Indicate the "best" vocal timbre sample for Classical Singing and for Music Theatre Singing for each subject by placing parentheses around that score.

Subject #1	Classical	A___	B___	C___	D___
	Music Theatre	A___	B___	C___	D___
Subject #2	Classical	A___	B___	C___	D___
	Music Theatre	A___	B___	C___	D___

(ETC.)

FIGURE 2. Authority perceptual measures chart.

in its postural supports, most students of singing have been told that "down is up" and "up is down" with regard to the image we have of changing pitch. We have been taught that we should approach each higher pitch (than the one we are singing) as if it were lower, and each lower pitch as if it were higher—all this in an effort to decrease strain on the mechanism and to increase usable vocal range for singers. Consequently, part of the art of singing is our ability to reconcile these directional opposites.

The purpose of this study, then, is to investigate the possibility that if we visually invert the concepts of "high" and "low" with regard to notes within the melodic contour of musical notation, we might then derive a more pleasing and consistent vocal timbre through training.

METHODS

Participants

Eight trained, professional singers between the ages of 21 and 45 years who regularly perform both classical and music theater repertoire volunteered as research subjects from the group of registrants at the First Annual Pedagogy and Vocology Week of the Voice Institute at USA: A Regional Center for Voice Studies and Research at the University of South Alabama. All participants had normal hearing, no history of chronic vocal pathologic conditions, no previous voice therapy, no history of drug or alcohol abuse, no history of smoking, and no current allergies or voice problems at the time of testing.

Data acquisition

This investigation was primarily contingent on perceptual feedback as judged by 2 voice authorities in a blind real-time setting with the 8 subjects. Oren L. Brown (primary, published classical singing authority) and Jeannette LoVetri (primary, published music theater singing authority) were seated behind a screen and instructed to rate 8 voice samples per subject. They were not aware of the conditions set for the subjects in producing each sample, aside from the shift from classical singing voice to music theater singing voice; because each was a teacher in both classical and music theater settings, both rated all samples. Four classical samples and 4 music theater samples produced from the same subject were rated as either (1) unacceptable, (2) acceptable, or (3) ideal on an Authority Perceptual Measures Chart,

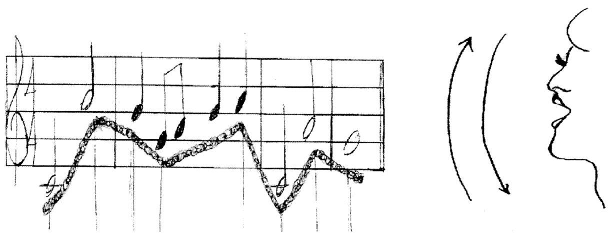

FIGURE 3. Condition A—postural shifts with natural melodic contour.

such as seen in Figure 2. Brown and LoVetri were also instructed to circle the most appealing sample (in terms of vocal timbre) of the 4 classical and then the 4 music theater samples for each subject.

We used the *Computerized Speech Lab* (*CSL*; Kay Elemetrics Corporation, Lincoln Park, NJ) as a signal acquisition device for the voice samples. Data from these samples were acquired for possible future use by researchers in analysis and for recording examples for research presentation.

Procedures

Subjects were instructed individually to stand before a music stand containing musical notation of the first 10 notes of the melody "Somewhere over the Rainbow" (from *The Wizard of Oz*), with the bottom portion of the page remaining covered until the final sample was collected in each of the two styles (classical and music theater voice). A common midrange key of C major was chosen for the exercise. The starting pitch (C4 or middle C) was generated from an electric piano keyboard before each sample to ensure consistent intonation in all samples. A head-mounted microphone was used by us for acoustic recordings. Each subject produced 8 samples of the melody, 4 in a classical singing voice

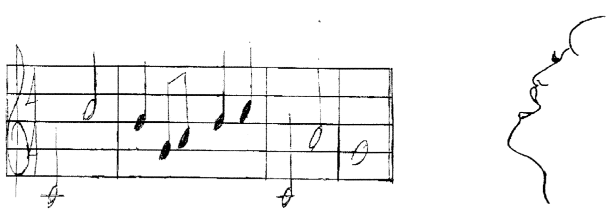

FIGURE 4. Condition B—head and neck elevated.

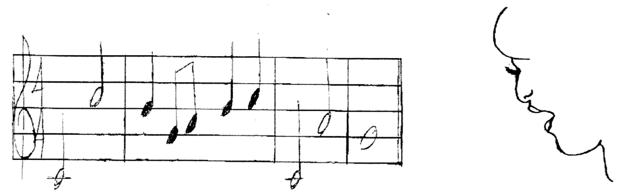

FIGURE 5. Condition C—head and neck downcast.

and 4 in a music theater singing voice. The melody was sung on the vowel [a] in the following conditions:

Condition A: The subject was instructed to sing the melody while reading the musical notation and allowing the head and neck to follow the curve of the normal melodic contour.

Condition B: The subject was instructed to sing the melody while reading the musical notation and holding the head and neck in an elevated posture throughout.

Condition C: The subject was instructed to sing the melody while reading the musical notation and holding the head and neck in a downcast posture throughout.

Condition D: The subject was instructed to remove the masking on the bottom part of the sheet music and reveal an inversion map of the melodic contour of the melody. The subject was then instructed to sing the melody while reading the musical notation and allowing the head and neck posture to follow the curve of the inversion.

RESULTS

The Authority Perceptual Measures of Brown and LoVetri are represented in Figures 7 and 8. The

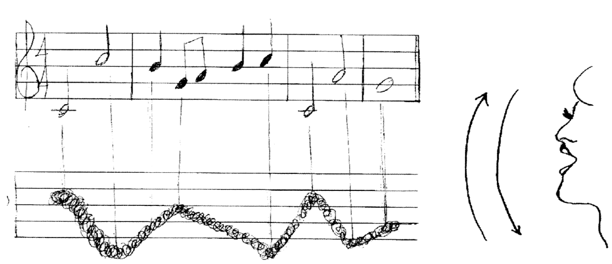

FIGURE 6. Condition D—postural shifts with inversion map of melodic contour.

Instructions:

Each subject will produce eight samples of singing – four (A-D) in Classical Singing Voice and four in Music Theatre Singing Voice.

3. Rate each sample for vocal timbre and record your findings on the chart below, following this numerical scale: 1= unacceptable, 2= acceptable, or 3= ideal.
4. Indicate the "best" vocal timbre sample for Classical Singing and for Music Theatre Singing for each subject by placing parentheses around that score.

Subject #1	Classical	A_2_	B_2_	C_2_	D (3)
	Music Theatre	A_1_	B_2_	C_2_	D (2)
Subject #2	Classical	A_1_	B (2)	C_1_	D_2_
	Music Theatre	A_1_	B_2_	C_2_	D (3)
Subject #3	Classical	A_2_	B_2_	C_2_	D(3)
	Music Theatre	A_1_	B_2_	C (2)	D_2_
Subject #4	Classical	A_3_	B_2_	C_2_	D (3)
	Music Theatre	A_1_	B_1_	C (2)	D_1_
Subject #5	Classical	A_2_	B_2_	C_2_	D (3)
	Music Theatre	A_1_	B_2_	C (2)	D_2_
Subject #6	Classical	A_1_	B_2_	C_1_	D (2)
	Music Theatre	A_1_	B_1_	C_1_	D (2)
Subject #7	Classical	A_2_	B_2_	C_1_	D (2)
	Music Theatre	A_2_	B_2_	C (2)	D_2_
Subject #8	Classical	A_2_	B_2_	C (3)	D_3_
	Music Theatre	A_2_	B_2_	C (3)	D_2_

FIGURE 7. Authority perceptual measures chart: Brown.

raw data results are interesting in several aspects. Although vocal quality varied with the instrument and use of each subject, both authorities were able to rate a relative "best" sound for each subject in the 2 singing style products, shown as the score in parentheses in each case. Brown's "best" product choices almost consistently favored the downcast posture timbre product of Condition C or the inverted melodic contour posture product of Condition D. LoVetri's "best" product choices were more divergent across Conditions B, C, and D. Nevertheless, neither authority rated any subject in either style at his or her best in the natural melodic contour posture of Condition A.

When percentages of perceptual improvement in a compilation of the two Authority Perceptual Measures Charts compiled in Table 1 were assessed, more subjects produced their "best" vocal timbre (indicated on the chart by parentheses) when singing with the head following an inverted melodic contour

Instructions:

Each subject will produce eight samples of singing – four (A-D) in Classical Singing Voice and four in Music Theatre Singing Voice.

5. Rate each sample for vocal timbre and record your findings on the chart below, following this numerical scale: 1= unacceptable, 2= acceptable, or 3= ideal.
6. Indicate the "best" vocal timbre sample for Classical Singing and for Music Theatre Singing for each subject by placing parentheses around that score.

Subject #1	Classical	A_2_	B_2_	C_2_	D (3)
	Music Theatre	A_2_	B (2)	C_2_	D_2_
Subject #2	Classical	A_2_	B (2)	C_1_	D_2_
	Music Theatre	A_1_	B (1)	C_1_	D_1_
Subject #3	Classical	A_1_	B_1_	C_1_	D (2)
	Music Theatre	A_1_	B (2)	C_1_	D_2_
Subject #4	Classical	A_1_	B_2_	C (2)	D_2_
	Music Theatre	A_1_	B_1_	C (2)	D_1_
Subject #5	Classical	A_1_	B_1_	C (2)	D_1_
	Music Theatre	A_1_	B_1_	C (1)	D_1_
Subject #6	Classical	A_2_	B_2_	C_1_	D (2)
	Music Theatre	A_2_	B_1_	C (2)	D_1_
Subject #7	Classical	A_1_	B_2_	C_2_	D (2)
	Music Theatre	A_2_	B_2_	C (2)	D_2_
Subject #8	Classical	A_1_	B (2)	C_1_	D_1_
	Music Theatre	A_1_	B_1_	C_2_	D (2)

FIGURE 8. Authority perceptual measures chart: LoVetri.

map in the context of the classical singing voice, compared with the other conditions: 0% of the results favored the timbre produced by head and neck postures following the normal melodic contour of the melody (Condition A), 19% favored the timbre produced by an elevated posture of the head and neck (Condition B), 19% favored the timbre produced by a downcast posture of the head and neck (Condition C), and 62% favored the timbre produced by head and neck postures following the inverted melodic contour (Condition D).

Interestingly, "best" ratings were less conclusive when subjects sang in their music theater voices, but they still indicated a substantial lean toward the downcast posture of Condition C: 0% of the results favored the timbre produced by head and neck postures following the normal melodic contour of the melody (Condition A), 19% favored the timbre produced by an elevated posture of the head and neck (Condition B), 25% favored the timbre produced by head and neck postures following the inverted melodic contour (Condition D), and 56% favored the

TABLE 1. *Composite of "Best" Singing Timbre Perceived at All Conditions*

Subjects with vocal timbre ➡	Best at Condition A (natural melodic contour postures)	Best at Condition B (elevated posture)	Best at Condition C (downcast posture)	Best at Condition D (inverted melodic contour postures)
Classical singing	0%	19%	19%	62%
Music theater singing	0%	19%	56%	25%

timbre produced by a downcast posture of the head and neck throughout (Condition C).

When the composite scores of the two authorities are analyzed statistically as seen in Table 2, one noteworthy result is suggested. Based on the compiled descriptive statistics rating each subject as producing (1) unacceptable, (2) acceptable, or (3) ideal timbres in each condition, as derived from the two Authority Perceptual Measures, subjects were rated as having a better singing voice when singing with the head following an inverted contour in the context of a classical singing voice, compared with the other conditions. However, ratings compared in this way were inconclusive when subjects sang in a music theater voice.

DISCUSSION

The purpose of this investigation was to obtain information from professional singers active in the performance of both classical and music theater repertoire with regard to the visual/kinesthetic effect of melodic contour in musical notation as it affects the production of vocal timbre. The evaluation of data gathered during the course of the study indicates that a reason exists to investigate the resulting postural shifts of the head and neck as they are guided by visual maps of melodic contour and its inversion. In addition, it was discovered that in no case was the tone quality produced considered to be the most pleasing when a singer's head and neck postures followed the natural melodic contour of the melody. Nevertheless, in many cases, tone quality was much improved in conditions when a singer's head and neck postures followed a map of the inverted melodic contour.

Analysis also indicates that vocal timbres resulting from such postural shifts must be judged to be suitable by the existing authority hearing the vocal output. In life, this authority is in the position to choose or reject the vocal product for its purposes, including those such as a casting director, producer, music director, conductor, agent, wedding director, choir director, club owner, school ensemble director, or voice faculty. For those talented singers who seek training, however, the voice studio is the site for development of the most pleasing vocal timbre possible for any individual instrument. Therefore, the first authority of significance in the education of a developing singer is the singing teacher.

As Oren Brown writes in his pedagogical treatise *Discover Your Voice*,[11] it is the responsibility of the singing teacher to assist the student in "establishing kinesthetic actions to bring about automatic responses." Not all actions or responses in singing are intuitive. Therefore, if developing singers are challenged to process such seeming opposites as body posture versus gravity, muscular function versus breath management, and natural melodic contour versus desired visual/kinesthetic response, we might then benefit from the design of a program for the teaching studio that would address this phenomenon.

Dr. Robert Thayer Sataloff points out in his text *Professional Voice: the Science and Art of Clinical Care*[12] that the "best acoustic analyzers are still the human ear and brain." This is why the singer and the voice teacher spend so many years conditioning a sense of the ideal set of kinesthetic actions that will result in a desired vocal quality. Obviously, voice teachers have been dealing with this phenomenon for as many years as singers have performed

TABLE 2. *Descriptive Statistics of Base Timbre Ratings*

Singing style	Condition	Average rating	SD
Classical	Natural contour (A)	1.69	0.704
	Head elevated (B)	1.88	0.342
	Head downcast (C)	1.63	0.619
	Inverted contour (D)	2.25	0.683
Music theater	Natural contour (A)	1.31	0.479
	Head elevated (B)	1.56	0.512
	Head downcast (C)	1.81	0.544
	Inverted contour (D)	1.75	0.577

with standard Western musical notation. Fortunately, however, current technology offers us a unique opportunity to find new ways of conditioning visual/kinesthetic responses and actions in the general voice studio. Development of these alternative methods follow the spirit of Sataloff's treatise on objective voice function technologies,[13] with the caveat that such technologies "are not substitutes for good studio teaching techniques but rather extra tools… technology that may enhance teaching efficiency and consistency."

With the encouragement of the results of this study, good support seems to exist for further consideration of a real-time pedagogical tool developed to address the visual/kinesthetic response to melodic contour and following in the tradition of real-time displays such as the *CSL* (eg, voice range profile, real-time pitch, and spectrogram) and the user-friendly studio technology of Garyth Nair.[14] Continuing development of a computer-based ready-scan inversion program, designed to improve quality and efficiency in the teaching studio, is now under way. A real-time program capable of displaying melodic contour mapping and inversion, made simultaneously visible with common practice notation, will undergo testing at Texas Tech University School of Music in the spring of 2005. It is the intent of the developers to bring the results of this testing to the Voice Foundation in the near future, with the hope of contributing to its ongoing mission of cross-discipline understanding in our vocal health industry.

CONCLUSION

On the basis of the results of this study, there is considerable indication that further research is warranted with regard to the visual/kinesthetic effects of melodic contour in musical notation as it affects vocal timbre in singers of classical and music theater repertoire. Further investigation into the scientific causes of these kinesthetic responses to melodic contour mapping and the resulting vocal timbres appropriate to classical and music theater singing may also be indicated. Moreover, it may be of interest to study the spectral representations of vocal timbres created from conditions of response to melodic contour mapping and its inversion as they are appropriate to classical and music theater singing. Finally, the results of the study indicate that the development of new technology for the general teaching studio, designed to address these effects, may be useful for singers.

Acknowledgments: The authors would like to dedicate the work of this study and its resulting investigations to the memory and legacy of Oren L. Brown, a great contributor to the fields of vocal health and singing, a caring mentor, a cherished colleague, and an open collaborator to the end of his days.

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