

ORBIS MUSICÆ

VOLUME XIV

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University

Musical Performance and Musical Research

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VOLUME XIV

MUSICAL PERFORMANCE AND MUSICAL RESEARCH

Editor

David Halperin

Web Design

Ori Ben Yosef

Samuel Rubin Musicology Division
Buchman-Mehta School of Music
Yolanda and David Katz Faculty of the Arts
Tel Aviv University

DEDICATED TO JUDITH COHEN,
EXEMPLARY SCHOLAR, EDUCATOR, AND
HUMAN BEING,
UPON HER RETIREMENT

PREFACE

The study of live or recorded musical performance is one of the most challenging areas in current musical research, involving innovative ideas, methodologies and technologies. This issue of *Orbis Musicæ* presents and discusses examples of current research in this stimulating field.

The five articles in this issue originate in a study day on music performance, organized by the Department of Musicology, Tel Aviv University, on February 28, 2005. Four of the studies investigate recorded music, using current analytical and technological tools to shed light on the micro-structure of musical performance and its relationships with musical expression, while the fifth draws upon recent findings in music cognition to sketch a plan for future research in the field.

This collection is dedicated to Prof. Judith Cohen, retiring from the TAU Department of Musicology, whose personal dedication and invaluable contributions to musicological research and music education have inspired us for decades.

Zohar Eitan

CONTENTS

Preface

Zohar Eitan 5

The Marvels of the Human Voice: Poem-Melody-Vocal Performance

Eliezer Rapoport 7

An Empirical Study of Intonation in Performances of J. S. Bach's

Sarabandes: Temperament, 'Melodic Charge' and 'Melodic Intonation'

Eitan Ornoy 37

Performance in Theory and in Practice: Helmuth Rilling's Interpretations
of Bach's B minor Mass

Uri Golomb 77

Communication of (e)Motion through Performance: Two Case Studies

Renee Timmers 116

Intensity and Cross-Dimensional Interaction in Music: Recent Research
and its Implications for Performance Studies

Zohar Eitan 141

The Marvels of the Human Voice: Poem-Melody-Vocal Performance

Eliezer Rapoport

Music Department, Bar-Ilan University, Ramat-Gan, Israel

e-mail: rapopoe@mail.biu.ac.il

Abstract

This paper examines and compares vocal performances. It also follows the path of poem to melody to singing, and their interrelations. Results are demonstrated in examples in which comparison is made between performances of the same melody by two or more artists in: “Au Cimetière” by Berlioz, “Der Tod und das Mädchen” by Schubert, the Aria “In Questa Reggia” (Turandot) by Puccini, and the ariette “Ah quel dîner” (La Périochole) by Offenbach.

Introduction

This work, presented at a study day on music performance at the Buchman-Mehta Music Academy in Tel-Aviv (February 28, 2005), is concerned with singing and interpretation, studied from the analysis of Fast Fourier Transform (FFT) spectrograms of recordings of singers' voices. This is a direct analysis of the sound source, in the form of acoustic waves (signals) emitted from the singer's mouth. Musical (and other) information is extracted and deciphered, and the encoded messages are interpreted. This analysis is objective and independent of the listener (see remarks in Appendix B). The path leading from a poem through its setting to music by a composer and finally to its realization by a performing artist is also followed

and discussed. Excerpts from: (1) Berlioz Melodie: “Au Cimetière” (No. 5 in the song cycle: “Les Nuits d’Ete”), (2) Schubert Lied: “Der Tod und das Mädchen”, (3) Puccini aria: “In Questa Reggia”, from Act II, scene II of Turandot, and (4) Offenbach ariette “Ah quel dîner” from La Périochole, each performed by two or more artists, are compared and analyzed. Results illustrate the various nuances in the interpretation by the various artists.

Berlioz Melodie: “Au Cimetière”

The poem “Au Cimetière” by Theophile Gautier, from the song cycle “Les Nuits d’Été”, set to music by Berlioz, is a song of melancholy, sadness and loneliness.

First stanza (here divided into two parts):

<u>Connaissez-vous</u> la blanche tombe	Sur l’if, une pâle colombe,
<u>Où flotte avec</u> un son plaintif	Triste et seule, au soleil couchante,
<u>L’ombre d’un if?</u>	<u>Chante son chant.</u>

Each stanza in the poem consists of two parts, each built of two structural units, consisting of two long phrases, with 9, and 8 syllables, respectively, followed by a short one of 4 syllables. This structure is adhered to in Berlioz’s Melodie (score, Figure 1). Berlioz wrote a melody with a very low ambitus, illustrated by the first stanza, spanning the range B flat – D – A, in the first part, and B flat – D flat – A flat in its second part. This is in accord with the atmosphere of a cemetery (exterior), and melancholy (inner feelings). A further feature is a unit of four repeated notes, such as in the opening of each line in the first stanza, first part (corresponding to the underlined

syllables in the text). It is repeated at the end of the stanza, modified by a downward leap. For English translations of this and the following texts, see Appendix A.

Au Cimetiere

Hector Berlioz

Crespin N r-R N r''-R R R R sr-R R''
 von Otter R'' N''-N' N'' K''-R' R''-R' R' N''-N' N''-R' R'

Con_ nais_ sez vous la blan_ che tom_ be,

Cr N'' sr' R' R R R-r sr-R r' R'
 6 vO N'' r''-r' r''-r' R''-R' R''-R R''-R t'-R-d'- N'r' R''-R'

Ou flotte a_ vec un son plain _ tif

Cr W N N N-r N R r-R-r N k-R
 12 vO N'' N'' N''-R' N''-R' N''-N' N''-R' R''-R' R' k'-R

L'ombre d'un if? Sur l'if u_ - - - ne pa_

Cr r N N-R R'' N sr R r R r kR N r-R''
 18 vO r''-r' N'' N''-N'-N'' R'' N' sr''-r' k''-R' r R' r' R' sr' R'-R''

_ le co_ lom_ be Triste et seu_ le au so_ leil cou_ chant,

Cr R R N' r'-R'
 24 vO R'' R'' R'' C'

Chan_ te son chant

Figure 1. Score of the first stanza (low voice version). The symbols above the notes will be explained in the following text.

Figure 2 presents the spectrogram of the unit of four repeated notes (the note B) opening the stanza (Connaissez-vous), sung by Regine Crespin (top) and Anne Sofie von Otter (bottom).

Figure 3 presents the four-note unit (repeated A) in “L’ombre d’un if”.

The added symbols used in the score (Figure 1) and in the spectrograms are a part of an extended notation and tone families classification scheme (Rapoport, 1996, 2004) to which the reader is referred for more detailed and complete presentation. The part needed in this study is explained here in a simplified manner: The FFT spectrograms (such as in Figs. 2, 3 and the others) represent the sound spectrum in a frequency-time diagram, with time as the horizontal axis and frequency as the vertical axis. The spectrogram “freezes” sound in time, and converts it into a picture, to be subject to observation and analysis. In the spectrogram, a tone is shown as a series of parallel lines along the horizontal time axis, corresponding to the fundamental and the series of overtones (harmonics). The sound intensity of any component of the overtone series is shown as its relative blackness in the diagram. The top part of the figure shows intensity vs. time of the sound waves. In the diagram, a tone of constant, non-varying frequency (like a piano tone) appears as a straight line, parallel to the time axis, and is denoted N. Vibrato is manifested as a sinusoidal modulation of frequency, a wiggly appearance in the spectrograms. Tones with vibrato are denoted as R-family tones. There are several varieties of tones, denoted according to their vibrato amplitude (or extent): large (R-tone), small (r), and very small (sr). Artists produce still a further variety of tones made of combination of N-family and R-family tones: a tone might start as an N tone, turning into an R tone, thus

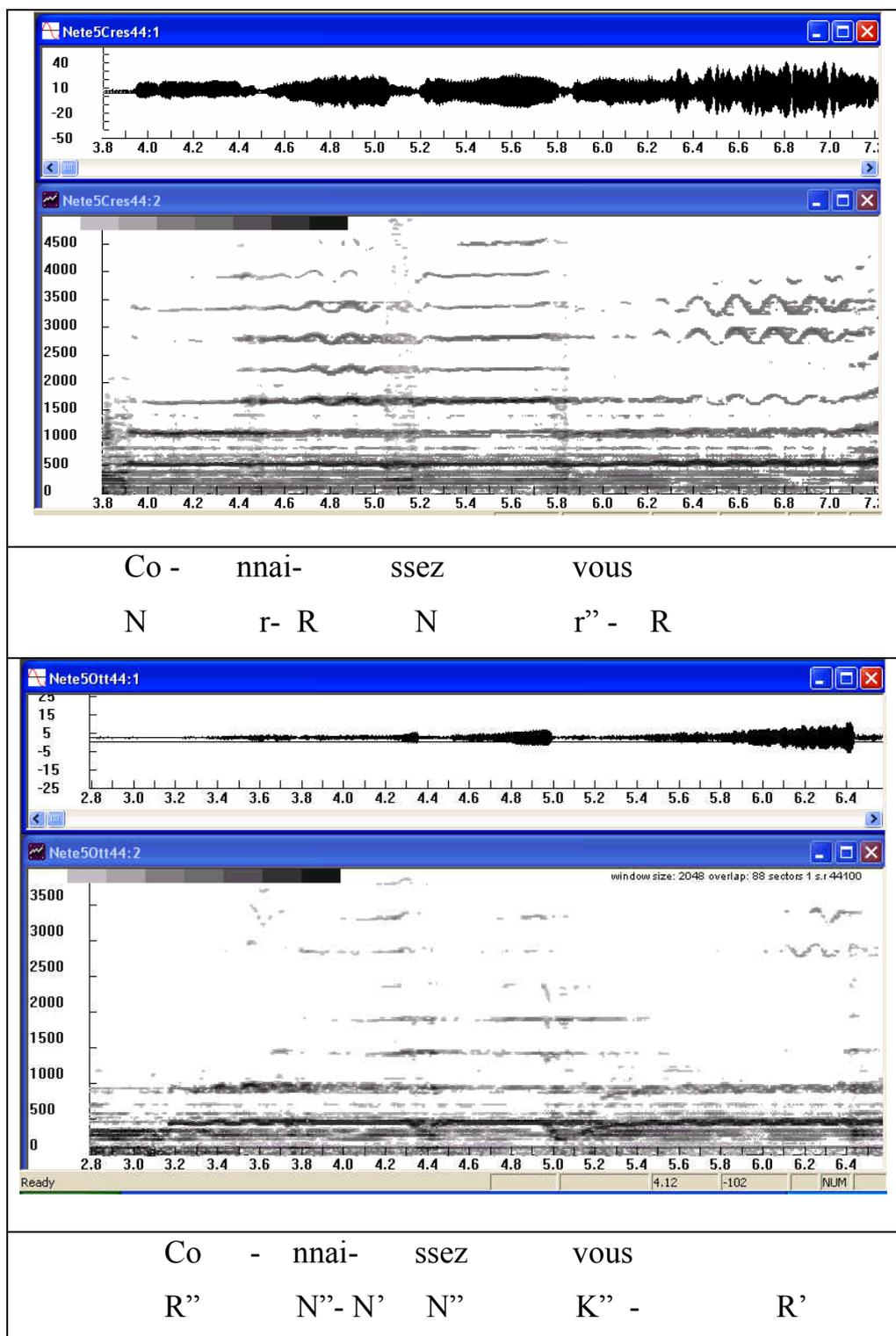


Figure 2: The phrase: Connaissez-vous. Top: Crespin, bottom: von Otter.

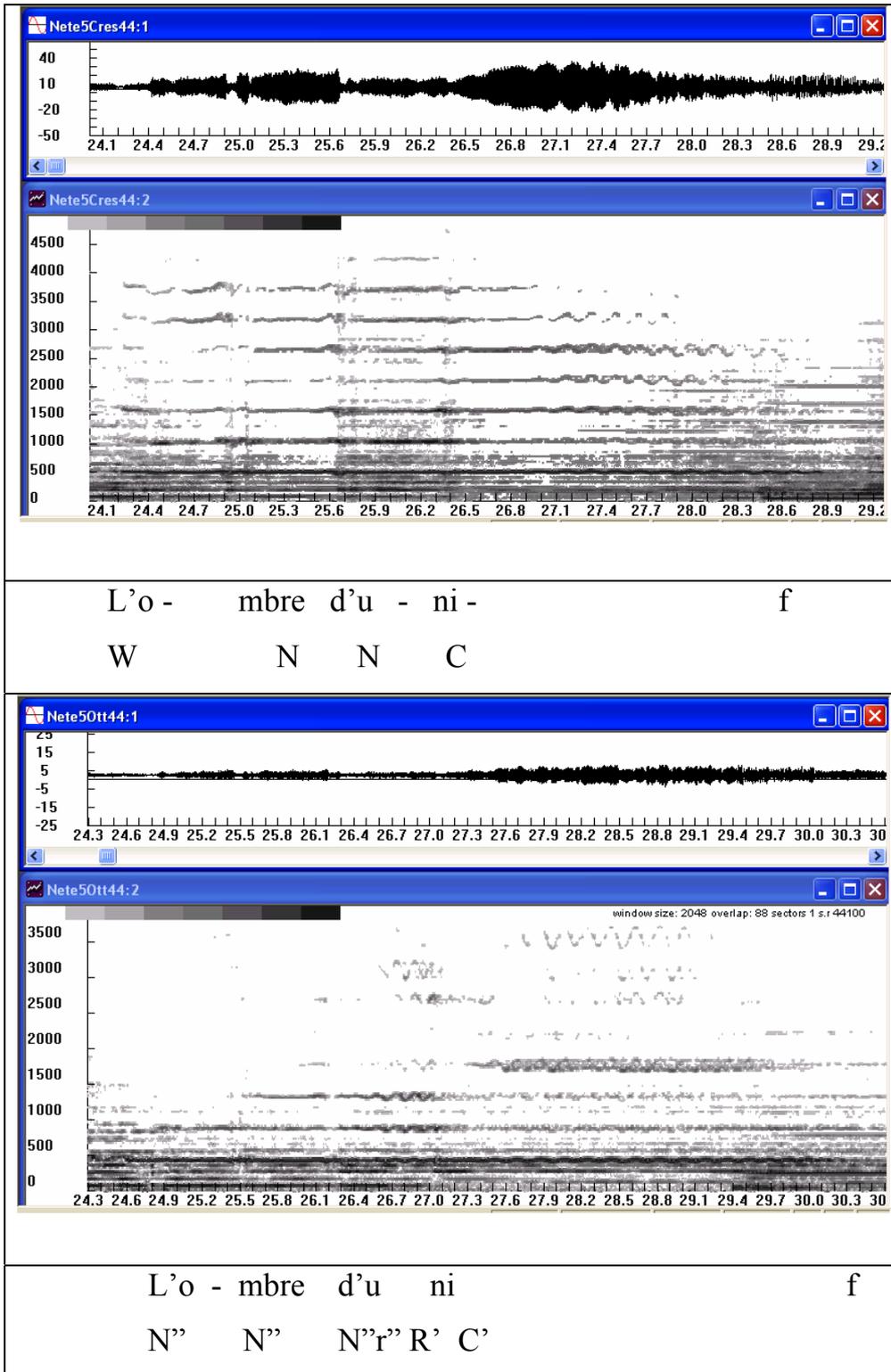


Figure 3. The phrase “L’ombre d’un if”. Top: Crespin; Bottom: von Otter.

denoted N-R (or NR). In a more gradual manner, a tone denoted N-r-R starts as N tone and develops vibrato in two stages of increasing vibrato amplitude. Such N-r-R and N-R tones belong to the C family (Rapoport, 1996). Furthermore, tones such as R-r, and r-R-r, sr-r, sr-r-R are self explanatory. This reflects the richness of tones and nuances produced by singers to express emotions and mood in singing (Rapoport, 1996). Still along the overtone spectrum there is also room for richness of nuances: We divide the frequency domain into two parts: (1) frequency lower than 2000Hz – range of vowel formants. (2) frequencies above 2000Hz, especially the range 2500-4000Hz (male singers), and 3000-5000Hz (female singers). This range is called the singer's formant (Sundberg, 1987). For the tone types discussed above, the full harmonic spectrum is present in full intensity: vowel formants + singer's formant. Tones denoted N', R' r' etc. represent tones with low intensity singer's formant. Tones denoted N'', R'', r'', etc. represent tones of very low, or zero-intensity singer's formant. All these are variants and nuances of timbre qualities. This completes the repertoire of tone types present in the singing of Crespin and von Otter in "Au Cimetière", first stanza.

Comparison of the two performances demonstrates the different approaches of the two artists. Crespin sings in full voice with fully developed overtones. The nuances and emotional inflexions are characterized by the artistic use of a wide variety of vibrato forms, including tones without vibrato (N-tones) alternating with tones with one or another varieties of vibrato: of very small, small, and large amplitude (sr, r and R-tones, respectively), and tones such as r-R, r-R-r, N-r, N-R.

Von Otter's singing is more delicate, as befits the melancholic atmosphere of the song: she plays mostly with the intensity of the overtones:

tones with only the low overtones (N^{''}, sr^{''}, r^{''}, and R^{''}-tones), low-intensity excitation of the high overtones (N['], sr['], r['], and R[']-tones). Tones with full intensity overtones (N and the sr, r, and R varieties) are much less frequent. All these are aspects of timbre, used as means of expression. Thus, Crespin uses the varieties of vibrato that affect the tone timbre (in the spectrograms it is the temporal aspects of timbre, Rapoport, 2004). Von Otter uses the overtone intensity as the parameter of voice quality and expression (vertical, or frequency spectrum aspects in the spectrogram). The sequence of N and R tones (Crespin), or the equivalent sequence of rise and fall in the intensity of overtones (von Otter) along the melodic line indicates the momentary tension – release (or excitement – relaxation) progression. Thus R indicates tension relative to N, and R^{''} (also relative to r).

This is clearly demonstrated in Figure 4, showing somewhat longer phrases. One might observe that in the top part of Figure 4, the number of N and r tones or parts of tone relative to the number of R tone parts is larger than in the bottom part, indicating increased tension in the latter.

One might observe that the information concerning vocal performance presented in Figs.2-4 is summarized in the notation in Fig.1, where one can follow the various tone nuances along the melodic line, the patterns of tension-relaxation, and the relation: text-melody-performance, down to the level of the relation of a particular tone type to specific word and specific musical note.

In the same way, Fig.6-7 (further below) are summarized in Fig.5, and Figs. 9-11 are summarized in Fig.8.

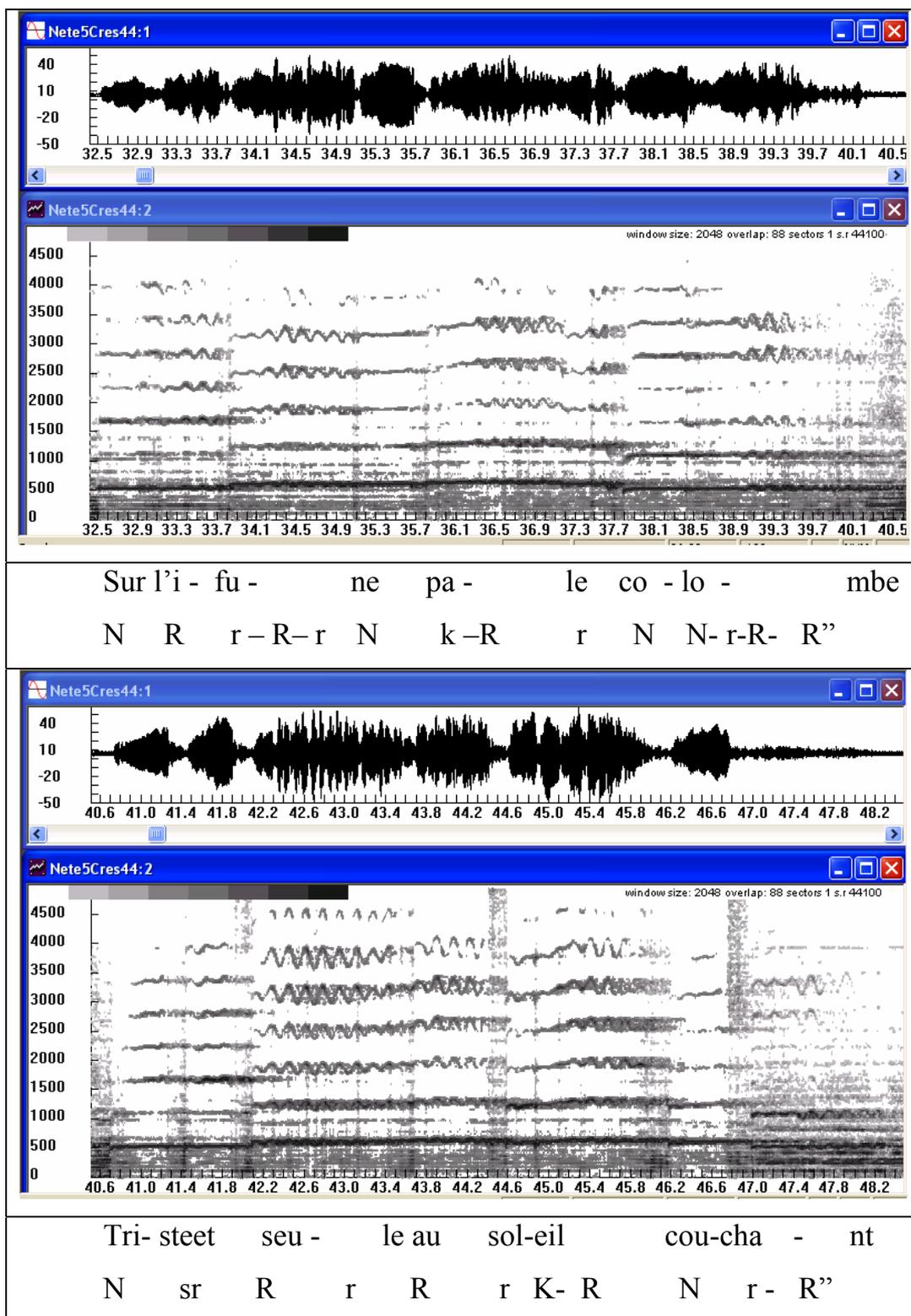


Figure 4. The second part of the first stanza (Crespin singing)

Schubert Lied: “Tod und das Mädchen”

The poem, by Claudius, is a struggle between a young girl who attempts to chase away Death, and Death, pretending to be a friend, who tries to entice her.

For the Death part, Schubert wrote a sequence of three one-note melodic segments: on D (first and second phrase), on F (third phrase), and again, on D (fourth phrase). A small rise to E and then F, then a descent to C and A terminate the second phrase. Similarly, a dip to A, rising back to D terminate the fourth phrase. These (seemingly monotonous) one-note phrases depict the atmosphere of the part.

The score of the phrase of the Death part (one-note melody) “Gib deine Hand, du schön und zart Gebild” is presented in Figure 5. Here DFD-DG refers to Dietrich Fischer-Dieskau, and Fsb to Brigitte Fassbaender.

Schubert: Tod und Maedchen (Der Tod) Franz Schubert

DFD-DG	KR	::	Kr	rR	K	r''	KR	r'	Ksr	R	rR
Ferrier	R		K	R	K	K	K		K	K	K
Fsb	kR		sr-R-r	sr	r-R	r'-r	sr-R-r		K	sw	sw-R-r''

Gib dei_ ne Hand, du schoen und zart Ge_ bild! bin

Figure 5. The phrase: “Gib deine Hand, du schön und zart Gebild”.

FFT spectrograms of this phrase, divided into two sub-phrases, are shown in Figure 6.

As can be observed in Kathleen Ferrier’s singing, a different type of tones is observed. Such tones start much below the nominal target frequency, and rise towards it in a convex arc. At the steady state full vibrato

develops. These tones are denoted K-tones. (KR or K-R are also used to demonstrate the two-stage nature of such tones). These are dark deep tones expressing grief and death, as befitting the part sung by personified Tod in the Lied. Indeed, in Ferrier's spectrogram most tones are K tones. Outstanding is the K tone on the word "deine" whose dark timbre might very easily be distinguished on listening. Fassbaender, in contrast, takes the role of Der Tod as the enticer. Her singing consists of various expressive sr, r, and R varieties.

In the second sub-phrase (Figure 7), again, all the tones in Kathleen Ferrier's singing are K tones. They differ in small nuances. Fassbaender's singing, again, comprises various types of R-family tones, with fine control of vibrato, ranging from sw (irregular vibrato at very small amplitude) to r, changing to R on the words "schön" and "Gebild"). Yet grief is expressed in the K tone on the word "zart".

The flexibility and fine control of the expressive qualities of vibrato are again demonstrated in Fassbaender's singing, as can be seen in Figure 6. Small amplitude and large amplitude vibrato alternate; a noteworthy example: the word "deine", the two vowels of whose diphthong are distinguished by changing the vibrato amplitude, leading to a tone labeled: "sr-R-r (and sr on the word's end syllable), with emphasis on the i of the diphthong ei. Similarly, an sr-R-r tone on the word "schön" in the second sub-phrase is again noteworthy. Fischer-Dieskau's singing, recorded with Gerald Moore (DG) some 27 years after Ferrier's is very similar to the latter in tone type and interpretation, as is obvious from the notation in Figure 5.

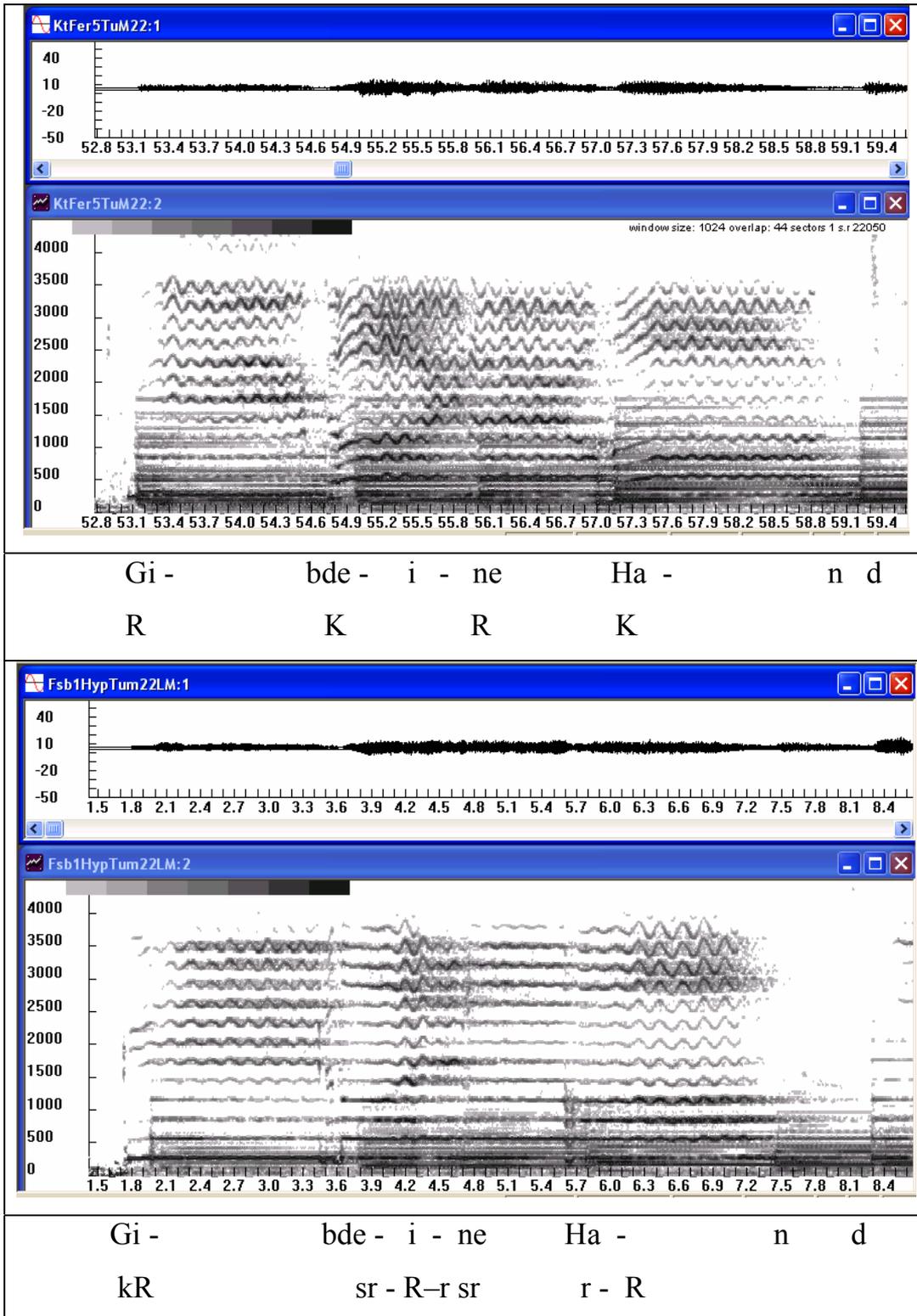


Figure 6. Death and the Maiden. Top: Ferrier; Bottom: Fassbaender

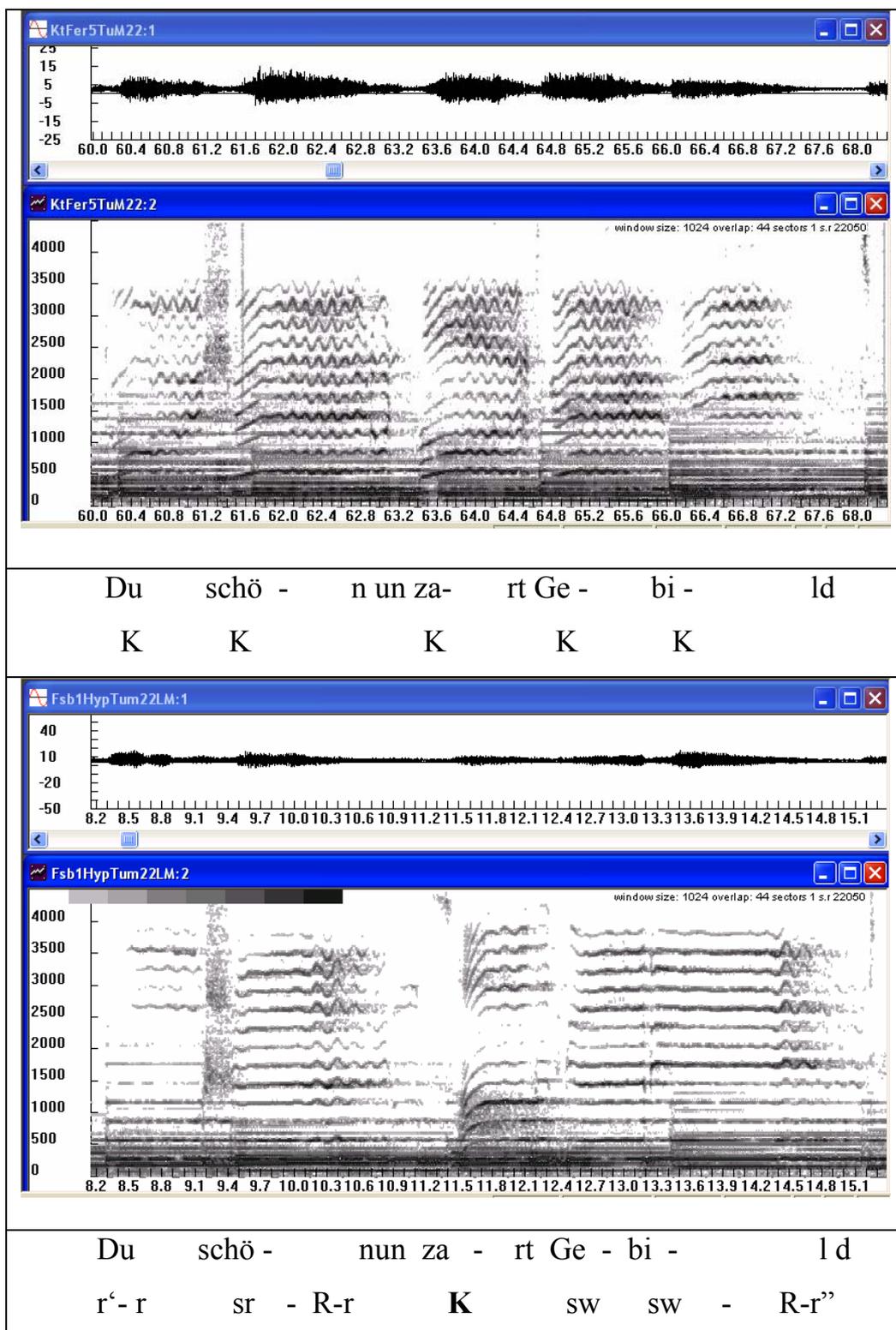


Figure 7. Death & Maiden. Top: Ferrier; Bottom: Fassbaender

Puccini: In questa Reggia (Turandot)

This aria of fury and vengeance tells the story of Turandot’s ancestress, the princess Lou-Ling, tortured and put to death in ancient times. Her desperate cry (un grido disperato), resounding in the palace since ancient times, passing from generation to generation, finds refuge in Turandot’s soul (first stanza). Turandot is determined to avenge Lou Ling’s purity, desperate cry, and death on the princes that come to solve her riddles. The climax of the aria is indeed:

“Io vendico su voi, su voi quella purezza, quel grido e quella morte! Quel grido e quella morte” (I will take revenge on you, for this purity, this cry and this death).

The score of the first stanza, with the notation, is presented in Figure 8.

Sutherland r3 R4 R2 R6 R4 r2 R4 [Wd3 R3] r"3w3 sr3R4rd3 R6
Callas G5 Z6 Z3! R7 Z5 R3 rt2Rt4 rd4 R5 R2r2 r2R3Rd4 r2R7

S. In que_ sta Reg_ gia or son mil_ l'an_ nie mil_ lle
C NR4 Z6 R2 R5! Z1 G6 R3 R6 R3 R'12
 Z8 K3R6 Z2 R6 R2 G2R6 R2 R7 r2Rr R'11

S un gri_ do di_ spe_ ra to ri_ so_ no
C z5 Z3 [zG2R4-DV4] R4 Z1 Z5 R1 R6 R2 Kr3R5 R6R"5
 G3R6 Z4 Z10 R6 Z3 rR5 Z2 ZR3r3 R2 r2R4r2 zR10

S E quel gri_ do tra_ ver_ so stir_ pe stir_ pe
C [r'2R3 [w3dw2 R9] r'3R3! R3 Nt3 r2 r2 K2R4 r'1R"2 Kst3R7
 [g2R4r2 - r5 rR7!] r3R2r2 !R4! [r2R2r2-r2] R4 r2R4R'3 R"4 G"3R"12

 qui nel_ l'a_ ni_ ma mi_ a si ri_ fu_ gio!

Figure 8 The opening stanza of Puccini aria: “In Questa Reggia” (Turandot)

The first stanza is centered around the “desperate cry”: the first line starts with a segment of six tones on the same note D, descending gradually to A. It serves as an introduction to the second line, where a leap of a third to the word “grido” and a second leap of a fourth to the word “disperato” emphasize the significance of these two crucial words. The climax is reached at the third line: “E quel grido...”, whose melodic contour contains two leaps: by a fourth, with *sforzando*, on the words: “quel” (grido), and “traverso”, again emphasizing their importance. In contrast to the legato and smooth melodic contours in the first two lines (with two leaps in the latter), the contour of the third line spans a larger ambitus, with two large jumps, and many notes are marked *sforzando*. The fourth line constitutes a relaxation after the build-up of tension in the previous three lines, returning to a smooth melodic contour.

Vocal FFT spectrograms of performances by Joan Sutherland and by Maria Callas, presented in Figures 9 (first 5 tones of line1), and 10 (line 3), demonstrate the different approaches of Sutherland and Callas. Sutherland, indeed, regards the first line as an introduction, as indicated by the R tones. Note that the duration of the tones is expressed in the number of vibrato periods contained in it. Thus, r3 and R6 denote tones with three and six vibrato periods, respectively. The duration of one vibrato period is approximately 160ms (i.e., six periods per second). Callas, on the other hand, sets the atmosphere of fury right from the beginning, producing Z-tones. Such tones, as seen especially in Figure 10 (bottom), are tones that start well below the nominal target frequency, and rise abruptly to the target, steady-state frequency. This abrupt rise or jump is characteristic of tones occurring in art songs and arias expressing rage and utmost tension. Z tones also drop abruptly at the tone’s end, the last vibrato period being particularly short.

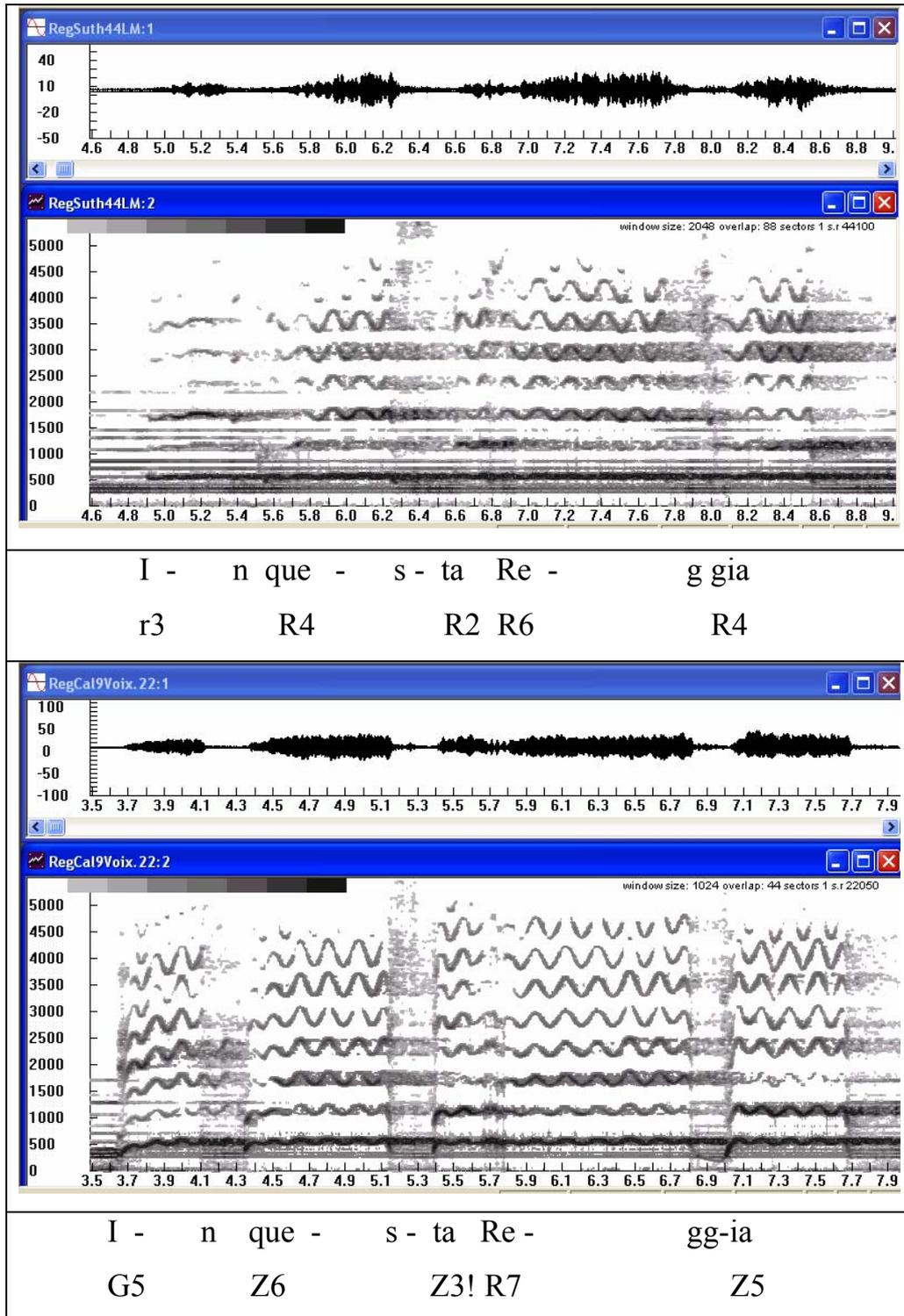


Figure 9. Turandot: In questa Reggia, opening 5 tones. Top: Sutherland; Bottom: Callas

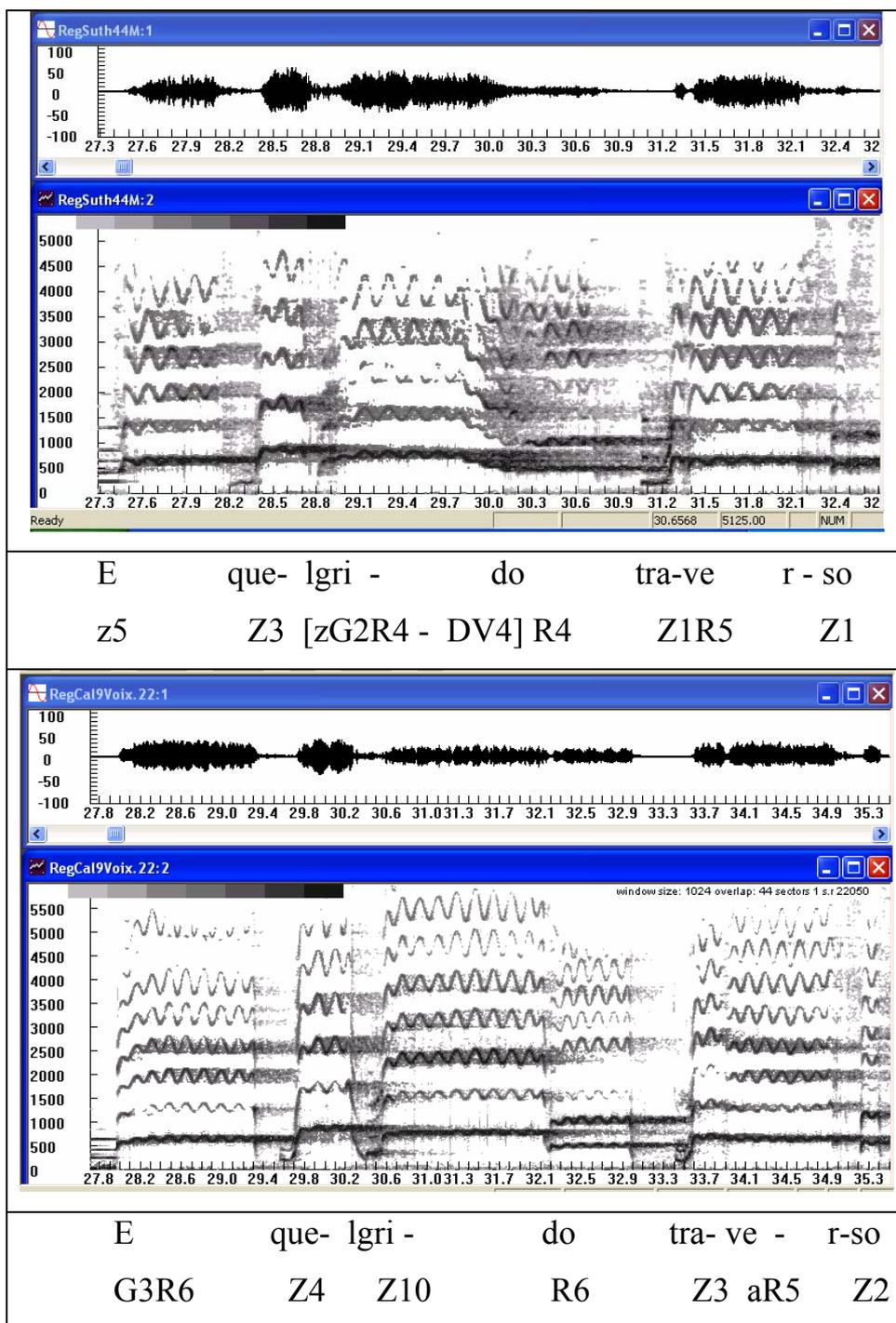


Figure 10. Turandot: In Questa Reggia, third line, first stanza. Top: Sutherland; Bottom: Callas

Again, the numbers following the Z symbols signify the number of vibrato periods. Another type of a tone (such as the opening tone in Callas's singing) is a K-tone with vibrato superposed on the convex rise. It is denoted by G.

Referring again to the score (Figure 8), the pattern of Z and R tones corresponding to tension-relaxation, respectively, is also evident. In Sutherland's singing, tension rises gradually from line 1 to the climax in line 3, as indicated by the pattern of Z and R-tones, finally relaxing completely in line 4 (variety of R nuances). Within the phrases, the excitement is at the first two bars of the line, relaxing at the third and fourth bars. In Callas's singing, there is tension in the first two bars of lines 1 and 2, expanding to the first three bars in the third line, where a climax is reached, relaxing in the fourth bar, leading to fully relaxed fourth line.

On the micro scale, a few features are noteworthy: On the first appearance of the word "grido" (2nd bar, 2nd line) Sutherland produces her first Z tone, whereas Callas, who already produced them on the 1st line, produces the more ornamental, artistic, G-tone. On the word's 2nd appearance (3rd line) Callas produces Z tones on both syllable, whereas Sutherland produces a rather elaborate, more complex artistic tone, marked: [zG2R4-DV4], starting with a jump z (smaller than a Z), getting rounded to a G tone with 2 vibrato periods, reaching a steady state of a four vibrato periods R tone, followed by a portamento descent (D) with four vibrato periods (V4). The square brackets, here and elsewhere, denote that the enclosed within is produced with legato.

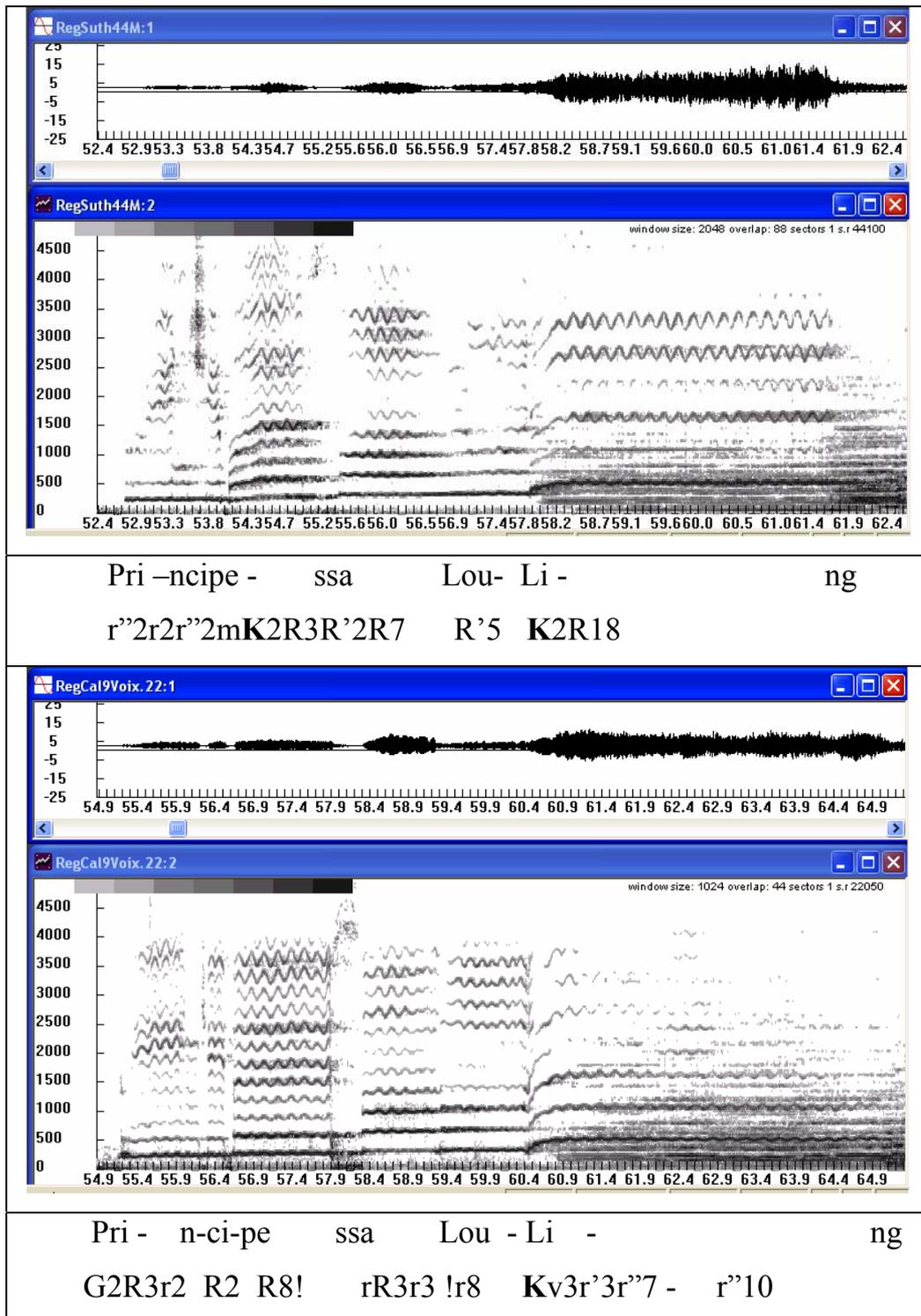


Figure 11. Turandot: the phrase “Principessa Lou Ling”. Top: Sutherland, Bottom: Callas

Sutherland	r"2r2	r2	K2R3r'2	R7	R'5	K2R18
Callas	G2R3r2	R2	R8!	r1R3r3	!r8	K3r3r'7-r"10

Prin_ ci_ pes_ sa Lou Ling

Figure 12. The phrase “Principessa Lou Ling”.

The final relaxation in the fourth line leads to the next stanza, full of tenderness and yearning, starting: “Principessa Lou Ling...”, which Puccini begins with a gradually rising concave melodic phrase, expressing yearning, affection, and nostalgic grief (Figure 12), also expressed in the R and K tones in the spectrograms of Figure 11.

The climax of the aria is reached at the phrase: “io vendico su voi... quella purezza, quel grido e quella morte”, where Puccini writes significant leaps of a sixth on the word grido, and sixth and seventh on the word morte (score Figure 13), specially stressed in Z tones in Callas’s singing. Sutherland produces other varieties of artistic nuances, noted in Figure 13. These are XHV tones. XH, CH, and ch tones are arch-like tones (Rapoport, 2004) that in the spectrogram appear as a tone with a convex rounded frequency increase to a climax, terminating in a rounded convex frequency descent. The V indicates vibrato superposed on the arch, with the indicated number of vibrato periods. XH, CH and ch denote the frequency range spanned along the frequency axis, being large, medium, and small, respectively.

Sutherland !R3 R3! R3 R3 R3 R8 R3 R4 R2R"2 R4 R3
 Callas(V) G2R2 R3r2 R4 Z5! zR4 Z10 CHV4 R4 GR2r"2 rR4! rR3r

io ven - di - co su voi - - su voi quel - la pu -

S R6! R3 R3! XHV9 !R3 [XHV9 R3] Z1R8D4 R7 R3
 C(V) rR8 rR3 Rt3 Z8 Z3 Z8 Z3! Z1Z8r2 Z6 Z4

3 rez - za, quel gri - do e quel - la mor - te! Quel

S Z1Z17RD7 R8 G8 Z1R7 CH11RD4 R5! ch11 R6
 C(V) ZG2R21RD5 Z8 Z4 Z6 Z14Rd5 Z4 Z7! Z6

5 gri - do e - que - e la mor - te

Figure 13. The phrase: "io vendico su voi....quella purezza, quel grido e quella morte".

A Short Excerpt from Offenbach's Operetta *La Périchole*

In a lighter, comical vein, a short melodic phrase from the ariette "Ah quel dîner je viens de faire" in Offenbach's operetta *La Périchole*, as sung by Regine Crespin and Frederica von Stade is presented in the spectrograms of Figure 14.

La Périchole tells about the dinner she had: "What a meal I've just had, and what extraordinary wine. I've had so much, I do believe that now I'm a little drunk ..."

The reader can by now perceive the variety of the tones in the spectrograms. In Crespin's singing, noteworthy are the tones corresponding to the word "dîner", two tones with gradual, rather steeply rising frequency for both syllables, expressing sarcastic admiration for the extraordinary dinner.

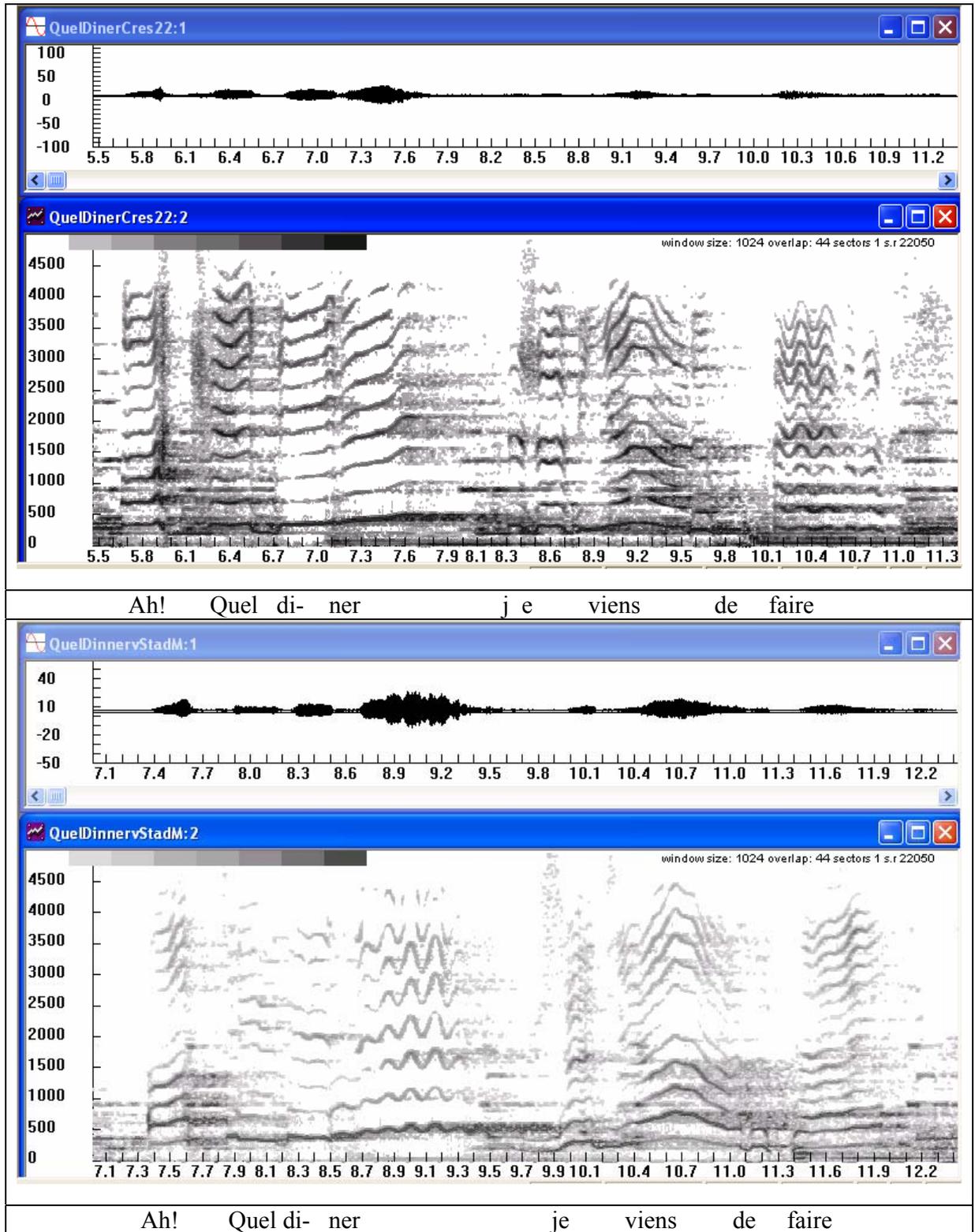


Figure 14. La Périchole: Ah! quel dîner. Top: Crespin, Bottom: von Stade.

The corresponding tones in von Stade’s singing start with decreasing frequency and small vibrato on the syllables: “quel dî-“ followed by mildly rising frequency on “-ner”, with vibrato. The most unusual shape of the tone on the word “viens” for both artists expresses exclamation: I had such a dinner! (All the tones in the spectrogram can be described according to Rapoport (2004), but here is not the place to introduce more symbols.) However, Crespin relaxes at the end to an R tone for the word “faire”, whereas von Stade exaggerates it with a tone of increasing frequency with vibrato, similar to that of “dîner”.



As can be seen from comparison with the score, indeed there is an ascending sequence F sharp–G, and a jump to C for the segment “quel dîner”, and thus the rising pitch in the corresponding tones in Crespin’s singing is in accord with Offenbach’s intentions. The first descent and then the rise in von Stade’s singing corresponds to the transition from the sigh “Ah!” to “quel dîner”, thus putting the emphasis on Ah! and not on quel dîner. Crespin’s relaxation at the end of the phrase is, again in accord with Offenbach, a descending sequence on “viens de faire” whereas von Stade’s ascending pitch is again exaggerated, not in accord with Offenbach. To my taste von Stade’s singing sounds excessive with mannerism, bordering on the vulgar, as compared to Crespin’s chic and coquettish manner.

Discussion

Nuances are important in the art of singing. Here a large variety of nuances, classified into different classes or families, were demonstrated in four melodies corresponding to four different moods and emotions, from melancholy and sadness (Berlioz), death (Schubert), or enticement (Schubert, in Fassbaender's interpretation), rage and revenge (Puccini) to light-heartedness (Offenbach). These nuances form a vocabulary of expressive singing in Lieder and opera arias.

In Berlioz's "Au Cimetière" Crespín uses the varieties of vibrato, that affect the timbre (in the spectrograms it is the temporal aspects of timbre, Rapoport, 2004). Von Otter uses the overtone intensity as the parameter of voice quality and expression (vertical, or frequency spectrum aspects in the spectrogram). In *Der Tod und das Mädchen* both Ferrier and Fischer-Dieskau produce K tones that start below the target frequency, rising to it in a convex arch, imparting some additional depth and darkness to the tones, thus painting the atmosphere of the Lied. In *Turandot* "In questa reggia" Z tones paint the crucial words "grido disperato" and others, depicting an atmosphere of rage and vengeance. Still a different set of tone forms appears in the ariette from Offenbach's *La Périchole*, befitting the comic atmosphere.

It is worth mentioning that in a recent paper Lerdahl (2001) proposed a process or recipe by which a poem could be set to melody. It is based on a hierarchical phonological analysis of the text, assigning the appropriate phonological stress on the various syllables, leading to corresponding musical grouping, meter, and tone duration, and eventually leading to a melodic contour. Recently and independently, Wagner (2005) used similar procedures

to analyze songs by the Israeli popular song composer Sasha Argov, with emphasis on the meter and rhythm of Argov's melodies and their relations to the texts, thus illustrating Argov's musical creativity and inventiveness. In a recent investigation of Schönberg's Sprechmelodien in "Pierrot Lunaire" (German texts by Hartleben), Rapoport, (2004, and 2006) made direct comparisons between FFT spectrograms of German speech intonation of the poems as read aloud by two persons, and the corresponding Sprechmelodien. He demonstrated that the musical rhythm was determined by the syllabic structure of the German text, and the Sprechmelodien's melodic contours were patterned after the intonation patterns of the spoken text. In the present study, interest is in the relation text – mood (and emotion) – melodic contour, and particular words of special importance. The melodic contour reflected the mood in the text: low ambitus, with same-note segments (Au Cimetière), one-note melody (Death), and contour comprising jumps on significant words: grido, morte (Turandot).

These are interpreted by the performing artists utilizing the numerous vocal nuances demonstrated here.

References

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- Sundberg, J. (1987). *The Science of the Singing Voice*. Northern Illinois University Press, DeKalb Illinois
- Wagner, Naphtali (2005). *Sasha Argov: Prosody Transforms into Music* [in Hebrew]. Jerusalem: The Bialik Institute.

Appendix A: Sources

Berlioz: Les Nuits d'Été:

Regine Crespin: Decca 440416 (recorded 1963)

Anne Sofie von Otter: *Berlioz: Les Nuits d'Été*. DG445 823 (recorded 1988)

Schubert: Der Tod und das Mädchen

Kathleen Ferrier: Decca 433476 1949 (Edinburgh Festival)

Brigitte Fassbaender: Hyperion CDJ 33011 (recorded 1990)

Dietrich Fischer-Dieskau: DG 415188 (recorded 1969-70)

Puccini: Turandot

Maria Callas: *Puccini & Bellini Opera Arias*. EMI CDC7 47966 (recorded 1954)

Maria Callas: *La Voix du Siècle*. EMI 7495022 (stated as recorded 1958)

Joan Sutherland: *Puccini: Turandot*. Decca 414 274 (recorded 1972)

Offenbach: La Périchole

Regine Crespin: *Grandi Voci*. Decca 440416 (recorded 1970-71)

Frederica von Stade: *Metropolitan Opera Gala*. DG 449177 (recorded 1996)

The full texts with their English translations can be found in the companion booklets of these CD's.

**Appendix B: Background Material, The Path: Sound Spectrogram –
Deciphering - Interpretation**

The vocal analysis presented in this study does not depend on a particular group of subjects filling a prepared questionnaire which is then analyzed statistically. It analyses directly the sound waves emerging from the singer's mouth. The various stages in the development of the present method of analysis, leading from observations made on the spectrograms to their interpretation and relation of the various vocal nuances to emotions, is described in detail in Rapoport (1996, 1997, and mostly in 1996a), to which the reader is referred for background material, and briefly outlined here:

The starting point – the vocal FFT spectrograms – belongs to the realms of physics and acoustics. The method was developed in the following steps:

- (1) Observation of the FFT spectrogram at the level of a single tone (or single syllable) led to the discovery of a large number of vocal nuances, and to the conclusion that even a single tone is a composite entity that can be decomposed into smaller, and simpler elements (e.g. vibrato).

- (2) These elements were further identified, and it was found that a small number of elements is sufficient to describe all the vocal nuances observed. Thus, a large variety of vocal tones are formed by the various ways that these elements can be organized in time (temporal structures)
- (3) Classification and grouping of the vocal nuances into six families: N, C, R, (T,K), S, Z families, according to their similarity, and elements they share in common. In the present work only elements from the N, C, R, K, and Z families were demonstrated.
- (4) Development of a special notation by assigning definite symbols to each of the elements.
- (5) Classification of the tone families in a hierarchical scheme according to structural considerations based on the type and number of the elements composing the tone.
- (6) Establishing a relaxation-tension hierarchy in the classification scheme from first principles (Rapoport, cited above). The two hierarchies were found to coincide. This led to the hierarchy, in the order from neutral, calm to excited: $N < C < R < (T,K) < S < Z$.
- (7) Association of vocal nuances and emotions. This was done by correlating the families of vocal tones and nuances in the sung vocal spectrograms with the emotional context in the texts of a large number of opera arias and art songs. This is also demonstrated in the present work, where N and R tones correspond to the atmosphere of sadness, loneliness and melancholy in “Au Cimetière”; K tones correspond to death and grief in Kathleen Ferrier’s and Dietrich Fischer-Dieskau’s singing in *Tod und das Mädchen*; Z tones correspond to the words “Un grido disperato” and others, expressing rage and vengeance in Callas’s and Sutherland’s singing in “In questa reggia”.

(8) Marking the symbols of each nuance, according to the notation, above the corresponding note in the score, leads to a “performance score” that allows observation of tension-relaxation patterns along the melodic line, relation of particular vocal nuances to important words in the text, comparison of performances of two or more artists, etc.

All these are deductions from the spectrograms done in a scientific, objective way. The various steps in the development of the analysis can be re-examined, reconsidered, modified, replaced, or improved if questioned. One might raise questions regarding objectivity in assessment, or expressing merit or preference for one performance relative to another in expressing the emotion or moods in the song or aria. However, if any was made here it was based on the vocal nuances in the performance, rather than on subjective personal taste preference.

Additional Musical Aspects

This work’s main purpose is analysis and comparison of vocal performances, and their relation to the text which was the source of inspiration to the composer.

The relation of vocal nuances to emotions and moods in the text and the emphasis of key words in the text were demonstrated. Of course the composer is also artistically sensitive to these factors, and has a variety of dimensions to express them in the music. This work concentrated on the melody, only one of these dimensions, and does not consider other dimensions: harmonic, contrapuntal, timbral-orchestrational, etc. It leads to the interesting question as to what extent is the singer influenced by the text, by the

melody, or by the other dimensions. This stimulating point certainly deserves further research. However, the author's experience shows the predominance of the influence of the text and its emotional context, especially in opera, where acting is involved.

**An empirical study of intonation in
performances of J.S. Bach's Sarabandes:
temperament, 'melodic charge' and 'melodic
intonation'**

Eitan Ornoy, The Hebrew University of Jerusalem

Address correspondence to: Dr. Eitan Ornoy, Musicology Department, The Hebrew
University of Jerusalem, Mount Scopus 91905, ISRAEL. Tel/fax: (+972)-9-7670294.

E mail: ornoye@mscc.huji.ac.il

Abstract

As part of a wider research aimed in exploring ideologies and prevalent conventions in the 'early music movement', intonation analysis was carried out through comparative study of a selection of recorded performances of J.S.Bach's Sarabandes for Flute and Violoncello solo. The recordings, made by prominent 'historically informed' and 'mainstream' performers of different periods, were analyzed for their compliance to the mean temperament tuning offered by various scholars as representing the historical practice. Intonation discrepancies of up to 39% were found in the interval sizes made by both groups of performers. Differences between both groups have been traced in the manner of execution of chromatic intervals only. Following analysis, an examination of data was made in light of Sundberg, Frydén and Friberg's rule system for musical expression. Its aim was to investigate the effect of notes of significant 'melodic charge' and 'melodic intonation' values on intonation tendencies. No correspondence was found between both rules and the measured intonation deviations. Results point to the limited influence of theory over practice where intonation of non-fixed pitch instruments is concerned, and show that intonation should not be regarded as a distinctive element of practice as regards to 'historically informed' performances. Results also point to the limited effect of a note's 'melodic charge' and 'melodic intonation' values on its performed intonation, and suggest a possible discrepancy between analysis-by-synthesis and analysis-by-measurements strategies.

Background

Early music movement

The term 'early music movement' (also 'authentic' or 'historically informed') is commonly used to describe the large group of musicians who strive for performing early music repertoire in the 'authentic' way in which it has historically been written and performed. This aim is to be achieved through various means, such as performance on historically oriented instruments, acquaintance with historical treatises dealing with performance practice or the reconstruction of a multitude of performance parameters which were lost or else went through extreme transformation throughout the years. The term 'mainstream performers' is commonly used to describe the large group of performers using "modern" instruments that do not affiliate themselves to the early music movements' agenda.

While challenging performance practice conventions common among their 'mainstream' colleagues, prominent early music activists have held the viewpoint by which thorough, direct acquaintance with past traditions was necessary for the proper performance of historical repertoire. Rejection of the model of historical progress coincided with the preference for 'historically oriented' instruments and with the view in which the composer serves as the highest authority over the performer (Dart, 1961, Restout & Hawkins, 1969, Dolmetsch, 1969, Goble, 1977, Donington, 1982). Putting period instruments' inherent idiomatic devices and sonic elements into the forefront, the use of original pitch and temperament was regarded essential for the proper deliverance of composers' intentions (Dart, 1954, Donington, 1963, Frotscher, 1981).

However, such traditional, 'positivistic' attitudes traced in the writings of pioneers active since the beginning of the last century have been increasingly challenged by performers and scholars from within the movement itself. Invalidation of traditional research as a tool for the reconstruction of composers' intentions was presented hand in hand with justification for pluralistic attitudes to interpretation. The performer's individual utterance was presented as equal in importance to that of the composer, while the use of 'modern' instruments in early music repertoire has been utterly legitimized (Morrow, 1978, Neumann, 1978, 1982, Dreyfus, 1983, Kerman, 1985, Crutchfield, 1988, Tomlinson, 1988, Taruskin, 1995). Critical attitudes were additionally presented in regards to the use of meantone temperament, considered more relevant for keyboardists than for players of non-fixed pitch instruments, unpractical for orchestra playing, unsuited for the transfer of the Baroque 'affect' to modern audience, or reflecting hidden nostalgia for pre-modern social orders (Donington, 1973, Harnoncourt, 1988, Neumann, 1989, Butt, 2002).

The existence of a wide spectrum of ideological attitudes could best explain the apparent lack of uniform standards of practice, as suggested by some recent studies on the issue. Traced in recordings of 'historically informed' performers of different periods, performance elements such as tempo, dynamics, rhythm or ornamentation have been found featured in various styles and manners (Fabian, 1997, 2003, Ornoy, 2006).

However, in a recent study aimed in exploring ideologies and ruling conventions in the early music movement, it has been found that contrary to critical positions, currently active early music performers show a clear tendency towards traditional, 'positivistic' standpoints in regards to several aspects of performance. In a survey conducted among a large group of professional 'historically informed' performers, the majority of

players have shown full, sweeping support for reading historical treatises, for choosing historically oriented elements of musical expression in the process of performing early music (such as sound production in accordance with the original instrument constraints, relevant types of vibrato, means of articulation, etc.), and for the use of intonation and temperament which they regarded as relevant to the historical period performed (Ornoy, 2002).

Intonation analysis (study 1)

Faced with such declarations, it seemed interesting to observe to what extent they are carried out. Hence, intonation analysis was conducted through comparative study of a selection of recorded performances of Baroque repertoire, made by prominent 'historically informed' performers of different periods (study 1). Examined for the manner of execution of melodic intervals, analysis was based on comparison between the suggested mean temperament tuning representing the historical practice, as offered by various models, and the interval sizes carried out in practice.

'Historically oriented' performers were additionally compared to their 'mainstream' equivalents. This was made in order to observe differences as well as similarities between both groups in regard to intonation.

Results have shown intonation deviations found to a large extent among both groups of performers (Short abstract of this study results has been most recently published. See Ornoy, 2006).

Sundberg et al. rule-system of musical expression

Deviations from the original musical score have led to several projects aimed in generating cognitive models of interpretation. An important project is the one led by Sundberg, Frydén, Friberg et al., who have attempted to formulate an overall rule-system for musical expression by using an analysis-by-synthesis strategy (by which a musical expert evaluates the performance of a computerized system).

The primary intention of the rule-system generators was to make explicit the intuition of a musical expert. Conveying and classifying expressive devices served as a fundamental stage towards the development of a set of rules regarding musical expressivity. The rule-system was established by investigating the process of a skilled musician ‘teaching’ a computer, and is thought to have a musical effect employed in performance either individually or as a set.

The rule-system concerns various musical parameters, such as a note’s duration, frequency or direction. Among the various musical factors addressed, intonation manipulation was found a dominant feature of musical expressivity. In this regard, a distinction was made between monophonic contexts (by which, among others, ‘melodic intonation’ and ‘melodic charge’ rules were suggested) and ensemble music (suggesting, for example, ‘mixed intonation for ensemble music’ and ‘harmonic charge’ rules).

Relating data to intonation rules (study 2)

Faced with the amount of intonation discrepancies found among both ‘historically informed’ and ‘mainstream’ groups of performers, an attempt was made to examine the relation between intonation analysis data and the Sundberg et al. ‘melodic intonation’ and ‘melodic charge’

rules (study 2). Such examination was based on the supposition that intonation deviations were related to musical expressivity and to performers' musical intuitions. Accordingly, one would assume that intonation modifications are related, among other aspects, to cases of significant 'melodic charge' and 'melodic intonation' values.

Study 1

Introduction

Previous studies have pointed to the limited influence of theory over practice where intonation of non-fixed pitch instruments is concerned. Research has shown that non-fixed pitch instrumentalists do not tend to abide by one specific tuning system, be it Pythagorean, just or equal (Nickerson, 1949, Sundberg, 1982, Karrick, 1998). Intonation discrepancies were found to be connected to a wide spectrum of influences, such as the effects of vibrato (Winckel, 1967), melodic direction and context (Edmonson, 1972, Sogin, 1989, Rakowski, 1990, Umemoto, 1990, Fyk, 1997), anatomical limitations (Small, 1937), large intervallic skips (Small, 1937, Dobbins and Cuddy, 1982, Rakowski, 1990) or even typical rehearsal settings (Morrison, 2000). The propensity was mostly towards a sharper pitch than the equally tempered value (Small, 1937, Shackford, 1961, Ward, 1970, Geringer, 1978, Sundberg, 1982).

Pitch deviations were detected in performances of both western and non-western music, as well as in different genres of musical expression (Cohen, 1969, Owens, 1974).

As mentioned above, a worldwide survey of a large group of 'historically informed' performers has been conducted, aimed in examining performers' attitudes in regards to principal factors of their

craft. It was based on personal interviews with 25 prominent performers (most of whom are world known soloists or teachers of the highest caliber), and a mailed questionnaire responded by 227 professional performers from whole over the world. Results pointed to the considerable importance given by all to the reconstruction of various historical elements of practice. 91% of the performers who took part in the survey declare reading and being acquainted with musicological sources (such as historical treatises, scholars' theoretical findings and directives etc.) as being a dominating factor in their practice. In regards to intonation, among the 139 non-fixed pitch instrument players who took part in the questionnaire (strings and winds), 79% claim to be using temperament and intonation which they considered as relevant to the historical repertoire. Among the 17 non-fixed pitch instrument players who were personally interviewed, 93% consider the use of historical temperament and intonation as being of considerably importance (Ornoy, 2002).

Having looked at performers' declarations in regards to intonation, analysis of recordings has been made in order to observe to what extent and by what means they are carried out.

Method:

Table 1 displays the list of analyzed recordings.

Table 1: List of analyzed recordings (The sign * is used for indicating performers considered as belonging to the ‘mainstream’ group. Performers are placed in chronological order within their instrument):

Performer	Rec. Date	Rec. issue and label
Maxence Lariou (Flute) *	1967	Philips, 438 809-2
Aurèle Nicolet (Flute)*	1969	Archiv, 2533 368
Frans Brüggen (Flute)	1975	SeOn, 71964
Wilibert Hazelzet (Flute)	1982	Archiv, 2742 007
Barthold Kuijken (Flute)	1988	Deutsch Harmonia Mundi, 77026
Janet See (Flute)	1991	Harmonia Mundi, 907024.25
Noam Buchman (Flute) *	1998	JMC, SP3
Pablo Casals (Cello)*	1938	EMI, CHS7 61027 2
Paul Tortelier (Cello)*	1963	EMI SLS 798
Nicolaus Harnoncourt (Cello)	1970	The Musical Heritage, B-272-274
Anner Bylsma (Cello)	1979	SeOn RCA, SB2K 60880
Mischa Maisky (Cello) *	1985	Deutsche Grammophon, 445 373-2
Pieter Wispelway (Cello)	1989	Channel Classics CCS1090
Anner Bylsma (Cello)	1992	Vivarte-Sony Classical, 48047
Peter Bruns (Cello) *	1997	Opus 111, 30-176/177

Analysis was made using the Melograph of the Laboratory for Musicological Research of the Hebrew University. The Melograph displays each of the analyzed sound’s fundamental frequencies in the

form of a melogram. Calculating each of the sound's average frequency determines its relative pitch. Thus the Melograph can provide information in regards to the standard pitch and temperament system being used by the performer.

Fundamental pitches are visually represented on the computer screen by a series of dots. The dots occur at regular intervals (a dot every four milliseconds), hence a full note's duration will appear as a series of dots displayed against a horizontal grid. In order to provide a standard for interpretation, a note's determined pitch was deduced from the average frequency of its representative dot cluster; dispersed dots representing blurred data were omitted from final calculation. Such, for example, might occur during a note's edge, when its consecutive note is overlapped in the recording process. Note, however, that the use of pitch vibrato should not have affected final analysis due to its visualization as extended frequency proportionally displayed on both sides of the grid.

Previous studies have shown that useful information gathered through the use of the Melograph could only be detected for small ranged, relatively slow monophonic repertoire (Dahlback, 1958, Cohen & Katz, 1968, Cohen, 1969, List, 1974, Moore, 1974). Hence, the repertoire chosen for analysis consisted of two of J.S.Bach's Sarabandes from the solo Flute suite in a minor (BWV 1013) and solo Violoncello suite in c minor (BWV 1011).

The analysis was made through the examination of the interval sizes made by each performer: each of the sampled notes of both excerpts was calculated for its average frequency (in Hertz), followed by the calculation of the interval sizes formed by each pair of successive notes (in cents). Blurred or unintelligible notes by which frequency could not be clearly detected by the Melograph were omitted from the data. In several cases the examination included non-successive intervals, based on

the supposition that intonation awareness is tied to significant harmonic contexts. Thus, for example, in the a minor arpeggio of bar 1 of the Flute Sarabande, the notes B4 and G#4 function as passing notes; the chord's structural notes (A4, C5, E5) are assumed here to be executed according to their harmonic function rather than to their relation with their adjacent neighbors.

Analysis included the sizes of minor and major 2nds (N=62, N=59 respectively), 3rds (N=58, N=48), perfect 4ths (N=37) perfect 5ths (N=52), minor and major 6ths (N=15), augmented 4ths and diminished 5ths (N=34), 7ths (N=12) and 10ths (N=8). 385 intervals were analyzed for their manner of execution among the 'historically informed' group of performers, and 368 intervals were analyzed among their 'mainstream' peers.

The values denoted as representing the historical practice (J.S.Bach's approximate mean tone temperament) were obtained by calculating the suggested size of each interval in accord with Werckmeister's model dated 1691 ('Werckmeister III') as well as with contemporary models whose period of publication and circulation is considered relevant to the production dates of most of the analyzed recordings (Kellertat, 1960, Kellner, 1977, Barnes, 1979). Table 2 presents the approximate alterations in the size of fifths and major thirds compared to their pure sizes as offered by each of the aforementioned models, out of which the analyzed interval sizes were deduced.

Table 2: suggested alterations from pure rate in cyclic order of fifths, representing J.S.Bach's meantone temperament system (Barnes, 1979).

Narrowing of fifths (in cents):

	E \flat	B \flat	F	C	G	D	A	E	B	F \sharp	C \sharp	G \sharp
Werckmeister III (1691)	0	0	0	6	6	6	0	0	6	0	0	0
Herbert Kellertat (1960)	0	0	0	2	6	6	7	3	0	0	0	0
Herbert A. Kellner (1977)	0	0	0	5	5	5	5	0	5	0	0	0
John Barnes (1979)	0	0	4	4	4	4	4	0	4	0	0	0

Widening of major thirds (in cents):

	E \flat	B \flat	F	C	G	D	A	E	B	F \sharp	C \sharp	G \sharp
Werckmeister III (1691)	16	10	4	4	10	10	16	16	16	22	22	22
Herbert Kellertat (1960)	20	14	8	1	0	6	12	19	22	22	22	22
Herbert A. Kellner (1977)	17	12	7	2	7	7	12	17	17	22	22	22
John Barnes (1979)	14	10	6	6	10	10	14	18	18	22	22	18

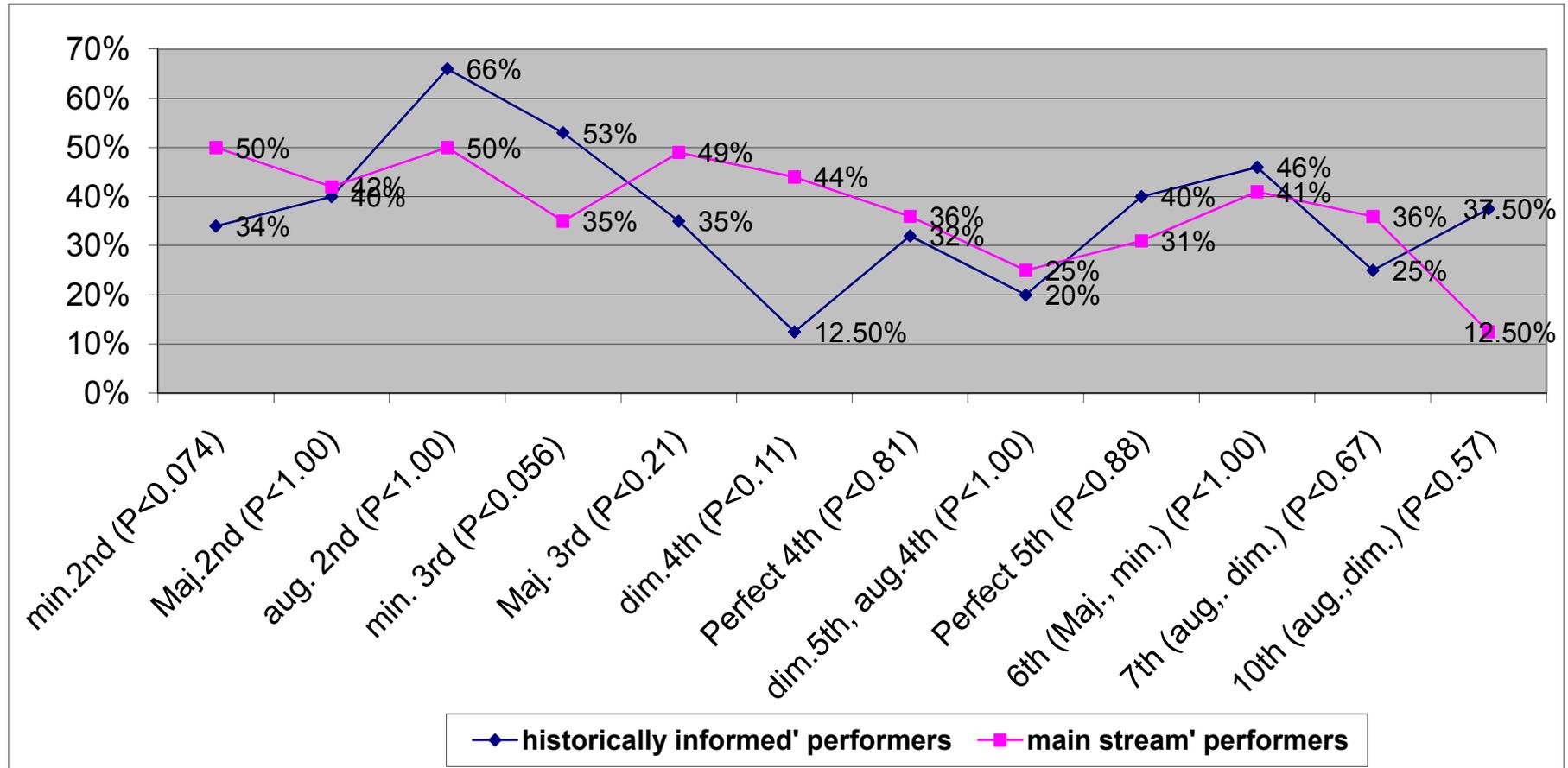
The proportions of deviation from historical practice were compared between the two study groups for each interval separately by means of Fisher's exact test. Comparison was used to a chance proportion of 50%.

Results and Discussion:

Results have shown similarity between both groups: among the 'historically informed' group 38% of all examined intervals (N =146) deviated from what could be regarded as the historical practice, while 39% deviation (N =146) was found among their 'mainstream' colleagues. No significant differences were found between the two groups in all cases ($P>0.05$).

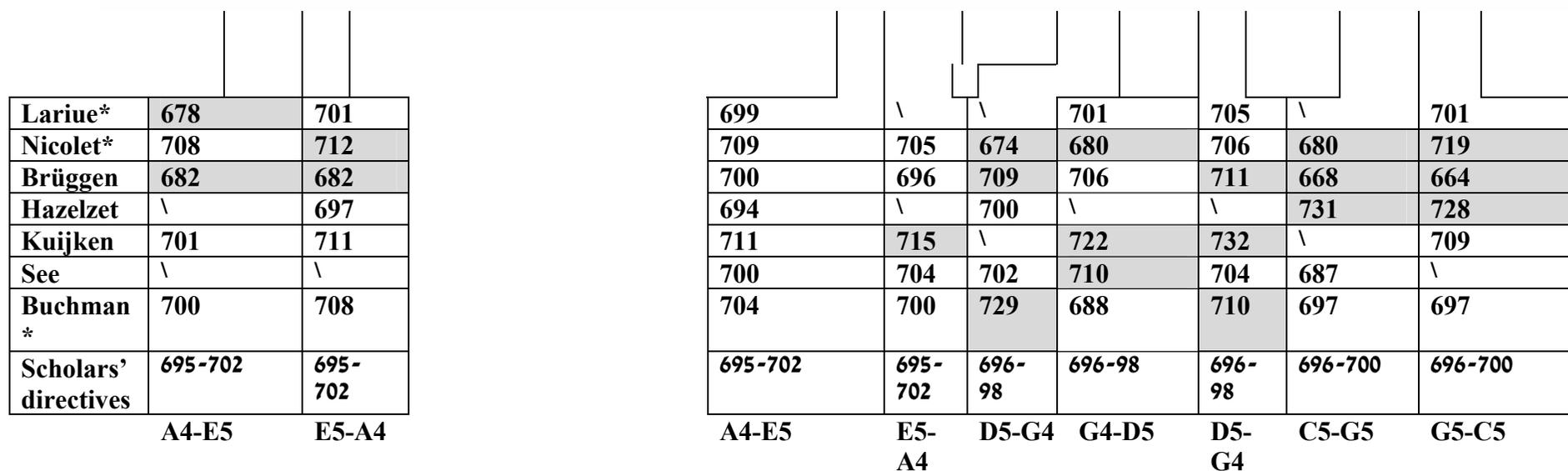
Figure 1 summarizes the amount of deviations from the historical practice found among all the intervals checked.

Figure 1: Deviations from historical practice.



Similarity between the two groups was mostly found in concordant intervals, such as 4ths, 5ths or 6ths. Of special interest is the amount of deviations found among the 'historically informed' group in regards to 5ths and major 3rds, these two intervals serving as pivotal in mean-tempered tuning. Figure 2 serves as an example for the size of 5ths as carried out by flutists (in cents). The lower row indicates the size of intervals representing the historical practice. Note that the intervals singled out in the performers' columns as not matching the historical practice are those deviating 10 cents and above scholar's directives. This agrees with human hearing sensibility in high range, detecting pitch differences from approximately 5 cents and above (Cohen & Katz, 1968, Sundberg, 1982, Sundberg, Fryden & Askenfelt, 1983. Karrick, 1998). Thus, 10 cents serves as an effective range assuring that the anomalous intervals are noticeable to the ear.

Figure 2: Melograph Analysis of 5ths: Bach's Flute Sarabande (BWV 1013)



= Intervals deviating 10 cents or more from scholars' directives.

The sign * is used for indicating performers considered as belonging to the 'mainstream' group. The sign \ indicates undetectable data.

Similarity between the two groups of performers was also found in the manner of execution of the aberrant diatonic intervals, by which approximately 37% of the intervals were carried out in accord with scholars' directives. Such accordance, for example, could be traced in the excessive widening of major thirds above their just size (386 cents), a practice considered by most scholars as corresponding to J.S. Bach's standard temperament system (Barbour, 1947, Donington, 1963, Barnes, 1979, Lindley, 1980, Lehman, 2005). Figure 3 serves as an example for the size of major 3rds as carried out by the cellists. In this example Harnoncourt and Bylsma's widening of the thirds (bar 5) is in accordance with historical practice, while Bylsma's diminution of that interval in his later recording (bar 2) is not. Note that here the intervals singled out in the performers' columns as not matching the historical practice are those deviating 15 cents and above scholars' directives. This is due to human hearing sensibility, by which pitch discrimination ability decreases in the lower range.

Figure 3: Melograph Analysis of Major 3rds: Bach's Cello Sarabande (BWV 1011)



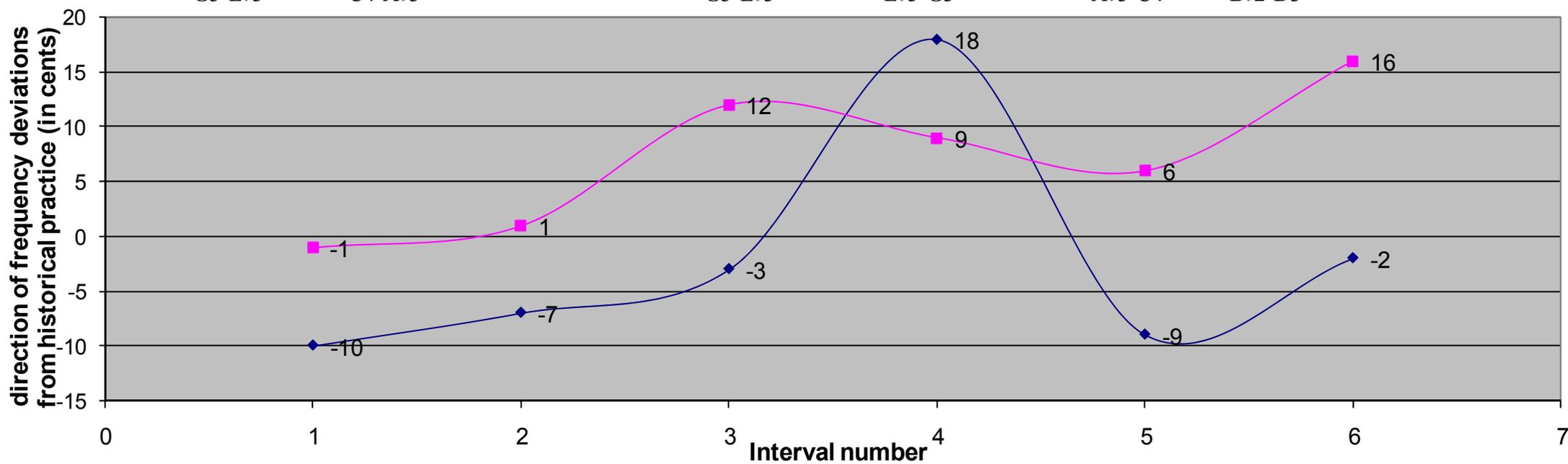
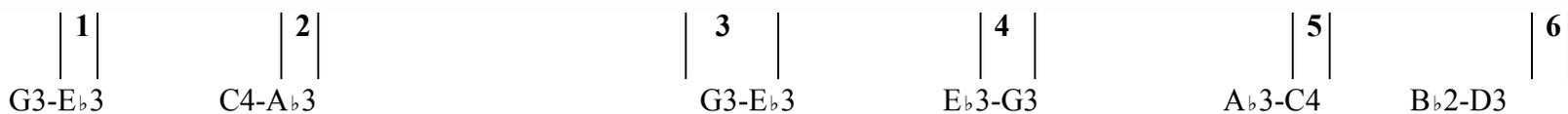
Casals*	408	411	402	419	428	410
Tortelier*	416	405	430	401	425	418
Harnoncourt	397	403	397	423	406	398
Bylsma, 79	391	408	403	453	393	396
Maisky*	388	405	419	401	409	415
Wispeleway	395	400	386	386	393	389
Bylsma, 92	390	384	414	\	\	401
Bruns*	397	409	408	427	386	412
Scholar's directives	400-406	404-408	400-406	400-406	404-408	396-400
	G3-E \flat 3	C4-A \flat 3	G3-E \flat 3	E \flat 3-G3	A \flat 3-C4	B \flat 2-D3

 = Intervals deviating 15 cents and more from scholars' directives

The sign * is used for indicating performers considered as belonging to the 'mainstream' group. The sign \ indicates undetectable data.

Figure 4 summarizes the direction of modifications from historical practice related to Figure 3. Notice how in most cases 'historically informed' performers are found narrowing their major 3rds below scholars' directives.

Figure 4: Direction of modifications from the historical practice- Major 3rds, Cello Sarabande.



◆ 'Historically informed' performers ■ 'Main stream' performers

The differences between the two groups, found to some degree in the manner of execution of discordant intervals such as 10ths, 7ths and diminished 4ths, correspond to findings regarding the manner of execution of chromatic intervals: among the 'historically informed' group 55% of the aberrant chromatic intervals have been carried out in accordance with historical practice, while such accordance was found to a much lesser degree (27%) among their 'mainstream' equivalents. Correspondence in that regard could be traced in the lowering of a sharpened note against raising its enharmonic equivalent. Such practice derives from the general principal expressed in historical sources, by which flats were performed a comma higher than sharps. The term 'comma' represented various values, such as in the '1/4-comma meantone temperament', in which a 'comma' is approximately 41 cents. In practice, the note, say, D \sharp should sound flatter than E \flat (Haynes, 1991, Barbieri, 1991, Lehman, 2005).

Figure 5 serves as an example for the size of minor 2nds as carried out by the flutists. In this example, Hazelzet's widening of the 2nd in bar 5 corresponds to the historical practice, while Kuijken's diminution of that interval (bar 7) is in contrast to it.

Figure 5: Melograph Analysis of minor 2nds: Bach's Flute Sarabande (BWV 1013)



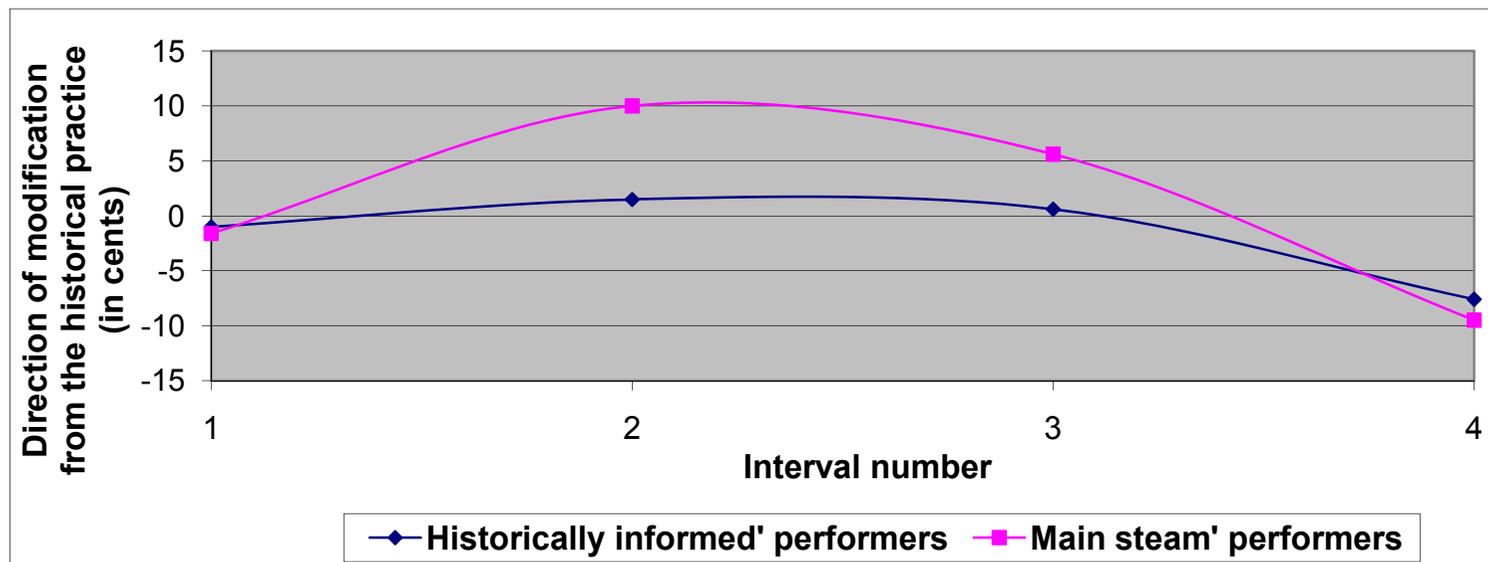
Lariue*	91	92	122	123	\	91	\	98	98	\	102	\
Nicolet*	108	87	95	112	92	86	79	95	94	103	73	73
Brüggen	137	89	117	85	133	99	99	\	\	101	125	72
Hazelzet	94	109	101	106	115	103	\	122	125	107	\	\
Kuijken	\	93	99	99	105	120	92	88	112	96	119	108
See	102	\	108	95	\	96	88	86	\	\	112	105
Buchman*	92	110	87	90	89	102	102	118	89	96	109	102
Scholars' directives	106-114	96-100	108-111	96-100	108-111	106-114	106-114	96-100	108-111	106-112	106-114	106-114
	B4-C5	G#4-A4	F4-E4	G#4-A4	F5-E5	B4-C5	B4-C5	G#4-A4	F5-E5	F#4-G4	C5-B4	B4-C5

■ = Intervals deviating 10 cents or more from scholars' directives.

The sign * is used for indicating performers considered as belonging to the 'mainstream' group. The sign \ indicates undetectable data.

Figure 6 summarizes the direction of modifications of chromatic intervals related to Figure 5. Note that most sharpened notes examined are executed lower by the 'historically informed' performers than by their 'mainstream' equivalents. The practice of raising sharpened notes featured in the latter group derives from the Pythagorean, 'expressive' modern manner of enhancing its function as leading notes.

Figure 6: Direction of modifications of chromatic intervals--minor 2nds, Flute Sarbande.



Study 2

Introduction:

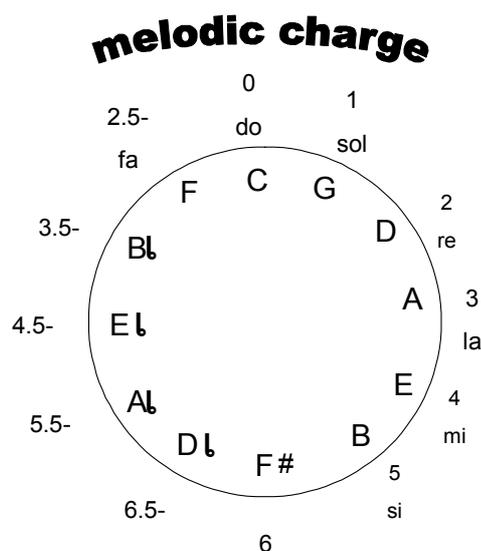
Tested on musically trained listeners, significant support for the aforementioned 'rule-system to musical expression' has been reported (Thompson, Sundberg, Friberg & Frydén, 1989). Although most rules of the overall system were found effective while implemented as a set (i.e. four or five different rules put together), in several cases application of just one rule implemented in an appropriate melody yielded significant ratings among subjects, pointing to its effect as an individual variable. Hence, while the process of creating expressivity involves a combination of various rules, and though there may be many synonyms for any one aspect of musical expression, the significance of each individual rule in affecting expression is connected to its overall musical context, and *"applying one performance rule that is very effective can be as beneficial to the performance as applying three less effective rules"* (ibid., p. 730).

Similar in texture (chromaticism) and in idiomatic characteristics (being intended for monophonic, non-fixed pitch instruments), both excerpts of this present study seem highly appropriate for examining the particular rules regarding intonation. Addressing these specific expressive devices enables evaluation of their individual significance on findings.

Since monophonic repertoire is involved, examination was restricted to the relation between 'melodic charge' and 'melodic intonation' rules, and the analyzed intonation deviations. Notes of relatively high or low 'melodic charge' and 'melodic intonation' ratings were thus examined for their frequency occurrence in real practice.

The term ‘melodic charge’ is used to describe a tone’s ‘remarkableness’ or ‘unexpectedness’ in its musical context. According to the rule's formulators, a note’s ‘melodic charge’ is a function of its position in the circle of fifths, increasing in value according to its distance from the root of the prevailing chord. Figure 7 displays 'melodic charge' values, C serving as the root of the chord. Note that distribution is asymmetrical around the circle of fifths; notes located down from the root (i.e. the circle's subdominant side) are marked negative and are greater in value.

Figure 7: Definition of 'melodic charge' by means of the circle of fifths (Sundberg, Friberg & Frydén, 1989).



Amplitude and duration were found to increase in proportion to a tone’s ‘melodic charge’ values (Sundberg, Frydén & Askenfelt, 1983, Sundberg & Frydén, 1987, Sundberg, Friberg & Frydén, 1989), while additional findings suggested correlation between interval tunings (in ensemble performances) and the melodic charge of the target note (Sundberg et al., 1989).

'Melodic intonation' refers to frequency deviations from equal tempered tuning in a monophonic context, connected to the number of semitones above the root of the chord (Friberg, 1991). Deviations are suggested as varying (in cents) from 0 (for the note which is the root of the chord) to 10 (for the note situated 6 semitones above the root of the chord).

Apart for the application of the rule system to data gathered by analysis-by-measurement strategy (by which a hypothesis is formulated upon the measured data), this examination differs from previous studies in addressing two different groups of performers divided in their preferred tuning systems. Hence, while early music performers were examined for their deviations from the historical mean-tempered system, followed by comparison to 'melodic charge' and 'melodic intonation' ratings, 'mainstream' performers were examined in this case for their deviations from equal tempered tuning followed by such comparison.

Method:

Both 'melodic charge' and 'melodic intonation' ratings were obtained by defining each musical excerpt's harmonic sub-texture and chord progressions. 'Melodic charge' values (marked X_{mel}) were calculated according to each note's position in the circle of fifths in relation to the root of its prevailing chord. 'Melodic intonation' values (i.e. the suggested frequency deviation in cents, marked ΔF_{mel}) were calculated according to each note's distance in semitones above the root of its prevailing chord.

Figure 8 displays 'melodic charge' and 'melodic intonation' ratings obtained for the Flute Sarabande. Figure 9 displays 'melodic charge' and 'melodic intonation' ratings obtained for the Cello Sarabande.

Figure 8: 'melodic charge' values and 'melodic intonation' ratings (in cents): Bach's Flute Sarabande (BWV 1013)



	a	b	c	e	g	a	f	e	f	g	a	b	d	f	e	d	b	c	a	b	a	b	c	e	g	a	f	e	d	g	a	b	d	f	g	e	d	c	e	g	e	d	c	b	c	g
ΔF_{mel} (‘melodic intonation’)	0	3	4	1	9	0	6	0	3	4	2	1	4	7	0	4	1	6	2	1	0	3	4	1	9	0	4	3	0	0	3	4	1	9	0	4	3	0	4	1	4	3	0	9	0	1
X_{mel} (‘melodic charge’)	0	2		1	5	0		0	2	4		1		0		1		1	0	2			1	5	0		2	0	0	2	4	1	5	0	4	2	0	4	1	4	2	0	5	0	1	

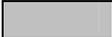
 = Notes of significantly low ‘melodic charge’ and ‘melodic intonation’ ratings (X_{mel} , ΔF_{mel} : 0-1).

 = Notes of significantly high ‘melodic charge’ and ‘melodic intonation’ ratings (X_{mel} : 5-6.5, ΔF_{mel} : 6-9).

Figure 9: 'melodic charge' values and 'melodic intonation' ratings (in cents): Bach's Cello Sarabande (BWV 1011)



	g	e	B	c	A	c	a	e	f	B	d	a	e	f	G	g	f	e	B	c	C	c	e	a	g	d	c	d	f	b	a	c	b	a	g	d	e	B	d	E
Δ Fmel (<i>'melodic intonation'</i>)	1	4	9	0	4	1	4	9	0	4	1	7	4	4	0	0	2	4	9	0	0	0	4	6	1	7	0	4	1	0	4	3	0	2	4	9	0	1	9	0
Xmel (<i>'melodic charge'</i>)	1	-4.5	5	0	-4.5	1	-4.5	5	0	4	1	-6.5	3	-3.5	0	0	-2.5	-4.5	5	0	0	0	-4.5	-5.5	1	-6.5	0	4	1	0	-3.5	2	0	-2.5	4	5	0	1	5	0

 = Notes of significantly low 'melodic charge' and 'melodic intonation' ratings (Xmel, Δ Fmel : 0-1).

 = Notes of significantly high 'melodic charge' and 'melodic intonation' ratings (Xmel: 5-6.5, Δ Fmel : 6-9).

Since in most cases the suggested deviations according to both rules are not discernible to the unaided ear, special significance has been given to notes by which deviations of 10 cents (or 15 in the Cello's case) and above the suggested temperaments (meantone or equal, depending on the group examined) has occurred. Similarly, significance has been given to notes deviating 5 cents and less, assuming in such cases that the minor aberration was unintentional.

Fisher's exact test was used in order to compare the proportion of deviations within each group to a chance proportion of 50%.

Results and Discussion:

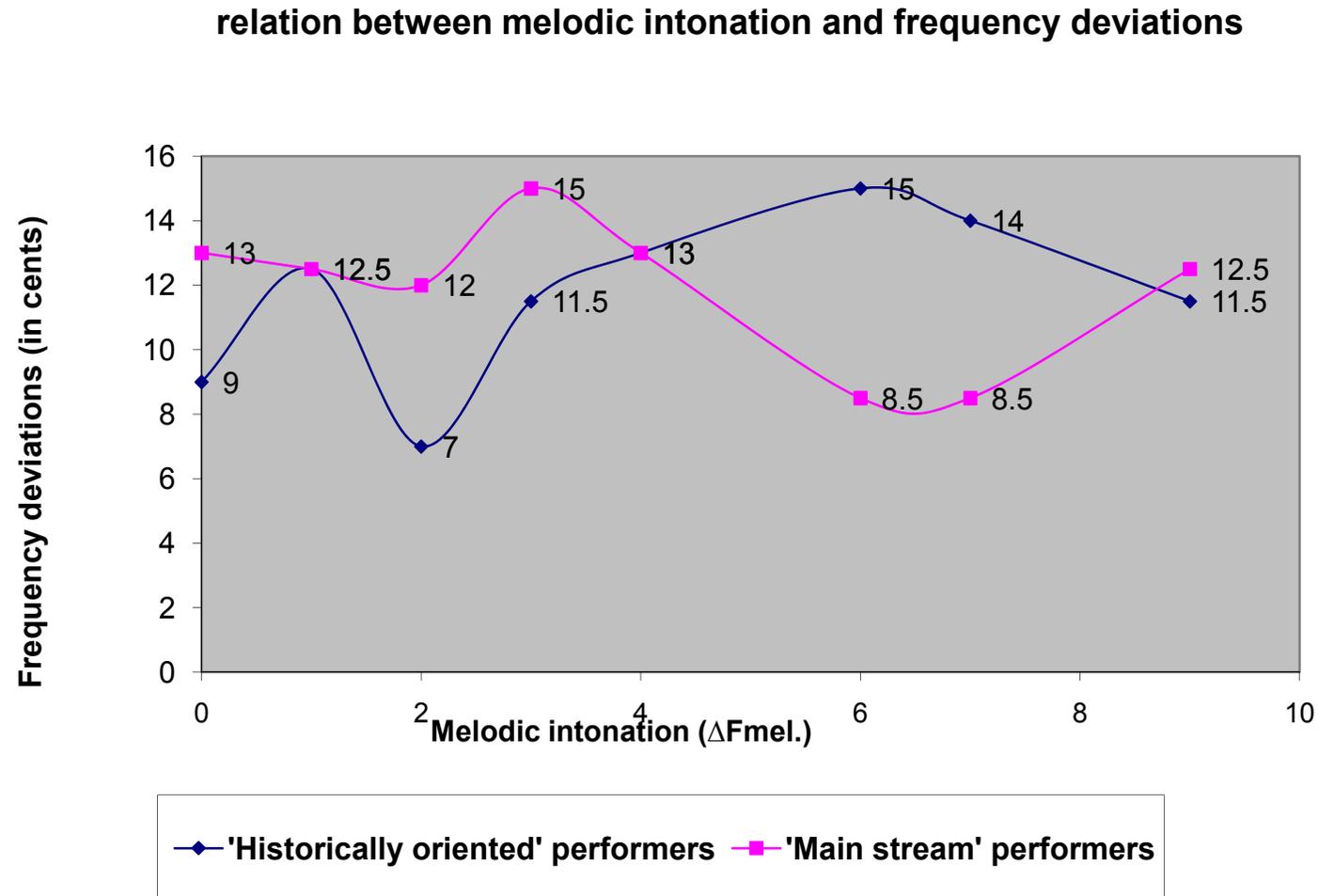
Results have shown no correspondence between both rules and the deviations made in practice by both groups: approximately 30% of the deviations have been found to match cases where low 'melodic intonation' and 'melodic charge' ratings were suggested (X_{mel} , ΔF_{mel} 0-1; frequency deviation of 5 cents and less the suggested value). Similarly, approximately 34% of the deviations have been found to match cases where high 'melodic intonation' and 'melodic charge' ratings were suggested (X_{mel} 5-6.5, ΔF_{mel} 6-9; frequency deviation of 10 or 15 cents and more from the suggested value).

Table 3 summarizes the amount of frequency deviations found matching cases of significant X_{mel} and ΔF_{mel} ratings. Note that in all cases the proportion of deviations was found significantly different from chance proportion ($P < 0.05$), thus contradicting the prediction made by the rules.

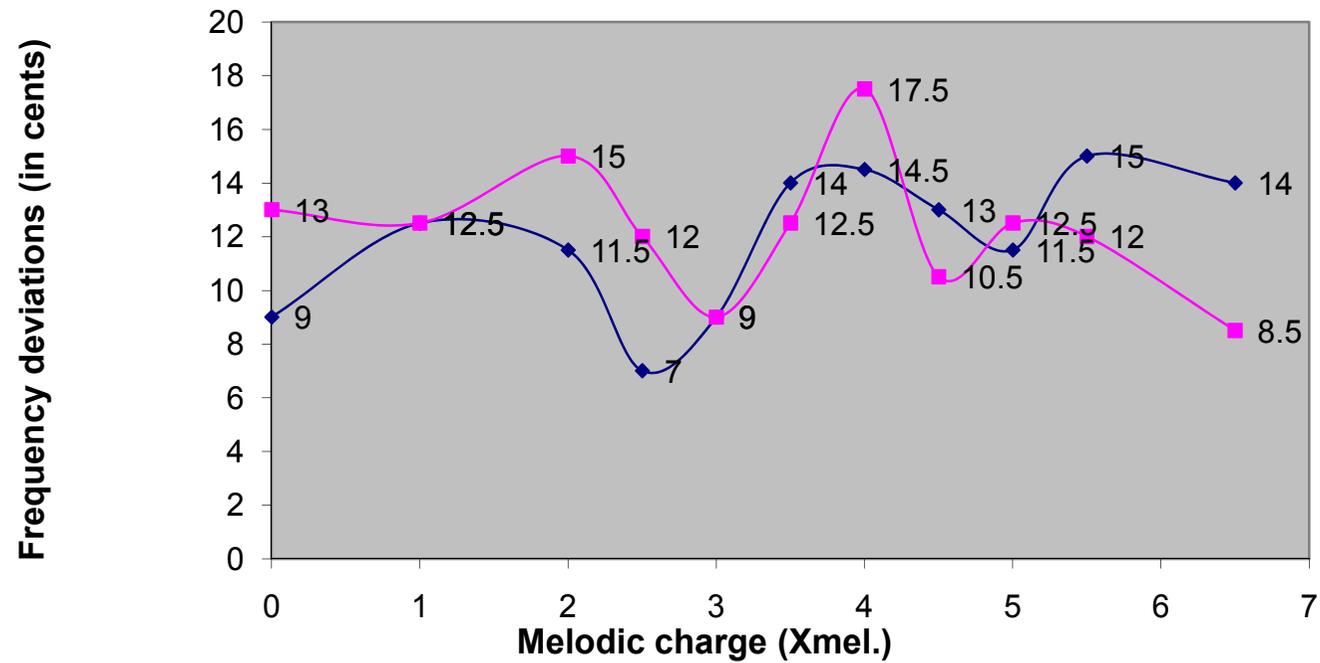
Table 3: Compliance between frequency deviations and notes of significant Xmel and Δ Fmel ratings.

		All performers	'Historically informed' performers	'Mainstream' performers
Low Xmel, ΔFmel ratings	Distribution:	62	38	24
	Frequency:	30%	36%	24%
	Total dist.	205	106	99
	P value:	P<0.0001	P<0.0046	P<0.0001
High Xmel, ΔFmel ratings	Distribution:	35	18	17
	Frequency:	34%	34%	35%
	Total dist.	102	53	49
	P value:	P<0.002	P<0.027	P<0.044

Figure 10 displays relationships between 'melodic charge' and 'melodic intonation' values and frequency deviation found among both groups.

Figure 10: Relation between rules and measured frequency deviations:

relation between melodic charge and frequency deviations



◆ 'Historically oriented' performers

■ 'Main stream' performers

Note that while low or high X_{mel} and Δ F_{mel} ratings do not seem to match the examined frequency deviations, both groups differ in their relation to close-to-high 'melodic intonation' ratings (Δ F_{mel}: 6-7). This is due to the different manner of execution of chromatic intervals practiced by each group. Hence, notes such as A \flat 3 or D \flat 4 in the Cello Sarabande excerpt (mm. 3, 5) are carried out by the 'historically informed' performers fundamentally higher than among their 'mainstream' peers, the latter lowering their flats in the Pythagorean, 'expressive' modern manner.

The significant frequency deviations seen among the 'mainstream' group in cases of notes of average 'melodic charge' values (X_{mel}: 3.5-4) is connected both to the manner of execution of chromatic intervals discussed above, and to the general tendency mentioned earlier towards increasing the size of large intervals, some of which constitute several notes valued X_{mel}: 3.5-4 (minor and major 6ths in the flute Sarabande excerpt, minor 7th in the cello Sarabande excerpt).

General Discussion

Apart from their wide implications on the study of early music performances, intonation analysis results reinforce conclusions made in many studies, pointing to the limited influence of theory over practice in regard to intonation of non-fixed pitch instruments.

Indeed, contrary to early music performers' declarations, it now seems that intonation is more confined to idiomatic or contextual limitations than to theoretical directives. These findings, together with the similarity in intonation discrepancies noted among their 'mainstream' colleagues (apart for the realization of chromatic intervals), suggests that

intonation should not be regarded as a distinctive element of practice where early music performances on non-fixed pitch instruments are concerned.

Following the second study, it seems that a note's 'melodic charge' and 'melodic intonation' value have limited effect on intonation carried out in practice.

Certain considerations should be made while examining findings: since several rules have been said to have simultaneous influence on a performance, no deductions should be made as to the reliability of any of the rules that might affect intonation other than the two tested here. Moreover, the cumulative effect of the rules as a set of cues, by which each of its components' values are closely connected to its musical context, might suggest in this case the small significance of the two rules examined, but not their overall abolishment. In order to fully examine the cause for intonation discrepancies found in data, additional, more comprehensive study should examine the effect of each of the various rules, statistically controlled for various other influences on intonation unrelated to the rule-system, such as physical constraints, the effects of vibrato, inherent idiomatic sub-features differing between 'historically oriented' (baroque flute or cello) and modern instruments, etc.

One should additionally bear in mind that the rule-system generators have pointed from the start to the numerous ways of performing musically, regarding the rules as merely descriptive of an expert's interpretation in a local musical context. Hence it is not unlikely that in both musical excerpts expressive devices other than those presented by the rule-system have been used, connected to various idiomatic, textual or non-textual aspects of musical performance.

Nevertheless, findings have clearly failed to show significant influence of a note's 'melodic charge' and 'melodic intonation' value on its performed intonation.

Such findings might very well suggest the possible discrepancy between the two methods of analysis, for data collected from actual performances, as in the present case, have failed to coincide with suppositions based on analysis-by-synthesis strategy. The findings hence raise questions of great importance as to the possible gap between performers' expressive tools employed as an outside assessor and the actual devices used by him in practice. It is reasonable to suppose, for example, that in the case studied here, confinement to idiomatic and technical limitations, such as inherent tuning deficiencies of the instrument or acoustic distortion in the recording studio, affect performers' expressive actions in both conscious and subconscious levels. Faced, theoretically, with similar interpretations as an outside evaluator, the same performer might very well suggest quite different expressive devices. Future research aimed at further investigation of such a hypothesis is sure to embrace the performer-as-teacher phenomenon, addressing many pedagogical and artistic actions such as master classes, conducting, instrumental teaching etc.

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Performance in Theory and in Practice:

Helmuth Rilling's Interpretations of Bach's B minor Mass¹

Uri Golomb

Abstract

The conductor Helmuth Rilling documented his views on Bach's B minor Mass in two different media: in addition to his three recordings, he wrote a monograph on this work, containing detailed analyses and performance instructions for each movement. Surprisingly, the recording that seems most consistent with the conductor's verbally-stated views is his 1999 version – the one most chronologically distant from the book.

In the book, Rilling repeatedly exhorts performers to trace the ebb-and-flow of tension within the music. His earlier performances, however, often display an internal rigidity which belies this ideal. This disparity might represent a tension between Rilling's aesthetics and his adoption, in the 1960s and 1970s, of a performance style better-suited for the projection of strict Unity of Affect, reflecting the influence of several of Rilling's mentors and erstwhile colleagues. In subsequent years, Rilling and his ensembles have gradually adopted a more locally flexible performance style, reflecting, in part, the influence of period-instrument performances.

The comparison between the book and the recordings provides a fascinating case study on the relationship between a performer's statements and practices; it also provides insights into how the ostensibly anti-Romantic influence of historical performance has increased the expressive options for Bach performance.

The conductor and scholar Helmuth Rilling, one of the most prominent interpreters of Bach's music in the 20th (and early 21st) century, provided posterity with several interpretations of Bach's B-minor Mass, BWV 232, in two distinct media. As a conductor, he made three commercial recordings of the work – in 1977, 1988 and 1999.² As a writer, he published an extensive monograph on the work in 1979, revising it for translation in 1984 and again for a second German edition in 1986.

In his monograph, Rilling seems to separate his discussion of the music from discussion of performance-related issues: he presents a detailed analysis of each movement, followed by recommendations for performance printed in *italicised* font.³ In the introduction to the book, however, Rilling makes it clear that the italicised sections do not spell out all the performative implications of his analyses.⁴ Instead, they “address only the basic elements of these implications, and not their details” (Rilling 1984: x). Thus, his recommendations for performance are not presented as self-sufficient; they should be read in conjunction with the analyses that precede them, and these analyses should have a bearing on the performance beyond what Rilling explicitly states in the italicised sections.

Partly for this reason, Rilling's analyses largely ignore “aspects of the work that seem to me to have no bearing on the architectural and structural elements of the piece, or to be of little importance in that regard (number symbolism, for example)” (Rilling 1984: x). In reality, Rilling's analyses also contain extensive references to the expressive affect of each movement – arguably an issue of no direct **structural** relevance. But structure and affect alike have clearer performative implications than number symbolism. On one of the rare occasions where his analysis does refer to number symbolism, he states that such symbols “do not

contribute to an understanding of the performance of the movement, and thus will not be discussed further here” (the quotation is from Rilling’s analysis of the *Sanctus*; *ibid*: 117).

On the whole, then, the monograph is clearly performance-oriented, and based on what I shall term an x/x philosophy of musical performance (see explanation in note 5 below): the belief that performances should realise the performer’s understanding of the musical work – be it in terms of structure, texture, thematic materials, harmonic tension and resolution, or expressive affect.⁵

It should be noted that Rilling’s approach is x/x – not +/+ : he advocates a more “objective” approach in movements which he perceives as less expressive (primarily the *Gratias* and the *Credo in unum deum*; Rilling 1984: 27-29, 53-55). In the *Qui tollis* and *Agnus dei*, he recommends performative restraint to match these movements’ meditative character (*ibid*: 34-38, 145-149). Overall, however, Rilling views the Mass as a richly expressive work. He observes notable contrasts between its movements, and while he perceives most movements in terms of unity of affect, he also discerns dramatic tensions and architectural developments within them. These observations are usually reflected in his recommendations for performance.

Rilling’s three commercial recordings of the Mass trace a remarkable transformation in his performance style. This transformation is consistent with the developments documented in his many recordings of Bach’s other works, as well as with broader developments in 20th-century Bach performance and reception. Comparison with his book reveals a complex and intriguing relationship between Rilling’s verbally-expressed views on the one hand and his practical choices as a musician on the other.⁶ Rilling’s interpretations of the Mass can therefore shed light on two different yet related issues:

1. The relationship between performers' verbally-expressed views on music and performance and their actual performance. In what sense can we view a performance as compatible (or incompatible) with the performers' statements? What significance can we attach to this compatibility (or lack thereof)? This can be seen as a subset of a more general issue: the relationship between verbal discourse on music and the choices of performing musicians.
2. Major developments in Bach performance in the 20th century, as documented in sound recordings. Rilling's case is particularly useful for elucidating two issues: the interaction between historically-informed performance (hence: HIP) and "mainstream", modern-instrument performance; and the question of expressiveness in Bach performance. These issues are related, given the frequent allegation that HIP musicians have advocated and/or practiced a deliberately dry, inexpressive performance style – and the contradictory belief that HIP has rejuvenated long-neglected techniques and aesthetic ideals of expressive performance. This, in turn, can be related to the wider question of what constitutes expression in musical performance.

In this paper, I will focus on the first issue. Alfred Brendel, introducing his own essays on music and its performance, claimed that the main reason for a performer to write down his views on music is

to clarify his own thoughts and articulate his perception for his own benefit. When advice is given it is aimed first and foremost at himself,

if not without the hope that it may be of some value to others. (Brendel 2001: xiii)

As an experienced and dedicated teacher of choral conducting, Helmuth Rilling clearly expected his book to be of value to his colleagues and students. In this paper, however, I shall treat it as a formulation of the conductor's advice to himself. My main questions will therefore be: a) what sort of advice did Rilling give himself; and b) to what extent, and in what ways, did he follow his own advice in each of his recordings. As I will try to demonstrate, the recording that matches the book most closely is – contrary to expectations – the one which is chronologically most distant from it. In attempting to explain why this happened, I will touch upon the second set of issues (developments in Bach performance and their relation to performative expression).

Helmuth Rilling and 20th-century Bach performance

Helmuth Rilling is one of the most prolific Bach conductors on record. In the 1960s, he recorded Bach's motets and several of his sacred and secular cantatas; between 1970 and 1984, he recorded Bach's complete sacred cantatas, as well as the Passions, Oratorios, and B-minor Mass. More recently, the Stuttgart Bachakademie, which Rilling founded in 1981, collaborated with the record company Hänssler Classic to produce the *Edition Bachakademie* – a recording of Bach's complete works, issued to celebrate the 250th anniversary of Bach's death in 2000. All the choral and orchestral works in this series are conducted by Rilling himself. The volumes dedicated to the sacred cantatas consist of a re-issue of the 1970-1984 cycle. Most of the other works, however, were recorded for the *Edition Bachakademie* during the 1990s. Rilling also

took part in selecting the musicians who recorded the chamber and solo works, many of whom appeared in concerts organised in Stuttgart Bachakademie.

Thus, through several decades, Rilling has been one of the most celebrated and influential interpreters of Bach's music (and especially of his sacred vocal music) – primarily as a conductor, but also as a teacher (directing workshops and master-classes on Bach performance), writer and lecturer. He remains active on all these fronts. His discography presents a rich documentation, covering over forty years with many repeat performances of the same repertoire, allowing us to trace the development of his performance style.

In his classification of the “spectrum of Bach interpretation” – i.e., the range of ensembles and approaches to Bach's liturgical vocal music – Rilling cites three main trends: the symphonic tradition, historical performance, and “church choirs, and congregational instrumental ensembles, primarily in Protestant (Lutheran) churches” (Rilling 1985: 4). Rilling belongs to the third of these traditions, having served as the Cantor of the Gedächtniskirche in Stuttgart from 1957 to 1988. His direct links with the church contributed both to his prestige and to his outlook. Since Bach himself was a Lutheran, and, for a significant part of his life, director of music at Lutheran churches, some present-day directors of similar institutions believe they have a unique intuitive grasp of the message he sought to communicate (Baumgartner 1999: 15-19). While Rilling has not made these claims for himself, he did state that **listeners** who share Bach's Lutheran background and beliefs are at a distinct advantage in understanding his church music – and, by implication, his musical legacy as a whole (Rilling 1985: 7-9, 15).

Rilling's two main ensembles – the Gächinger Kantorei (founded in 1954) and the Bach-Collegium Stuttgart (founded in 1965) – represent the

German *Kantorei* tradition: mixed chamber choruses, usually linked to the church, most often accompanied by chamber ensembles; while continuing to use modern instruments, these ensembles do aspire to take historical performance-practice research into account. Wilhelm Ehmann (1961: 7-8), himself part of this tradition, traces the origins of these ensembles to the *Jugendbewegung* of the 1920s and 1930s. Hans Grischkat, Rilling's teacher and a prominent Bach performer and scholar in his own right, was closely associated with this movement (Leitner 2000). The *Jugendbewegung* placed a premium on the participatory aspect of musical performance, sometimes rejecting professionalism altogether, and expressing a preference for simple, direct music (Potter 1998: 8). It embraced Bach as a didactic composer, and explained away polyphony as a symbol of social integration. Its attitude to expression approached -/-, praising Bach's music for its detachment and avoidance of individualism (Hiemke 2000: 75-83). This philosophy is mostly associated with the first half of the 20th century, especially the 1930s and 1940s. Much of it is clearly inapplicable to Rilling, who insists on high professional standards. However, the *Jugendbewegung's* austere, -/- view converged on other prominent Bach images – not least the image promoted by the Leipzig School, with which Rilling is closely connected.

For the purposes of this paper, the Leipzig or Saxon school is defined as the circle of performers associated with the Thomanerchor in Leipzig (directed by Karl Straube, 1918-1940; Günther Ramin, 1940-1956; Kurt Thomas, 1956-1960; Erhard Mauersberger, 1961-1971) and the Kreuzchor in Dresden (directed by Rudolf Mauersberger, 1931-1971),⁷ and scholars associated with them (notably Arnold Schering and Wilibald Gurlitt). These musicians' approaches to Bach covered the x/- spectrum; even those of them who believed that Bach's music is richly expressive advocated a restrained, austere style of performance.⁸ This

strict x/- approach was particularly linked with the East German tradition, and connected with their advocacy of the boys' choir as an ideal medium for Protestant church music generally, and Bach's in particular.

Rilling has explicitly rejected this argument, expressing instead a strong preference for mixed choirs, and an even stronger preference for female soloists – over boys and counter-tenors alike – for reasons of vocal security and musical experience alike (Rilling 1985: 11-12). More importantly, Rilling's own philosophy has always been x/x: the performer's aim, in his view, is to decipher, "through analysis and reflection", the message that the composer sought to convey to his own audience, and then to create a performance that would make that message "emotionally relevant and timely" for present-day listeners (ibid: 13). This x/x approach also applies to structure and texture. Rilling believes it is important to project both "the organization of details and the differentiation of small forms" and "the architecture of large-scale movements" (ibid: 10). In texture, x/x translates into a strong demand for clarity (ibid: 10-11). Rilling therefore prefers reliably even tone production, which enables the achievement of equal intensity, and in which various strands can be heard without having to fight for prominence.

Nonetheless, Rilling has often expressed his admiration for the Leipzig school, and throughout his career has maintained close contact with the leading musicians there. This connection was further strengthened during his tenure as deputy chairman (1978-1990) and first chairman (1990-1996) of the Neue Bachgesellschaft. More importantly, Rilling has accepted, in theory, several of their stylistic prescriptions – most notably the notion that terraced dynamics (the direct switch from *forte* to *piano*, as opposed to the use of *crescendi* and *diminuendi*) are the

most appropriate method of dynamic change in Bach's music (Rilling, in interview with the author, December 2002).

Rilling also maintains, however, an open-minded approach to various performance schools. His studies of orchestral conducting link him to the more conventional symphonic establishment (including a 1967 master-class with Leonard Bernstein), as does his wide repertoire. In his 1984 lecture "Bach's significance" (translated and published as Rilling 1985), he is mostly critical of contemporaneous HIP performances. However, it should be noted that his approach has changed in subsequent years. Among other things, he now invites HIP musicians to appear at the Stuttgart Bachakademie's events. His programming philosophy is clearly reflected in the *Edition Bachakademie*. For example, he invited the Robert Levin to record the "English" Suites on a modern piano; the keyboard concerti on a harpsichord, accompanied by the "modern" instruments of the Oregon Bach Festival Orchestra under Rilling's direction; and *Das wohltemperierte Klavier* on a range of historical instruments.

Although Rilling has denied being directly influenced by HIP musicians, he has conceded the influence of performance practice research on the profound changes in his performance style (both statements appear in Ben-Ze'ev 1995). The denial is, in any case, not entirely credible, given his direct links with such performers: Robert Levin, for example, acted as Rilling's musicological advisor in several projects, and many of Rilling's vocal soloists, especially since the mid-1980s (e.g., Sybilla Rubens, Ingeborg Danz, Howard Crook, James Taylor, Dietrich Henschel, Franz-Josef Selig), have also appeared frequently with prominent HIP ensembles (for details, see their respective biographies on www.bach-cantatas.com).

The increasing influence of HIP stylistic features on so-called ‘mainstream’ musicians is by no means a unique phenomenon, and indeed has been a prominent feature in the East-German Bach school from the late 1970s. For example, the Thomaskantors from 1941 to 1971 – Günther Ramin, Kurt Thomas and Erhard Mauersberger – maintained a strict, austere style characterised by terraced dynamics and a deliberately rigid approach (at least within movements) to articulation and timbre. Initially, this also characterised the style of Hans-Joachim Rotzsch, who took over in 1971. In 1979, however, Rotzsch began to collaborate with the Neues Bachisches Collegium Musicum, which Max Pommer founded in 1978 with the aim of forging a more historically-informed performance style, albeit on modern instruments (Mikorey and Messmer 1985). The Rotzsch-Pommer performances clearly displayed HIP-influenced stylistic traits (faster tempi, incisive and more varied articulation, locally directional dynamics,⁹ etc.). While Rotzsch later expressed reservations about HIP influences (in *ibid*: 31), his successor (and current Thomaskantor), Georg-Christoph Biller, expressed a preference for period instrument ensembles (in Baumgartner 1999: 7).

Rilling’s assimilation of HIP features, therefore, is part of a wider phenomenon. For many critics, this suggests the adoption of a lighter, more dance-like style; this might seem contrary to Rilling’s repeated demand, in his book, for an intensely expressive approach to Bach. A closer examination, however, reveals that the new HIP-influenced style is well suited for the realisation of some of Rilling’s more ‘romantic’ prescriptions.¹⁰

Rilling's interpretations of the Mass

Rilling's commercial recordings of the Mass come close to covering the full length of his recording career. The 1977 version is his first recording for CBS, with whom he later recorded the two Passions and the *Weihnachts-Oratorium*. At the time, Rilling was about halfway through his cycle of the complete sacred cantatas, and the soloists in his 1977 Mass also made frequent appearances in that cycle.

The 1988 version was made four years after Rilling had completed his cantata cycle.¹¹ It is his only recording for Intercord, and features an orchestra and soloists with whom he collaborated less frequently, at least on record. The notes are by Ulrich Prinz, the Bachakademie's academic director.

The 1999 recording was the penultimate recording of a large-scale choral work to be made especially for the *Edition Bachakademie* (it was followed by Rilling's second recording of the *Weihnachts-Oratorium*). In his liner notes (Rilling 1999), he described this recording of the composer's "Opus Ultimum" as the culmination of his own career as a Bach conductor, coming as it does after he had conducted virtually all of Bach's choral and orchestral music. The ensembles are, once again, Rilling's own ensembles, and the soloists also appear with Rilling in other *Bachakademie* projects (recordings of the secular cantatas, Passions, *Magnificat* and other vocal works). In an interview with the author (November 2001), Rilling stated that he has enjoyed a close collaboration with his record company, Hänssler Classic, by the time this recording of the Mass was made, and that he was closely involved in the recording and editing process – more so than in his earlier recordings of the Mass.

The fact that all three performances employ Rilling's own choir, and two of them employ his own orchestra, arguably makes it easier to ascribe the resulting interpretation to Rilling himself. In the absence of detailed documentation of the rehearsal process, it is difficult to know for certain what aspects of the performance can be ascribed to the conductor as opposed to the musicians under his direction (even when such documentation is available, there might be conflicting interpretations of it). In cases like Rilling's, who works largely with ensembles he had founded, the conductor is likely to have shaped the ensemble's overall style as well as the specific performance – often in co-operation with the musicians (who, in turn, were chosen in part for sharing the conductor's stylistic preferences, or for their willingness to adapt to them).

The 1977 version employs a larger ensemble than either of its successors; coupled with wider vibrati in choir and orchestra alike, this results in a richer, more opulent sound. Slower tempi and a relatively uninflected approach to articulation and timbre within movements often create a static impression – partly balanced, however, by the wide dynamic range in some movements. The later recordings increasingly adopt faster tempi and reveal a growing tendency towards local flexibility, variety and directionality. The differences between the three versions are consistent with developments that can be observed elsewhere in Rilling's discography.

In terms of articulation, the 1999 version is the lightest and most incisive. In terms of dynamics, the picture is more varied. On the one hand, the most wide-ranging long *crescendi* appear in the 1977 version; on the other hand, both the 1988 and 1999 versions feature greater moment-to-moment variety, with more multi-directional changes (small, local rises and falls, as opposed to the extended *crescendi* and *diminuendi* of 1977, in which the same direction of change was maintained over long

stretches of music). The 1988 version contains more instances of terraced contrasts (with some degree of flexibility within each “terrace”) than either of the flanking performances.

In terms of tempo, the 1977 version is the slowest – both in its entire length, and in each and every movement (except for the *Second Kyrie*). The 1999 version is the shortest of the three, but in several individual movements the 1988 version is the fastest (see also the tempo table and illustrative graph). The 1988 version also features more frequent, and wider, tempo modifications – especially concluding *ritardandi*.

The one ideal common to all recordings is textural clarity. Rilling rarely resorts to aggressive aspiration;¹² in other respects, choral singing in the 1977 version is reminiscent of recordings by such Leipzig-school conductors as Rudolf Mauersberger and Karl Richter, particularly in the use of *non legato* articulation to clarify textures. In 1988 and 1999, the choir became progressively smaller, and textural clarity is enhanced through greater unanimity of sound and attack and through more varied articulation.

The relationships between book and recordings

Rilling’s book on the Mass appeared between the first two recordings. Its first edition was published in 1979; he revised it for the 1984 English translation, and again for a second, 1986 German edition (which I was unable to consult). As noted above, the book reveals, both implicitly and explicitly, Rilling’s x/x approach to performance – the belief that performances can, and should, communicate the performer’s views on the music. In a critique on the attempts to analyse performances

in terms of verbally-expressed analyses, philosopher Jerrold Levinson stated:

When we hear a striking PI [Performative Interpretation] of a familiar piece, the question we put to ourselves as interpreters of such interpretations should be not, ‘what CI [Critical Interpretation] does that PI embody or convey?’ [...] but instead ‘What CIs might such a PI support or reflect?’ An insightful PI might prompt one to arrive at a new CI, or allow one to confirm the validity of a CI already proposed, or induce one to question a CI regarded as authoritative, and so on, but it cannot itself unambiguously communicate a CI. (Levinson 1993: 57; cf. Cook 1999: 48-49; Bowen 1999: 446-451; Butt 2002a: 88)

Rilling’s book does, however, come close to specifying, in words, a PI (already an impossibility from Levinson’s viewpoint, which defines a PI not as a set of instructions for performance, but as the performance itself) which would communicate his own CI of the work. It is significant, of course, that he needs to explain his views on the music before proceeding to give his explicit performance suggestions – the latter cannot simply stand on their own and “unambiguously communicate” the former. However, even if one accepts Levinson’s viewpoint, one could still expect Rilling’s recordings to be “support or reflect” his verbally-expressed views on Bach’s music – especially given his x/x philosophy.

More specifically, one would expect a particularly strong correlation between the book and the performance that is chronologically closest to it. This correlation would probably be incomplete – performance decisions, even in the studio, are sometimes made on the spur of the moment, and are partially affected by factors outside the musicians’ control (including, in the case of recording, the production team’s contribution). However, one might still expect the 1977 recording (made, in all probability, while or shortly before Rilling started writing his book) to be similar in spirit, and at least in several details, to the type of performance recommended in the book. The other recordings, on the other hand, might reflect Rilling’s subsequent thinking, his later ideas,

and one would therefore expect to find fewer correspondences between them and his book.

In some respects, listeners and readers are likely to conclude that this is indeed the case. Rilling's performances have increasingly reflected the influence of period-instrument performances; but these influences largely post-date the book, which rarely touches upon performance-practice issues. George Stauffer (1993: 258) writes that Rilling's "suggestions for performance are closer to nineteenth-century traditions than to the practices of Bach's day". Reading the book on its own, that conclusion is understandable. Rilling describes individual movements in the Mass in terms of dramatic development, of gathering and release of tension, and believes that these patterns should be realised in performance. Despite his general advocacy of terraced dynamics, he often recommends large-scale, gradual dynamic build-ups towards climaxes (e.g., Rilling 1984: 8 [*First Kyrie*], 14 [*Second Kyrie*], 70 [*Incarnatus*], 131 [*Sanctus*]; see also my discussion of Rilling's interpretations of the *Crucifixus* below). He also recommends the employment of smaller dynamic inflections to create localised variety or a sense of purpose within phrases (e.g., *ibid*: 24 [*Gloria*], 27 [*Laudamus*], 34 [*Domine deus*]), and suggests variety of articulation as a means of distinguishing between themes or sections (e.g., *ibid*: 14 [*Second Kyrie*], 24 [*Gloria*], 55 [*Credo*]; see also my discussion of Rilling's interpretation of the *Qui tollis* and *Qui sedes* below). For the most part, he neither prescribes nor proscribes varied articulation within phrases.

Rilling's emphasis on overall development arguably reveals a certain degree of anachronism, as Stauffer suggests. Performance practice research suggests that performance in the Baroque era had a flexible, locally-inflected, speech-like quality. As David Schulenberg puts it,

the chief distinction between Baroque and later expression may be that in [the former] the signs are small *figures* in the surface, while in later music the signs take the form of larger music *processes*, such as the extended crescendo or the prolonged dissonance. (Schulenberg 1992: 105; see also Harnoncourt 1988: 39-49 and *passim*; Butt 1990: 12-15 and *passim*; Butt 1991: 84-86; Butt 1994: 41-51; Gustav Leonhardt, in Sherman 1997: 196; Fabian 2003: 245-246 and *passim*; Golomb 2005, section 4.1.1; Golomb 2006)

During the period in which all versions of the book were written (1979-1986), Rilling emphatically rejected this viewpoint and the performances it inspired (Rilling 1985: 14). He analysed Bach's music in terms of large-scale patterns of tension and release, and insisted that these patterns must be projected in performance. In the notes to his 1999 recording of the Mass, Rilling reiterated his belief that performers must project "the arc of tension woven into [the work's] overall architecture" (Rilling 1999: 29). In his actual performances, Rilling has increasingly adopted the locally-inflected phrasing of HIP musicians; as far as one could judge from his recordings, however, this development largely postdates all versions of his book.

Rilling's 1977 performance would probably strike many listeners as 'romantic' in its thick textures, wide dynamic range, slow tempi and predominantly *legato* articulation – features that are much less characteristic of his later recordings. In this, it would indeed seem consistent with his book. A closer comparison between the book and the performances, however, sheds a different light on the former: although their sound-world is less 'romantic', the 1988 and 1999 versions realise many more of Rilling's 1979/1984 recommendations.

This generalisation is not without exceptions: there are cases where the 1977 recording offers a detailed realisation of the 1979 recommendations. The most notable example is the *Crucifixus*. Rilling analysed this movement as proceeding gradually towards an expressive peak in the so-called 10th variation (bars 37-10), and advocated a

performance which moves gradually yet inexorably towards a climax, and from there to a subdued conclusion. In the first edition, he wrote that this pattern of rising and falling intensity must be reflected in performance.

The conductor should project

an arch of constant intensification from the thin texture and resulting restraint of variations 2 and 3 to the climax of the dissonant variation 10. The relaxation of sound begins at the end of the eleventh variation and continues in a constant diminuendo through the ever-lower-moving setting, until the end of the final chord. The spectrum of expression that is available for the interpretation of the text ranges from the plaintive restraint of the beginning, where one hardly dares utter the word crucifixus, to the piercing sharpness and uncompromising harshness that characterize the dissonant entrances in the tenth variations. (Rilling 1984: 76)

This recommendation can be read as a fairly accurate description of Rilling's performance of this movement in the 1977 recording.

In the original edition (Rilling 1979: 80), this arch-of-tension interpretation was presented as Rilling's sole recommendation for performance. When he revised the text for the 1984 English edition, however, he added an alternative suggestion for performers, which he presented as equally viable:

considering the location of the movement in the SYMBOLUM NICENUM and the explicit omission of the first soprano, one could perform [the CRUCIFIXUS] with restrained dynamics throughout, in order to provide a sharp contrast with the following ET RESURREXIT. (Rilling 1984: 76)

“*Restrained dynamics throughout*” is a fairly accurate description of Rilling's approach in the 1988 recording. It should be noted, however, that while the dynamic range of this recording is much narrower than that of the 1977 recording, the 1988 version features a greater variety of articulation and localised, multi-directional dynamic inflections (small, local *crescendi* and *diminuendi*, as opposed to the single, all-encompassing dynamic arch of the 1977 recording).

In another comment added to the revised version, Rilling writes that the movement's climax-oriented shape can be projected “*through deliberate variations in the character of [the choir's] diction*” (ibid), rather than through dynamics. In the 1999 recording, he demonstrates how diction, accent and articulation can create a sense of heightened intensity in variations 10-11 even within a narrow dynamic range. The choir adopts a heavier, more *marcato* articulation in these variations than in earlier portions of the movement, with particular emphases on each voice's entries (the effect is emphasised by the more *legato* articulation in the “*passus et sepultus est*”, variations 8-9, bars 29-36). The soprano's heavier accentuation is sensed almost throughout. The soprano's longer note values in bars 43-44 lead to softer articulation, but this is balanced by the more incisive articulation of the crotchets in the alto and bass (bars 43) and the tenor (bar 44). The effect is enhanced by the choir's clear enunciation of the consonants (though that, in itself, does not seem sharper here than in the rest of the movement).

Here, book and recordings chart the same course. In the 1970s, Rilling preaches and practices a seemingly ‘romantic’ interpretation, based primarily on the use of dynamics. In the 1980s and 1990s, his interpretation becomes more restrained, in theory and practice alike.

However, this seemingly straightforward example proves to be the exception rather than the rule. For one thing, even in the 1979 edition, Rilling sometimes suggest several different performative interpretations for the same movement. A primary example is the *Qui sedes*. In his performance notes for this movement, Rilling explicitly states that “*There are a number of possibilities for tempo*”:

A very slow tempo, which would demand considerable sustaining power from the two soloists [the alto and the oboe obbligato], would [...] stress the gravity of the textual message. [...] a faster tempo, in which the listener feels the half measure as the basic pulse, would release the

meditative tension of the QUI TOLLIS PECCATA MUNDI and emphasize the playful component of the 6/8 meter. (Rilling 1984: 40)

Predictably, Rilling chooses the slower tempo in 1977 (total duration 6'33") and the faster one in 1988 (total duration 4'42") and 1999 (total duration 4'48"). Articulation in all three performances is consistent with his prescribed parameters: Rilling argues that notated staccati quavers should be "*definitely detached, but played relatively long*" (ibid). The distinction between the *legato* and *staccato* portions, however, is clearer in the later two recordings than in the 1977 version. Both later versions sound more restrained: the basic parameters for 1977 are *forte* and *sostenuto*, especially in the strings, whereas the later versions employ quieter dynamics and lighter articulation. Within these parameters, however, these performances employ a greater degree of local nuance (metric accentuation, directional dynamics proceeding beyond bar lines). The metrical element is most strongly projected in the 1999 version. Here, Rilling's different performances give different elucidations for the same words: despite the clear differences in articulation between them, they are all consistent with his prescriptions. At least in this particular case, Rilling's recommendations underdetermine the performance.

All the above-mentioned cases, however, are exceptions (albeit highly significant ones). As a rule, Rilling's 1977 version is the **least** consistent with his own book, despite the chronological proximity; the CBS recording is usually more uniform than the book demands.

This is especially notable in the approach to articulation. In the *Qui tollis*, for instance, Rilling sees "the variety within the theme" – the contrast between repeated notes (Qui tollis pec-: ♩|♩) and the following melismas (♩|♩| ♩|♩|♩|♩) – as an important source of "expressive strength" in the vocal lines:

For the performance of this movement, it is crucial that the nearly static beginning of the theme and its quasi-expressive continuation be clearly

articulated in each of the three fugato developments. However, the periods with the texts miserere nobis [...] and deprecationem nostram [...] must stand in relief against the theme through the use of consistently legato articulation. (Rilling 1984: 37)

He also insists on a clear differentiation between “*independent rhythmic motion of the continuo and cello*”, the “*sixteenth-note movement in the flutes*” and “*the underlying eighths in the strings*” (ibid). Overall, Rilling states that “Bach wanted all elements of the orchestra to participate in the subjective expression of the movement, with increasing agitation from bottom to top” (ibid: 36).

In the 1977 version, he takes little heed of this advice. The performance is shaped almost exclusively by its dynamic contours: Rilling projects the *Qui tollis* in three dynamic waves (bars 1-29, 30-41, 42-end), each with its own pattern of rise-and-fall. Articulation is almost constantly smooth; individual motifs and strands are barely differentiated, and the texture is dominated by the choir and flutes.

In 1988, Rilling placed a stronger emphasis on texture in shaping the movement, in closer accord with his own analysis. In 1977, most interpretive details appeared in the choir, which was placed against a comparatively neutral and unvaried orchestral background. In 1988, there is greater equality of detail between choir and orchestra, though the size of the latter seems to have been reduced (the string section in this movement seems to consist of one player per part). Rilling brings out the instrumental bass line patterns (*staccato* ♩ in the cellos, ♩ in the continuo)¹³ and the clearly-separated, sigh-like *legato* quaver pairs in the violas. The vocal parts are shaped with a clear upbeat-to-downbeat trajectory, which provides a sense of direction even when individual crotchets or quaver-pairs are distinctly separated. Here, the articulatory patterns proposed in the book are audible in the performance. This facilitates a clearer exposition of the relationships between the voices:

since each figure is shaped differently, patterns of imitation, and the simultaneous appearances of several figures, are audible as such. On the other hand, it gives the movement as a whole a somewhat halting effect.

The 1999 version displays a similar articulatory variety, but partly revives the dynamic directionality of the 1977 version. Rilling retains the “qui tollis”/ “peccata” / “miserere nobis” contrasts outlined in his book, but in a more continuous context: metric accentuation is lighter, the separation between crotchets and quaver-pairs is more subtle and their connection through directional dynamics clearer. The dynamic range of the 1988 and 1999 readings is smaller than in 1977, but the rate of change is more frequent – especially in 1999; dynamic inflections reflect the contours of individual phrase, not just large-scale patterns.

It is clear from his book that Rilling recognised the expressive import of motivic details already in the late 1970s – hence his combined demands, in his book, for varied articulation and attention to orchestral detail. Yet in his 1977 recording, he seems to virtually ignore the 1979 recommendations, whereas the 1988 and 1999 recordings come much closer to a realisation of the conductor’s own stated views.

A similar pattern can be observed in the D-major trumpets-and-drums choruses. For these movements, Rilling advocates a fast tempo – not so fast as to jeopardise “*a flawless choral performance*”, but fast enough to guarantee “*an unequivocal, forward-pressing character*” and “*to make the virtuosic component of the movement immediately perceptible*” (Rilling 1984: 87; see also *ibid*: 20, 27, 48, 114, 131, 140). Not surprisingly, this is allied with a recommendation for light articulation; and the references to “*forward-pressing character*” are connected with an advocacy of directional dynamics.

In these movements, the 1999 recording usually comes closest to realising Rilling’s stated ideals, while the 1977 version – with its

the articulation of both the choir and orchestra should possess intensity throughout, and therefore must avoid both a gentle legato and the playful informality of a too-short staccato. (ibid)

In his brief recommendation for performance, Rilling does not mention most of the specific figures he outlined in his analysis a few pages earlier. We should recall, however, his general statement in the introduction – that the “aggregate of the thoughts and observations presented necessarily has implications for the shaping of the work in performance” (Rilling 1984: x), even if these are not explicitly spelled out. His articulation prescriptions are consistent with this: “*gentle legato*” should be avoided in order to ensure that the figures are clearly detectable and separated from one another; “*playful informality*” should be avoided as it negates their symbolic and expressive import.

Again, the 1977 recording does not live up to the conductor’s own standards, especially when compared to his later renditions. The actual timing of the three performances is not that different (2’14” in 1977, 2’11” in 1988, 2’05” in 1999). Most listeners, however, will probably find the 1988 and 1999 versions faster and lighter, because of the difference in articulation, accentuation, dynamics and texture. In 1977, Rilling seems to go more for “*relentless dynamic intensity*” than for **intensification**, ignoring his own demand for a performance which is “*progressively stronger and more dramatic*”. In terms of articulation, one could argue that he abides by the letter of his recommendation, avoiding both “*gentle legato*” and “*too-short staccato*”; yet neither his dynamics nor his articulation in this recording allows for the sense of development and forward thrust that he clearly deems essential in his writing.

In his 1999 version, by contrast, he allows dynamic shaping of individual phrases and motifs, as well as several larger *crescendi*. The articulation is much more varied, with accentuations of the ♪♪ figure,

clear anacrusis-downbeat patterns in “ex PE” and “et VI”,¹⁵ and of “resuREcti” (see music example above). He thus brings out clearly the figures he focuses on in his analysis, in a manner which also supports his demand for rising intensity, both locally and across the entire movement. The 1999 recording, then, is a much clearer realisation of the 1979 interpretation-in-theory; its clear teleology illustrates Rilling’s demand for a performance possessing “*an almost ecstatic dimension*” more clearly than either of its predecessors, especially the 1977 version.¹⁶ Even many of the specific techniques which Rilling did not describe in his book can be clearly related to the 1979 analysis, and the expressive aims that Rilling had set himself at the time.

Summary

The attempt to understand musicians’ performances through a comparison with their stated views on the music and its performance is always problematic (as is the opposite and complementary project: attempting to understand the performers’ words by comparing them with their recordings). It is always possible that the performer’s words might represent a post-hoc justification for performative choices, rather than the thought processes that shaped the performance. In other cases, the performer’s words and the musical choices documented in the recording are difficult to reconcile with each other. My comparison of Rilling’s statements with his performative practices – and similar comparisons I made, in other contexts, between the statements and practices of other performers¹⁷ – confirm what one would suspect in any case: that performers’ stated ideals cannot, in themselves, be used to predict their approach in practice (see also Butt 2002a: 42).

More often, the performance would illuminate the verbal discourse, clarifying what performers might have meant in their employment of certain terms or images, or showing how they prioritise between conflicting demands they expresses in words. Rilling's prescriptions for articulation in the *Qui sedes* (see p. 95 above) could be seen as a case in point. His demand that notated staccati quavers should be "*definitely detached, but played relatively long*" is arguably realised in all three performances, yet these differ radically from each other. Here, Rilling advises performers to balance between seemingly contradictory demands, and his own response to this advice has changed: in 1977, he emphasised his recommendation that the notes be "*played relatively long*", whereas in 1988 and 1999 the emphasis shifted towards ensuring that they be "*definitely detached*". This specific shift in emphasis was consistent with Rilling's general willingness, in the later performances, to allow a more dance-like rendition of this movement.

In general, however, Rilling's performance prescriptions, in conjunction with his analyses, are specific enough to allow a detailed comparison between them and his recorded performances; and they shed an interesting light on each other. An isolated reading of the book, without reference to the recordings, could lead to the conclusion that he is presenting a 'romantic' vision of the music, and advocates a similarly 'romantic' style of performance. Similarly, listening to the three performances without reference to the book, listeners might conclude that the 1977 version is the closest to 'romanticism'.

As I already noted (see note 10 above), the term 'romantic' is only partially applicable here. A more appropriate term might be 'romantic modernism'. John Butt (2002b) uses this term to indicate the application of 'romantic' performance techniques in a manner removed from the romantic ideology of performative freedom and individualism. The latter

ideology demands variety – varying the presence and intensity of features like vibrato and gradual dynamic inflection in accordance to the desired level of expression. “Classical modernism” turns these features “off”. “Romantic modernism” turns some of them “on” (e.g., equalised vibrato and *legato*) while restraining others (e.g., applying a wide dynamic range in a calculated, non-improvisatory manner). Both types of “modernism” avoid spontaneity, preferring to project “an aura of professionalism and specialism”.

‘Romantic modernism’ is clearly felt in the 1977 version, accounting for the ‘romantic’ association this recording engenders for several listeners and critics. One could argue that a similar spirit informs the analyses and performance recommendations in his book. While placing an emphasis on the work’s expressive character, Rilling usually avoids richly metaphorical language (his account of the *Expecto* is an exception in this respect), preferring a more ‘objective’ style (cf. Dreyfus 1996: 103).

The rigidity of ‘romantic modernism’, however, can also help explain why Rilling’s *espressivo* recommendations are better realised in the later versions. By then, Rilling reveals a greater willingness to shape individual phrases with localised inflections. Rilling’s newer style, for all its greater lightness, is therefore better suited than his older, ‘traditional’ style to realising his richly expressive vision of the work. Elsewhere, Rilling explicitly advocates a sense of lightness, even playfulness, which sits uneasily with the traditions that inform his 1970s style.

Overall, the 1999 version (and, to a lesser extent, the 1988 version) converges closely on the performance recommendations and detailed interpretations that Rilling offered in 1979. This is especially true in the D-major choruses, in movements where Rilling discerns dance-like qualities, and in cases where Rilling explicitly advocates detailed

articulation and clear separation and individual shaping for particular figures and motifs. In those cases where Rilling, in his book, focuses primarily on the shaping of the movement as a whole (most notably the *First Kyrie*,¹⁸ the *Incarnatus* and the *Crucifixus*), the 1977 version comes closest to realising the 1979 prescriptions. Even in these cases, however, the 1988 and 1999 versions are consistent with most of the book's performance recommendations.

Several factors can account for the closer proximity between Rilling's theory and practice in 1988 and 1999. First of all, Rilling's earlier style is often characterised by dynamic uniformity and an avoidance of strong tensions. This limits the possibilities for generating momentum, inhibiting Rilling's options for realising his own analyses. As already noted, the 1977 recording comes closest to the conductor's own recommendations in movements which he projects in single dynamic trajectories. The discrepancies are more clearly felt where the analysis refers to several focal points of tension, or to alternation between several elements (e.g., *Second Kyrie*, *Et in terra*, *Qui sedes*, *Agnus dei*; Rilling 1984: 12-14, 22-24, 38-41, 145-149). The greater flexibility of his later style allows greater scope for realising such internal diversity.

Flexibility is often directly advocated in the book.¹⁹ The 1977 version, however, incorporates many features more redolent of the "Lutheran" tradition, with its strictly terraced approach; the strictness associated with that tradition is felt especially in the celebratory D-major choruses. This too inhibits the realisation of the type of inflected readings Rilling advocates in his book.

Another important area is articulation. As noted on p. 82 above, Rilling mostly advocates articulatory variety between phrases. Even this limited degree of differentiation, however, is not often realised in the 1977 Mass, where *non legato* is used primarily for clarification. In the

later recordings, on the other hand, Rilling is much more willing to realise in practice the varied articulation he preaches in his book.

Rilling made explicit references to most of these changes (e.g., Rilling 1999: 28). He attributes them to his growing acquaintance with Bach's *oeuvre* and idiom and with musicological research into performance practice. He also cites improvements in the constitution of his performing ensembles. Rilling consistently advocated the use of "an ensemble of essentially chamber dimensions" which should nonetheless take into account the drier acoustics of larger modern halls (Rilling 1985: 15); the choir, he says, should consist of lighter, younger voices (his choristers are mostly aged 25-30; Rilling 2001). His precise definition of "chamber ensemble", however, has changed: he estimates that he has gradually gone down from a 40-strong choir to about 24 singers (Parrott and Rilling 2000: 39). He claims that he now has stronger, better-trained voices at his disposal, and using a smaller ensemble allows him to increase clarity without losing strength. Presumably, the smaller choir also makes it easier to achieve greater dynamic flexibility and more variety in articulation.

The influence of period instrument performances, however, is another likely explanation. All the changes in Rilling's performance style – faster tempi, brighter timbres and textures, smaller performing forces, greater local variety of articulation and dynamics, and so forth – are redolent of HIP performance (similarities can be noted, for instance, with the recordings of John Eliot Gardiner, Richard Hickox, Philippe Herreweghe and Ton Koopman). In a review of the 1999 Mass, Bernard Sherman (1999) characterised Rilling's stylistic development as "a barometer of musical taste", an indicator on the influence of HIP practices on mainstream performance.²⁰ Like some of his Leipzig colleagues, Rilling displayed an ambivalent attitude towards HIP, but

increasingly adopted its practices. This proved to have a decisive influence on his approach to expression, which had always been ostensibly x/x. Though he does not immediately acknowledge HIP influences, it should be noted that he has been in continuous contact with several prominent HIP musicians, as noted above.

In the 1970s and early 1980s, Rilling's stylistic approach resonated with the styles of other German church traditions – such as that of the Leipzig school and of Karl Richter. In subsequent decades, his style increasingly came to incorporate HIP elements. This development made it easier for him to realise his own vision of the work: Rilling's prescriptions for a detailed, expressive rendition of Bach's music in his 1979 book are more closely realised in his later, HIP-influenced readings.

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Discography

Helmuth Rilling 1977

Orchestra: Bach-Collegium Stuttgart

Continuo: organ

Choir: Gächinger Kantorei Stuttgart

Soloists:

Soprano: Arleen Augér

Soprano 2 & Alto: Julia Hamari

Tenor: Adalbert Kraus

Bass: Siegmund Nimsgern

Location and date of recording: Stuttgart; April 1977

First catalogue number: CBS 79 307. 3 LPs. Issued 1977.

Copies consulted: CBS Maestro M2YK 45615. 2 CDs. Issued c. 1985
CBS Odyssey MB2K 45615. 2 CDs. Issued 1989.

Helmuth Rilling 1988a

Orchestra: Stuttgarter Kammerorchester

Size: Strings 5-4-4-3-1

Continuo: organ

Choir: Gächinger Kantorei Stuttgart

Size: 8-8-13-11-11²¹

Soloists:

Soprano: Ulrike Sonntag

Soprano 2 & Alto: Marjana Lipovšek

Tenor: Howard Crook

Bass: Andreas Schmidt

Location and date of recording: Kirche der Karlshöhe, Ludwigsburg; May 1988. First catalogue number: Intercord INT 885 855. 2 CDs. Issued 1988.

*** Helmuth Rilling 1988b**

Orchestra: Stuttgarter Kammerorchester

Choir: Gächinger Kantorei Stuttgart

Soloists:

Soprano: Arleen Augér

Alto: Anne Sophie von Otter

Tenor: Aldo Baldin

Bass: Wolfgang Schöne

Date of recording: 1988

First catalogue number: Platz PLLC 5004/5005. 2 CDs. Also available on DVD.

Special comments: Information from <http://www.bach-cantatas.com/Vocal/BWV232-Rec5.htm>,

http://www.bekkoame.ne.jp/~hippo/musik/title/bach_bwv232.html,
<http://www.hmv.co.jp/product/detail.asp?sku=1939638>.

Helmuth Rilling 1999

Orchestra: Bach-Collegium Stuttgart

Size: Strings 6-5-4-3-2²²

Continuo: organ

Choir: Gächinger Kantorei Stuttgart

Size: 6-6-6-6-6

Soloists:

Soprano 1: Sibylla Rubens

Soprano 2: Juliane Banse

Alto: Ingeborg Danz

Tenor: James Taylor

Bass 1 (*Et in spiritum*): Andreas Schmidt

Bass 2 (*Quoniam*): Thomas Quasthoff

Location and date of recording: Stadthalle Sindelfingen; March 1999

First catalogue number: Hänssler Edition Bachakademie, vol. 70 (CD 92.070). 2 CDs. Issued 1999.

¹ This paper is based, in part, on my doctoral dissertation, *Expression and Meaning in Bach Performance and Reception: An Examination of the B minor Mass on Record*, and in particular on the section devoted to Helmuth Rilling ([Golomb 2004](#): 68-81).

² I am aware of the existence of another recording, made in 1988 but released much later. This recording is based on a televised broadcast, and has recently been released on DVD. It was made in the same year as Rilling's second commercial recording – 1988 – but features a different orchestra and different soloists. Unfortunately, I have not been able to consult this recording. Its details are listed in the discography under the heading Rilling 1988b; it is marked with an asterisk, to indicate that I have not heard it. A further recording of the Mass under Helmuth Rilling was issued in 2006 by Hänssler

Classics. This recording was released after this paper was completed, and consequently I was unable to refer to it in my discussion. See also note 11 below.

³ All italicised quotes in this paper were also italicised in the original.

⁴ In this paper, the word “performative” means “in, of, or through musical performance” (see also [Levinson 1993](#)).

⁵ This view is neither self-evident nor universally held among performers generally, and Bach performers in particular. In this paper, I employ a schematic categorisation of views on the relation between the performers’ perception of the music and the features they choose to realise in practice (see also [Golomb 2004](#): 25-26). The phrasing below refers to expressive intensity, but can also be applied to other parameters:

1. $+/+$: This music is expressive, and should therefore be performed expressively;
2. $+/-$: This music is so expressive that it could (or should) be performed inexpressively;
3. $-/+$: This music is not expressive, but should be performed expressively;
4. $-/-$: This music is not expressive, and should not be performed as if it were.

This scheme obviously demands several qualifications – above and beyond the necessity of finding out what performers and critics alike mean by “expressive” and related terms. Furthermore, it refers only to views of a particular work, not to an overarching ideology; no performer or critic regards all music as equally expressive. A scheme for positions “in principle” might recognise the following options:

1. $x/+$: Performance should always be as expressive as possible – whatever the music’s own expressive intensity (in practice, this means $+/+$ for music perceived as expressive, and $-/+$ for music perceived as inexpressive).
2. $x/-$: Performance should always be contained and restrained, allowing music to speak for itself whatever its own expressive intensity ($+/-$ for music perceived as expressive, $-/-$ for music perceived as inexpressive).
3. x/x : The level of expressive intensity in the performance should be calibrated with the level of expressive intensity in the music ($+/+$ for music perceived as expressive, $-/-$ for music perceived as inexpressive).

⁶ It should be noted that recordings do not constitute a straightforward documentation of musicians’ interpretations. In the context of studio recordings (a category which encompasses all the recordings discussed in this paper), it is difficult to assess the performers’ contribution, beyond supplying the raw materials from which the recording was constructed. The input from the production team is considerable, both during the recording sessions and in post-session editing (for more on this issues, see [Gould 1984](#): 331-368, esp. 337-343; [Day 2000](#): Chapter One, esp. 23-38, 46-52; [Monsaingeon 2002](#): Part Two; [Tomes 2004](#): 140-150, 155-159; [Philip 2004](#): Chapter Two, esp. 42-62; [Golomb 2004](#): 15-16). Unedited live recordings partly circumvent the problem of editorial interference (though the production team still has considerable influence through the choice of equipment, the placing of microphones etc.); such a recording, however, inevitably reflects the accidental features of a

particular evening. Only when the performers are intimately involved in the recording and editing process can the recording be safely described as reflecting their interpretation at the time. These issues exacerbate a problem which plagues any attempt to interpret a choral-orchestral performance: assessing the role of the conductor *vis-à-vis* the other musicians. I discuss briefly the issue of Rilling's involvement in the production of his recordings, and his role in shaping the ensembles that performed under his direction, later in this article. In general, I have reason to believe that his recordings document the interpretation that he and the musicians under his direction were likely to have given in concerts around the period of the recording. In any case, recordings provide the best documentation for musical performances; however imperfect that documentation might be, there is, as far as I am aware, no credible alternative for it.

⁷ The directors of these institutes after 1971 started to adopt a different, more HIP-influenced performance style, as I will discuss briefly below.

⁸ For more on this subject, see Golomb 2004: 53-55. By x/- spectrum, I mean that this school included writers and performers who believed that Bach's music is intensely expressive but should be performed with austere restraint (+/-), as well as writers and performers who regarded austere restraint as an integral feature of Bach's own music (-/-). Arnold Schering provides an especially clear demonstration of the +/- approach (see, for example, Schering 1931: 171; 1936: 187-188; 1941: 71; 1974: 87-89), Wilibald Gurlitt of the -/- approach (see, for example, Gurlitt 1951: 75-79).

⁹ The term "directionality" refers in this paper to patterns of tension-and-resolution that affect the sense of goal-orientation in the music. This encompasses both "local directionality" – ebb-and-flow within individual phrases – and "overall directionality" across an entire movement (Cohen 1994: 34-37). When referring to a performance as "directional", I mean that the performers audibly seek to underline or highlight patterns of tension-and-resolution (especially harmonic patterns) in their performances. By "directional dynamics", I refer to the use of dynamics to underline or highlight such patterns. In several cases, this is related to wave dynamics – that is, dynamics that rise and fall in correspondence to the rise and fall of melodic contours.

¹⁰ There is no consistent definition of 'romanticism' in the context of Bach performance; indeed, several performers (most notably Karl Richter, Otto Klemperer and Nikolaus Harnoncourt) have been called 'romantic' and 'anti-romantic' by different critics. In my dissertation (see Golomb 2004: pp. 36-51), I define a 'romantic' Bach performance as a performance that satisfies all three of the following criteria: it is **anachronistic** (i.e., the performers adopt techniques that are more associated with 19th-century music than with music of Bach's era); it audibly strives towards **expressive intensity** (that is, features in the performance are most readily explainable as an attempt by the performers to achieve an expressive performance); and it audibly strives towards an **individualistic interpretation**. According to this view, the existence of just one or even two of these criteria is not sufficient to define a performance as 'romantic', though it might well explain why some critics have referred to it as such (for example, Klemperer's Bach performances were considered 'romantic' primarily because of their perceived anachronism). In Rilling's case, the 1977 version does not, in my view, satisfy the third criterion (that is, the performance does not contain significant departures from the prevailing Bach style

of the period that could be clearly identified as ‘idiosyncratic’ or ‘personalised’); however, the strive towards expression is clearly noticeable, as is Rilling’s knowing anachronism.

¹¹ This paragraph, and all subsequent references to “Rilling 1988”, refers to the recording listed in the discography as Rilling 1988a. As noted above (see note 2), I have been unable to consult the recording listed in the discography as Rilling 1988b. Two of the soloists in that latter recording (Arleen Augér and Wolfgang Schöne) also appeared in the 1977 recording; the tenor, Aldo Baldin, appeared frequently in Rilling’s 1970-1984 cycle of the complete sacred cantatas.

¹² The word “aspiration”, used in the context of choral singing, comes from the verb “to aspirate”. It refers to the use of syllables like “he-he-he” to accentuate and separate individual notes in melismatic passages.

¹³ Rilling also suggests that the “*independent rhythmic motion of the continuo and cello must be clear enough so that when they abandon their independent lines from time to time in cadential measures [...] and join into the expressive flow of the vocal setting, the change is clearly audible*” (Rilling 1984: 37). This recommendation is not fully realised in any of his recordings. The effect is most vividly realised in the recordings directed by Thomas Hengelbrock (Deutsche Harmonia Mundi 1996) and Konrad Junghänel (Harmonia Mundi France 2003).

¹⁴ The new context is the setting of “Et expecto resurrectionem” – in contrast to the old context (the second movement of Cantata No. 120, which served as the model for this movement in the Mass). As Rilling notes, this figure is associated with a rise in the cantata as well, calling upon jubilant voices to rise to heaven (“Steiget bis zum Himmel’n auf”).

¹⁵ This is achieved by a *staccato* shortening of the anacrusis, followed by definite accentuation of the downbeat note, which is sung *tenuto*.

¹⁶ Several of the features I noted in the 1999 version – for example, the anacrusis-downbeat patterns – are also present in the 1988 recording, which already features lighter and more detailed articulation in comparison with the 1977 version. However, that version remains less detailed than the 1999 version; its dynamic range is also narrower. Consequently, there is more textural clarity and cumulative tension alike in the 1999 version.

¹⁷ The first part of my doctoral dissertation (Golomb 2004: 36-162) was largely devoted to a comparison between the views and practices of several prominent Bach conductors, taking their recordings of the B-minor Mass as my primary case-study.

¹⁸ On Rilling’s performances of this movement, see also Golomb 2005.

¹⁹ In discussing the *Laudamus*, for example, Rilling calls for “*a variety of dynamics*” in the orchestral parts, to ensure textural clarity and clear exposition of “*individual thematic figurations*” (Rilling 1984: 27). There is little trace of this in the dynamically-uniform 1977 reading. Here, Rilling comes closest to realising his own recommendations in 1988 (in 1999, the requisite variety is present in the solo violin and soprano, but less so in the orchestral strings).

²⁰ Other modern-instrument recordings of the B-minor Mass revealing a similar HIP influence include those conducted by Claudio Abbado (Universal 1999), Seiji Ozawa (Philips 2000) and Georg

Christoph Biller (Philips 2000). Biller, the current Thomaskantor, has recently released another recording of the Mass, this time with a period-instrument ensemble.

²¹ The booklet names 16 sopranos; I assumed equal distribution between the two sections.

²² Rilling (1999: 28) cites this as the “maximum size”; “where suitable, we reduced the instrumentation to comply with the structure of a specific movement”.

Communication of (e)motion through performance:

Two case studies

Renee Timmers

Contact information: Renee Timmers, Nijmegen Institute for Cognition and Information, Radboud University Nijmegen, Montessorilaan 3, 6585 HE Nijmegen, The Netherlands. E-mail: r.timmers@nici.ru.nl and reneetimmers@solcon.nl.

Abstract

This paper examines the role of the communication of activity in the communication of emotion in music performance. The starting point is the hypothesis that performers are especially well able to communicate levels of activity and that communication of emotions is to a considerable extent based on this communication. Two case studies are reported that confirm that the ability of performers to communicate the activity of an emotional interpretation of a musical passage is stronger than the ability to communicate the valence of an emotional interpretation. In the first case study, the performers expressed discrete categories of emotions, but the two low activity emotions were strongly associated and happiness was not always reliably communicated. In the second case study, the communication of activity was much stronger than the communication of valence. The question is raised whether emotion in music performance exists without perception of activity and whether communication of emotion is sometimes rather communication of motion.

Introduction

This paper examines the communication of emotion in two case studies of performances of western tonal music and investigates whether this communication is primarily based on the communication of (emotional) activity. The background of the studies is formed by a series of empirical studies that have recently been conducted by Juslin (1997, 2000, 2001), and closely related work by Gabrielsson, Scherer and Sundberg, among others (Gabrielsson & Juslin, 1996; Scherer & Oshinsky, 1977; Scherer, 1995; Sundberg *et al*, 1995). One of the aims of these empirical studies has been to define cues that are responsible for the communication of emotions from performer to listener, focusing on communication in western tonal music. In a simple manner, communication can be said to occur when a performer expresses an interpretation of music using means (cues) to which listeners are sensitive. The communicated interpretation could concern metrical structure (Sloboda, 1983), phrase structure (Palmer, 1989; Todd, 1985) or an emotional interpretation of music (Gabrielsson & Juslin, 1996). Juslin (2000) elaborated this simple framework by adapting Brunswik's lens model (Brunswik, 1956). In Juslin's adaptation of the model, performers and listeners show preferences for the association between cues and emotions that may only partly overlap. The model (Juslin, 2000) allows for communication of an emotional interpretation of the music to occur ("achievement" of communication) even when listeners and performers do not fully agree on the means to express emotions (lack of "match" in encoding and decoding of cues).

An important assumption of the model is that distinct categories of emotions are communicated. This is in line with observations made by Gabrielsson and Juslin (2003) and others that communication of emotions in music is only reliably above

chance level as long as it concerns a limited number of basic emotions. If listeners are asked to indicate what emotion they perceive in a musical passage, disagreement between listeners will increase considerably when they need to specify for example the type of sadness (*e.g.* melancholy, regret) of a passage, while they may agree that it falls into the general category of sadness.

There are a couple of reasons for assuming that the communication of basic emotions through music is particularly strong, especially when emotions in response to music are seen as related to emotions in daily life. Several authors have suggested the existence of a limited number of emotions that are functionally distinct, have distinct behavioural expressions, and are associated with distinct brain substrates and distinct patterns of physiological changes (*e.g.* Damasio *et al*, 2000; Ekman, 1994; Levenson, 1992; Oatley, 1992, Panksepp, 1994). Ekman and colleagues (1982) described the facial expressions accompanying several emotion types. They demonstrated cross-cultural understanding of facial expressions of happiness, interest, anger, disgust, and to a lesser extent fear and surprise. They also observed similar facial expressions across cultures in comparing facial expressions of Japanese and American participants watching a stress-inducing film. In a parallel manner, the characteristics can be described of vocal expressions of basic emotions and cross-cultural validity can be tested. In an overview, Scherer and colleagues (2003) summarized observed characteristics of vocal expressions of happiness, anger, sadness, fear and boredom, as well as characteristics of aroused/stressed vocal expressions. In an earlier article, Scherer (1986) suggested how tension in the vocal tract (when excited) and the shape of the mouth (as in smiling) may lead to these voice characteristics. In his interpretation, vocal expressions are a result of different emotion components. Physiological arousal is one component that influences vocal expressions especially strong.

The connection to music is made with the suggestion that performers imitate speech cues for expressing emotions in order to communicate discrete emotions in music performance (Juslin & Laukka, 2003). Thus the meaning of the performance cues has its basis in more general vocal cues. Juslin and Laukka (2003) compared the results of studies investigating cue utilization in speech and music performance, and indeed showed clear parallels between expressions of emotions in both domains.

Although this is a most plausible theory with considerable verification, there are nevertheless a couple of problems with it. As mentioned by several authors, the definition of basic emotions is problematic (Ortony & Turner, 1990; Scherer *et al*, 2003). Different authors do not only disagree on which emotions to include, they also do not necessarily include the most applicable emotions to music (Scherer, 2004). Moreover, some authors have argued that music does not express specific emotions.

More characteristically emotional in music might be the dynamical properties of “ebb and flow” or “tension and release”. As Cook and Dibben (2001) indicate, Hanslick played an important role in focussing attention to the internal dynamics of music. According to Hanslick (1854), music cannot present the content of feelings, only the dynamics or motion of a physical process. Influential has also been Meyer’s (1956) theory of emotion and meaning in music. Meyer (1956) focused on “embodied” meaning of music and suggested how emotional responses may be the result of violations and resolution of violations of expectations based on the musical structure. Violations lead to tension increases, while resolutions release tension. The patterns of tension and release may be responsible for emotional responses.

Krumhansl (1996) found some empirical confirmation of the relationship between perceived tension and patterns of expectation based on melodic and harmonic structure. Schubert (2001) emphasised, however, the influence of the performer on

the perception of tension. He summarized several studies on tension, among them the study by Krumhansl (1996), and showed that tension is often most strongly related to the dynamics of a performance. He suggested that the relationship with dynamics is stronger than the relationship with music theoretical predictions.

Sloboda and Lehmann (2001) investigated the influence of the performer on the perceived intensity of emotion of the music. Perceived intensity of emotion was relatively high at moments that pianists had explicitly mentioned in the interview. In a related study, my colleagues and I found a strong correlation between listeners' ratings of emotional engagement and the dynamics of the performance. The pattern of dynamics was closely linked to the pianist's perception of the formal properties of the music (Timmers *et al*, 2006).

The two interpretations of emotions in music as dynamic property or discrete category may seem to be distinct and unrelated. However, the two approaches can be connected if emotion categories such as happy and sad are characterized as a location within a two-dimensional space. In an elaboration of the "continuous response" paradigm as used by Krumhansl for the indication of tension, Schubert (2004) asked listeners to indicate variations in emotions over time when listening to music along two dimensions of "arousal" and "valence". This approach emphasises the changing characteristics of music over time, as do the studies of perception of patterns of tension and release. Schubert showed that arousal is also often related to performed dynamics (Schubert, 2001; 2004). The two dimensions of arousal and valence are derived from Russell's circumplex model (Russell, 1980). According to this model, emotions can be represented in a circle that has pleasure and displeasure at two extremes (right-left), and, at right angles to that, arousal and sleepiness at two extremes (top-bottom). Positions in between at 45, 135, 225, and 315 degrees are marked by

the categories of excitement, distress, depression and relaxation. This representation has an empirical basis and formalizes the conceptual distance between different emotions as well as the structure of affective experience (Russell, 1980). In later use of the model, the dimension of pleasure-displeasure is often referred to as valence, while the dimension of arousal-sleepiness is referred to as arousal or activation. Valence distinguishes “positive” emotions such as joy, hope and love from “negative” emotions such as fear, sadness and anger. Arousal distinguishes “active” emotions such as anger and excitement from “calm” emotions such as depression and hope. From the basic emotions, sadness is the least active, anger and fear are most active, and happiness is the only positive emotion and intermediate to high in activation.

In this paper, I will argue that performers are very well able to communicate “activation” or a sense of “intensity”. Indeed performers are especially able to highlight moments of high intensity and contrast these with moments of low intensity. This sense of intensity may be interpreted as “activation” or as “tension” depending on the context and the instruction to the participants. This does not mean that activation and tension are theoretical synonyms. On the contrary, they both have distinct theoretical backgrounds. Nevertheless, listeners may interpret performers’ expressive intensity as a signal of “emotional activation” or as a signal of “tension” and indeed performers may use similar means to express one or the other. Moreover, this sense of intensity may also provide a strong cue for which emotional category is being expressed. Because different categories of emotions may have distinct levels of activation associated with them, the choice between emotional categories may be cued to a considerable extent by the communication of activity alone.

In contrast, the communication of valence is less straightforward. Although performers may have some means to communicate “optimism” compared to “pessi-

mism”, these means are less consistent over performers and performances of different music, and listeners interpret them less automatically than cues for the level of intensity. Additionally, performers may have specific cues to suggest specific categories of emotions, but again these are less general and perceived less automatically. The main cue is, therefore, an indication of the level of activation. Other additional cues qualify this indication of activation.

These arguments are based on several studies that colleagues and I have conducted in the past years (Timmers *et al*, 2006; Timmers & Ashley, in press; Timmers, 2007; Timmers, in press). Although these studies are limited in scope, they do give several important indications. The suggestions are also in line with results of and suggestions made in studies conducted by others, which will be summarized in the discussion. In this paper, a summary of two studies will be given. The first study examined the communication of basic emotions and the communication of activity and valence in ornamented performances of a Handel sonata. The second study compared the communication of activity, valence and tension in historical and modern performances of a Schubert song. Most details of the method of the studies are provided elsewhere and will not be repeated here. The first study is explained in detail in Timmers and Ashley (in press). The second study is explained in detail in Timmers (2007) and Timmers (in press). The summaries provided below include the details necessary to understand the studies. Additionally, they include re-analyses of the data related to the specific question addressed here.

Study 1: Communication of emotion using ornamentation

The first study (Timmers & Ashley, in press) examined the possibility of the communication of emotion by ornamenting existing melodies. A professional flutist and violinist were asked to ornament the beginning phrases of three melodies from Handel's sonata for recorder and basso continuo in G minor (HWV360). They were asked to ornament these melodies in such a way to make the melodies sound happy, loving, sad, and angry. They performed along with a fixed piano accompaniment that fixed the tempo of each performance. The solo and piano performances were mixed into a mono-track audio file and presented to participants in a listening experiment. The participants rated for each performance the presence of the four moods of "happy", "loving", "sad" and "angry" on a uni-polar seven-point rating scale.

The ornamentation that the performers used to express the four emotions was analysed in two ways¹. First, the type of the ornament was defined and, secondly, the characteristics of the ornaments were defined. Among the types of ornaments considered were trills, appoggiaturas, mordents and turns (all categories distinguished by Bach, 1753). In addition, the total number of added ornaments was calculated, which gave the density of ornaments, and the ornaments were grouped into simple ornaments that consist of only one ornamental note and compound ornaments that consist of more than one ornamental note. The distinction between simple and compound ornaments was referred to as the complexity of the ornaments.

¹ The third analysis focusing on the structural position of the ornament is left out of consideration here. The results of this third analysis show the relevance of the metrical position of the ornaments.

The analysed characteristics of the ornaments included its duration, timing (before or at the original onset time of the ornamented main note), harmony (consonant or dissonant), and melodic direction (up or down), again following categories distinguished by Bach (1753). In addition, the average sound level of the entire performance was calculated.

Table 1: *Significant correlations for flute performances between emotions (Columns) and ornamentation (Rows) (N = 24. p < .05). Emotions include instructed (i-H. i-L. i-S. i-A. i-Act. i-Val) and rated emotions (r-H. r-L. r-S. r-A). Aspects of ornamentation include type (top rows) and characteristics (bottom rows).*

Ornament	i-H	i-L	i-S	i-A	i-Act	i-Val	r-H	r-L	r-S	r-A
Single app.			.59	-.48	-.49		-.42	.53	.70	-.62
Trill			-.60		.41			-.44	-.66	.54
Turn	.41									
Slide		.55				.47				
Arpeggio			-.42	.45	.46			-.50	-.55	.41
Complexity			-.55	.46	.46		.41	-.49	-.68	.62
Density		.42					.56			
On-timing	-.41		.48			-.60				
Duration			.61	-.46	-.67			.57	.64	-.48
Direction				-.45				.55		-.59
Harmony			-.55					-.45	-.56	.52

The main results of the analyses of the flute performances are reported in Table 1. This table shows that the flutist varied the ornamentation most systematically

in association with the presence or absence of sadness and anger (Table 1, left column). Fewer characteristics were varied systematically in association with the presence or absence of happiness and love. Similarly, the characteristics that were varied in association with sadness and anger were also best recognized by the listeners, but in a generalized manner (Table 1, right column): Listeners interpreted these characteristics as evidence for the presence of love as well as sadness, and, in some instances, as evidence for happiness as well as anger. This included characteristics such as the complexity and the duration of the ornaments, and the use of larger tone intervals (arpeggios).

In other words, a clear distinction was observed between the use of ornaments to express high and low activity emotions. In contrast, the distinction between positive and negative emotions was less strong. Instructed valence was associated only with the timing of ornaments: ornaments were relatively often timed anticipating the main note in happy and loving performances, while they were timed to delay and shorten the main note in sad and angry performances. However, this distinction did not return in the responses of the listeners.

A similar pattern of results was found for the violinist (see Table 2). Again most characteristics were associated with the presence or absence of sadness and anger (Table 2, left column), but the listeners interpreted these characteristics as evidence for love as well as sadness, and, in some instances, as evidence for happiness as well as anger (Table 2, right column). These characteristics included complexity, density, and timing of the ornaments, as well as the overall sound level. The violinist timed the ornaments in a different way than the flutist. For the violinist, the timing of the ornaments was probably a result of the systematic variation of the number of

added ornaments: if more ornaments were added, relatively many were timed before the original time of main note rather than at the original time of the main note.

Despite the predominant association between the use of ornamentation and activity of emotions, the communication of emotions was successful for both performers. Happy performances were least well recognized from the four emotions followed by loving performances. Still, the recognition was generally well above chance level and the recognition percentages corresponded with results from other studies.

Table 2: *Significant correlations for violin performances between emotions (Columns) and ornamentation (Rows) (N = 24. p < 0.05). Emotions are instructed (i-H. i-L. i-S. i-A. i-Act. i-Val) or rated (r-H. r-L. r-S. r-A). Aspects of ornamentation include type (top rows) and characteristics (bottom rows).*

Ornament	i-H	i-L	i-S	i-A	i-Act	i-Val	r-H	r-L	r-S	r-A
Single app.		.43			-.47					
Double app.			-.58	.43	.70				-.48	
Trill	.64					.47				
Turn							.53			
Substitute			.55						.48	
Complexity			-.47	.54	.65		.57		-.53	.44
Density			-.53	.45	.49			-.42	-.67	.54
On-timing				-.55	-.46			.41	.48	-.43
Sound level			-.76	.71	.64		.42	-.61	-.70	.74

Study 2: Communication of emotion in vocal performances

The second case study (Timmers, in press) examined communication of emotion in historical and modern performances of *Die junge Nonne*, a late song of Schubert in F minor (D828; Op. 43 No. 1). This is not an experimental study in the sense that performers were instructed to give different interpretations of the song. Instead, performances from records by famous singers as Emmy Ameling, Gundula Janowitz, Lotte Lehman and Elisabeth Schwarzkopf were selected to serve as material. A series of listening experiments was conducted in which fragments from performances of *Die junge Nonne* with different moods were presented to the participants and the participants rated the activity and valence of the perceived emotion on a scale from 1 to 7 (representing either low to high activity or negative to positive valence). After that, the participants listened to the musical fragments again and rated the quality of the performances and how much the performances affected them emotionally. In a second follow up, participants wrote down the dynamics per bar of a musical fragment or the tension per bar of a musical fragment². In all these tests, participants were asked to direct their attention to the performance of the music. The participants were advanced performers.

An additional purpose of the study was to examine the effect of recording quality and familiarity with performing style on the perception of emotion, dynamics

² The results for the tension experiment are not reported in Timmers (in press) to keep the paper limited in scope. Separate publication of these results is planned.

and quality, which is of peripheral interest here, but needs to be taken into account because historical recordings were used.³

In discussing the results of this series of studies, the following questions are addressed: 1) Do performers influence both the activity and valence of perceived emotions? 2) How do perceived valence and activity relate to aspects of the performances such as tempo, dynamics and vibrato? 3) How does perceived tension relate to these aspects of the performances?

To answer the first question, an analysis of variance was run that tested the effect of fragment and singer and the interaction between fragment and singer on rated activity and, in a second repeated measures ANOVA, on rated valence. For activity, the main effect of fragment and the interaction between fragment and singer were highly significant ($p < .0001$), while the main effect of singer was marginally significant ($p < .05$). The interaction shows that singers gave a personal interpretation of the activity of the music: the activity of a musical fragment is not the same for each performance. For valence, on the other hand, the main effect of fragment was the only highly significant effect, while the interaction and the main effect of singers were marginally significant ($p < .05$). This indicates that singers' influence on the perception of valence was not very strong.

To answer the second question, the average rated activity and valence per performance were correlated with the average bar duration, dynamics, vibrato rate, and

³ In the original study, two versions of each song were used: a clean and a noisy version in order to be able to investigate the effect of version besides the effect of recording date. However, for the purpose of the current paper, only the clean versions of all recordings are used and the effect of version is left out of consideration.

vibrato extent per performance. Bar duration, vibrato rate and vibrato extent were measured using PRAAT⁴ (for a description of the measurements see Timmers, 2007). The dynamics per bar were written down by participants in one of the experiments as explained before. To calculate the average dynamics, the dynamic markings – such as piano and mezzo forte – were translated into numerical values and then averaged.

Table 3: *Significant correlations between rated activity and valence and variables of the performance including bar duration, dynamics, vibrato rate and extent, and glissandi up and down.*

Variable 1	Variable 2	Correlation	Variable 1	Variable 2	Correlation
Activity	Dynamics	.86	Valence	Bar duration	.50
Activity	Vibrato extent	.70	Valence	Down	.45
Activity	Up	.53			
Activity	Down	-.41			

Table 3 shows the significant correlations between aspects of the performances and rated activity and valence. As can be seen, activity is especially highly correlated with dynamics, followed by vibrato extent. A rise in activity is associated with an increase in dynamics and vibrato extent. Additionally, performances with higher activity are associated with more upwards and fewer downwards pitch glides than performances with lower activity. Valence correlates positively with bar duration and downward glides. This indicates that performances of music rated as posi-

⁴ A web-link to PRAAT and explanatory texts can be found at www.fon.hum.uva.nl/praat/.

tive are slower and have more downward glides than performances of music rated as negative. This may be counter-intuitive at first, but it is a confirmation of previously found results for this song (Timmers, 2007). The findings can be understood in the context of this particular song, where the positive passages resolve the tension present in the negative passages. In *Die junge Nonne*, a young woman seeks to find rest and peace from her tormented earthly life. Her life is stormy as the roaring wind and her heart is as dark as the grave. She hopes to find peace by joining the convent and marrying the eternal husband. In this sense, negative tension is resolved. This resolution is not a matter of calming down of high arousal, because both the negative and (relatively) positive passages have phrases with high and low activation.

In this analysis, activity does not correlate with bar duration (or tempo), in contrast with expectations. This is because tempo is first of all correlated with valence. However, if we take the relationship between valence and bar duration into account in addition to the relationship between activity and bar duration in a multiple regression model, the variations in bar duration are significantly related to activity ($p < .05$): bar duration tends to decrease (tempo tends to increase) with higher levels of activity.

As mentioned, one of the tasks of the participants was to indicate the dynamics of each bar of a fragment, while in another experiment, they were asked to indicate the tension of each bar of a fragment. The correlation within one performer of indications of dynamics and tension was on average .78. This is a bit lower than the correlation of .86 between dynamics and activity reported in Table 3. Other significant correlations between perceived tension and aspects of the performance included, for four out of six singers, the correlation between tension and vibrato extent, and, for three out of six singers, the correlation between tension and vibrato rate.

In these listening experiments, a conceptual distinction was made between tension of a performance and the activity of the perceived emotion of a musical passage. The tension was assumed to vary within a musical phrase of around six bars, while the activity of the perceived emotion of a musical phrase of around six bars was assumed to be (approximately) stable. This is relevant for the interpretation of the correlations: activity correlates with average dynamics, while variations in tension correlate with the variations in dynamics within a musical phrase.

A crucial question might be whether higher activation also means that the performances were considered more emotionally affecting. In the same series of experiments, participants were also asked to judge the quality of a performance and to indicate to what extent the music affected them emotionally. Correlations were used to examine the association between affect, activity and valence. None of these correlations turned out to be significant. Affect did correlate significantly with some aspects of the performances. It correlated negatively with dynamics and positively with bar duration, suggesting a tendency to find relatively slow and soft passages more emotionally affecting. The strongest correlation was however with rated quality: most affecting were the best performances, which were the modern rather than the historical recordings. The modern performances were on average also the slower and softer performances.

Discussion

What do these two case studies suggest concerning the communication of emotion in music performance? The first study suggested that communication of distinct emotional categories using ornamentation is possible. However, in the analysis

of the performances and the responses of the listeners, it became clear that strongest communication concerned high activity emotions (specifically angry) compared to low activity emotions (specifically sad, but also loving). Listeners showed sensitivity to the relationships between aspects of the performances and emotional activity. They did not show sensitivity to the means that the performers applied to communicate emotional valence. Indeed, angry and sad were best communicated, while communication of happy was least successful. Moreover, listeners' ratings of love correlated highly with ratings of sadness.

The different means of communicating activity for the two performers (and the two studies) suggest a many to one mapping. Different performance variables are interpreted along one dimension. This may be due to the experimental design in which listeners were asked to interpret the musical fragments in terms of a limited set of categories (and, in the second study, a limited set of dimensions). However, it is not necessarily an artefact. A mapping of many cues to a few concepts is in line with the notion of redundancy in performance cues (Juslin, 2000). Although redundancy limits the information capacity, it increases the chance of success of communication. Moreover, this type of mapping suggests why music provides an interesting domain for expressing emotions and emotional arousal; it offers multiple manners to say "the same thing".

The second study demonstrated, similarly to the first study, the ability of performers to communicate a personal interpretation of the emotional activity of a musical passage compared to the less successful communication of a personal interpretation of the emotional valence of a musical passage. Again, the study did show that the performers varied certain aspects of the performances in association with the va-

lence of the mood of a passage. However, listeners' sensitivity to these expressions of valence was limited.

In the second study, participants also wrote down perceived tension per bar. This provided the opportunity to examine the relationship between perceived tension and aspects of the performance. The highest correlation was between perceived tension and perceived dynamics. The other significant correlation was with vibrato extent. On the one hand, this suggests that dynamics may have (at least) two different functions. On the other hand, it suggests a connection between perceived emotional activity and perceived tension.

No connection was observed between perceived activity and reported emotional affect. In contrast, listeners reported to be more emotionally affected by the modern performances, which tended to be softer and slower overall, than by historical performances, which tended to be more intense in rubato, overall dynamics, and faster in tempo. They also found the modern performances of higher quality. This suggests the relevance of aesthetic experiences as well as the relevance of familiarity with performing style for emotional affect. Additionally, it may suggest that affect arises at calm passages that are set against arousing musical passages.

That perception of arousal and reports of emotional affect are not correlated emphasizes that perception of emotion and experience of emotion should be clearly distinguished. As Gabrielsson (2001-2002) suggested, the relationship between perceived and felt emotions may vary from positive to negative to unrelated. The results reported in the second study suggest two distinct processes responsible for the perception of activation and for actual emotional arousal. Perception is only one aspect of the appraisal processes that give rise to emotional responses (Scherer & Zentner, 2001).

How reliable and general are the results of the presented studies? The studies were limited in scope, and concerned only a few pieces and a few performers. The first study was an experimental study in which performers were asked to perform three fragments of a Handel sonata in different ways in order to express different emotions. The difficulty with this procedure is that it is partly unnatural. An emotional interpretation such as “play it angry” is imposed on music that is not itself angry, which may have introduced an interaction between notated and performed emotional cues. The second study did not have this problem. Only original performances were used. This made this study less experimental, which might have been a reason for the lack of influence of the performer on the perceived valence. If the performers were instructed to emphasize the “positive” or “negative” character of a passage, the influence of the performer might have been stronger. The combined results of the two studies are therefore stronger than the separate results.

Nevertheless, the generality of the results is suggested by parallels with other studies. For example, the relative ease of communication of activity is also apparent from the results reported in Juslin and Laukka (2003) and Scherer and colleagues (2003). Scherer and colleagues indeed observed that arousal is among the most influential components for vocal expressions of emotions. They add, however, that arousal alone cannot fully explain emotional expressions in speech. The summaries provided by Juslin and Laukka (2003) indicate that emotions of high and low activation (anger and sad) are best communicated in music performance and speech. Additionally, the reported measured cues mainly distinguish emotions with regard to their activity. For example, expressions of fear and anger often share characteristics such as high tempo, high sound level, and upward pitch contour, while sad and tenderness show opposite trends. Happiness often has an intermediate to high level. Happiness

shows opposite trends to negative emotions for some aspects of performances only. For example, it is together with tenderness more regular in microstructure than fear, anger or sadness.

In short, this paper was not aimed to test or falsify theories that propose communication of emotions to concern discrete categories of emotions. Rather, it was aimed at investigating what processes enable communication of emotions (discrete or not) in music performance. The labelling of musical passages with emotion words may be part of the communication process. The perspective of the paper was to emphasize the relative prominence of communication of activity through performance. Performers seem especially well able to communicate a sense of activation, which is proposed to be the first important step for the perception of emotion and tension. This sense of activation was in the reported studies first of all related to the dynamics of the performances, and secondly to the use of vibrato, tempo, rhythm, and glissandi in the performances.

It may be questioned if communication of activity is sufficient for communication of emotion. When emotions are considered to be first of all a valenced response, as in the definition of Ortony, Clore & Collins (1988), the communication of valence should be at least as clear as the communication of activation for emotions to be truly perceived.

Additionally, it may be questioned if it is possible to communicate emotions through music performance without varying activity. The suggestion from the perspective of this paper is that that would be complicated compared to the ease of communication of activity in performance.

It is certainly not the case that the suggestion of the primacy of communication of activity is by now demonstrated. Instead, it is a proposal that still needs real

verification. Future studies may verify the proposition by *e.g.* comparing the ease of perception of discrete emotions in performance of music with the ease of perception of activity. This could be accomplished by making a comparison between response times needed to judge emotions or emotional activity and between reported certainties with which participants provide an answer. The prediction would be that performances influence the decision for “aroused” or “calm” more effectively than the decision for “happy”, “sad” or “angry”.

Acknowledgements

The research for Study 1 was funded by a TALENT stipend of NWO (Netherlands Organisation for Scientific Research) and was conducted at Northwestern University in collaboration with Richard Ashley. The research for Study 2 was funded by the Arts and Humanities Research Council’s Research Centre for the History and Analysis of Recorded Music (CHARM). It formed part of a wider project on “Expressive gesture and style in Schubert song performance” led by Daniel Leech-Wilkinson. I would like to thank Zohar Eitan, Daniel Leech-Wilkinson, and an anonymous reviewer for their comments on a previous version of this paper.

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Intensity and Cross-Dimensional Interaction in Music: Recent Research and its Implications for Performance Studies

Zohar Eitan, Tel Aviv University

zeit@post.tau.ac.il

Abstract

This article surveys empirical and theoretical studies (including recent empirical studies by the author and associates), suggesting that intensity-based analogies linking different dimensions of audition are instrumental in music perception. Based on this research, the article then suggests several lines of empirical investigation into the roles of intensity-based analogies between musical dimensions in the *performance* of music.

Intensity and Intensity Contours

We perceive the world, music included, by distinguishing specific dimensions in separate sense modalities, such as pitch, loudness, and timbre in audition, or hue, lightness, and size in vision. However, we can also relate different sense modalities, or different dimensions within a single sensory mode, through a-modal percepts, such as temporal congruence or intensity.

Diverse stimuli in different sense modalities, such as visual brightness, muscular tension, tactile roughness, or auditory loudness, may be organized along a bipolar “quantitative” continuum, in which change in one direction (e.g., brightening, crescendo) is conceived as an increase, and change in the other (e.g., darkening, diminuendo) as a decrease. Such changes may be

described in terms of intensity – as intensifications or abatements in the stimulus level. Physically, intensification is achieved by higher levels of energy, presumably coded at the neuronal level by an increase in overall discharge rates (e.g., Recce, 1999).¹ Perceptually, intensity is equated with changes in sensory magnitude (brighter light, louder sound, etc.).

The course of intensity changes over time creates *intensity contours*. At least conceptually, different sensory modes may present analogous intensity contours, associated through similar patterns of increase or decrease in magnitude or frequency: an auditory accelerando followed by ritardando is thus analogous to a gradual visual brightening followed by gradual darkening. Comparable analogies can be described for musical dimensions: a crescendo, an accelerando, and a pitch rise (among other dimensions), all intensify, while their opposites (diminuendo, ritardando, pitch fall) abate.

This article surveys empirical and theoretical studies (including recent empirical studies by the author and associates), suggesting that intensity-based analogies linking different dimensions of audition are instrumental in music perception. Based on this research, the article then suggests several lines of empirical investigation into the roles of intensity-based analogies between musical dimensions in the *performance* of music.

Perceptual and cognitive studies of intensity-based equivalence

Cross-modal analogy

Experiments using different experimental paradigms suggest that intensity is a cross-dimensional quality. Cross-modally, it associates perceived magnitudes in different sensory modes (e.g., loudness and brightness). Unimodally, it associates different dimensions within the auditory mode (e.g., pitch and loudness).

Developmental studies suggest that intensity may be a primeval sensory dimension, preceding sensory specification in infancy. “The newborn perceives changes over space and time in the quantity of energy, not the sense through which it arose” (Maurer, 1993). Hence, “infants respond to stimuli as equivalent based on the degree of similarity of the stimuli with regard to their intensity: A bright light and a loud sound are responded to as similar, whereas a bright light and a dim light are responded to as different.” (Lewkowicz & Turkewitz, 1980). Infants indeed transfer habituation responses from visual brightness to auditory loudness (*ibid.*), and 3.5 year old children match auditory loudness and pitch to brightness (Marks, Hammeal & Bornstein, 1987). Coordinated intensity contours, matching changes in auditory dimensions (pitch and loudness) with analogous, concurrent changes touch and motion, are also important in infant-parent communication (e.g., Maurer 1993, Papousek 1996, Stern 1985, Sullivan & Horowitz 1983).

Though sensory discrimination is fully developed in adults, intensity analogies do affect adults’ perception as well. In his pioneering psycho-

physical experiments, S. S. Stevens asked adult subjects to match the perceived intensity in one dimension to that of another (e.g., alter the loudness of a sound until it matches a given visual brightness). Subjects easily and consistently matched intensity in one dimension to that of another (e.g., tactile force, loudness, visual brightness). Moreover, different dimensions across sensory modes conformed to a power function (Stevens's power law), such that a constant percentage increase in the stimulus magnitude produces a constant percentage increase in the perceived effect (Stevens, 1975).

Another experimental paradigm suggesting intensity-based analogies involves speeded classification: subjects are asked to rapidly classify values in one dimension (e.g, distinguish between a bright and dim light), while the values of a second dimension (e.g, loud and soft sound) are varied. For some dimensions (e.g., louder sound or higher pitch with brighter light), speed and accuracy of performance are enhanced if intensities in the two parameters concur, and hindered if parameters are incongruent (see Marks, 2004, for a summary).

Cross-dimensional effects on auditory perception

Different dimensions within the auditory domain can be conceived as increasing and decreasing in intensity. These may include dynamics (crescendo-diminuendo), tempo (accelerando-ritardando) or attack rate, pitch contour (rise-fall), as well as various types of event density, both temporal (progressive changes in the duration of events of a certain type), and "spatial" (e.g., the number of concurrent attacks). Studies based on diverse research paradigms suggest that some such dimensions are indeed perceptually and cognitively related through intensity analogies. Pitch, loudness, and

timbre interact in speeded classification tasks (Melara & Marks, 1990a, b). For instance, congruence of pitch and loudness (higher pitch and louder intensity; lower pitch and softer intensity) results in faster pitch and loudness discrimination than non-congruence (higher pitch and softer intensity; lower pitch and louder intensity).

In a different line of research, intensity change in one auditory dimension created or enhanced a perception or illusion of corresponding changes in another. Neuhoff and McBeath (1996), and Neuhoff, McBeath and Wanzie (1999) found that changes in loudness (crescendo and diminuendo) create an illusion of congruent pitch changes (rise and fall), and vice versa (see also Nakamura, 1987). Tekman (1997) reported that pitch accents sound louder, and dynamic (loudness) accents sound longer. Pitch, however, was not affected by dynamic accents. Collier & Hubbard (2001) found an interaction between pitch and tempo: accelerations were perceived as faster in higher pitches, and decelerations perceived as slower in lower pitches. Correspondingly, Bond & Feldstein (1982) found that perceived speech rate is positively related to vocal frequency and intensity; they suggest that these perceptions stem from frequently experiencing such covariation in spontaneously occurring speech. Finally, note that ERP (Event-Related Potential) studies suggest that such perceptual correspondences may have a specific neural basis, as they indicate that the brain processes “abstract” intensity contours differently than the specific auditory stimuli that generate them (Paavilainen, Degerman, Takegata & Winkler, 2003).

A more complex interaction of musical dimensions, which may still be attributed to intensity analogies, is reported by Boltz (1998) with regard to pitch structure and tempo: tempi were perceived as slower when a melody

contained larger melodic intervals and more changes in contour (as well as non-congruence between rhythmic and melodic accents). Thus, to be perceived as equivalent, tempo should accelerate as more contour changes, larger intervals, and more accentual non-congruence are introduced. Since these factors involve changes in the magnitude (intervals) and frequency (contour) of melodic change, they can be described as changes in melodic intensity.

Relevant studies by the author

Recent experiments by Eitan & Granot indicate that analogies of intensity contours associate auditory parameters in several musically meaningful realms, including the perception of musical motion, the perception of similarities and differences among musical figures, the perception of musical tempo, and assessing tension in music.

Eitan & Granot (2006) presented subjects with musical stimuli in which different musical dimensions either intensified (e.g., pitch rise, crescendo, accelerando) or abated, and asked them to imagine a moving human character, so that imagined motion would correspond to the music. Results indicate that intensity analogies between musical parameters affect their spatio-kinetic associations, as kinetic associations for one musical dimension “spill over” to another. For instance, both pitch descents and diminuendi evoke an image of spatial descent, and both accelerations and pitch rises are associated with speeding up of motion.

In a different experiment (Eitan & Granot, 2007), subjects were asked to rate the similarity between pairs of musical stimuli that were either con-

gruent (e.g., pitch rise and crescendo) or incongruent (e.g., pitch fall and crescendo) in their intensity contours. Congruence of intensity contours resulted in greater perceived similarity between stimuli in different dimensions, including attack rate, pitch direction, and loudness, suggesting that these stimuli are perceived as analogous musical “gestures”.

Interactions between attack rate, pitch direction, and loudness were also shown in two additional experiments, recently concluded. In one (Eitan & Granot, Manuscript in preparation a), subjects were asked to evaluate whether musical stimuli accelerate or decelerate. In fact, attack rate was isochronous in all stimuli, but other dimensions (e.g., loudness, pitch, textural density) increased or decreased. Subjects perceived crescendi, pitch rises, and increases in textural density as accelerating, and their opposites as decelerating, suggesting that intensity changes in non-temporal parameters may induce an illusion of analogous changes in tempo.²

Finally, Eitan & Granot (Manuscript in preparation, b), asked subjects to rate the degree of tension change in short musical stimuli that increased or decreased in tempo, pitch, or loudness, and their different combinations (e.g., an accelerating diminuendo, or a descending crescendo). In most cases, the relationships of intensity changes in different parameters to perceived tension were additive, such that adding one intensifying change to another (e.g., a crescendo and an accelerando) increased the degree of perceived tension, while combining an increase and a decrease in tension (e.g., a diminuendo and an accelerando) resulted in a lesser degree of perceived tension, “subtracting” the tension conveyed by one dimension from the tension conveyed by the other. This suggests that intensity changes in dif-

ferent parameters (e.g., *accelerando*, *crescendo*, and pitch rise) add up to a general percept of musical tension.

Two general points regarding Eitan & Granot's experiments above should be noted. First, three of these experiments used both parameters "naturally" encountered in extra-musical audition (like loudness or temporal density), and music-specific parameters, like tonal harmonic progression or melodic intervals. Decisively, "natural" auditory parameters were better associated with intensity than musically-specific parameters like harmony and melodic intervals. Second, differences between musically-trained and untrained participants were small in all four experiments. These findings both suggest that the main source of analogies of intensity contours is not music-specific experience and training, but general, extra-musical factors – either "natural," everyday auditory experience, or innate determinants.

Integrated intensities in music

The above studies suggest that cross-dimensional intensity contours may shape perceived musical structure and expression in meaningful ways. They may affect the sense of musical "motion" and continuity. They may affect the perception of similarity in music, and thus take part in shaping perceived motivic and thematic structure, or in constructing "gestures" typically associated with specific structural functions, such as transition or conclusion. Intensity-based analogies may also take part in the perception of musical style, by constructing gestures related to a specific style (e.g., progressively "stretching" values in different dimensions, a typical 19th century gesture; see Meyer, 1989). Perceived musical "spaces," such as tonal pitch

space (Lerdahl, 2001), or contour space (Morris, 1987), may also be affected by cross-parametric intensity contours.

Indeed, studies of diverse musical repertoires have revealed that structures that correlate congruent intensity changes in different parameters are common, and may serve important structural functions. Of these, the most important is perhaps the arched (convex) shape, in which a relatively long intensification, which may integrate various parameters (e.g., pitch contour, dynamics, textural and temporal density, or harmonic tension) is followed by abatement. Such structure, widely found in Western and other musics, is often associated with a progression of tension and release (Agawu, 1982; Berry, 1976; Cohen, 1971; Meyer, 1989).

Related manifestations of intensity correlations in musical repertoires were found in several recent studies. Huron (1990a, 1990b, 1992) found that in 18th and 19th century repertoires, dynamics, texture, and pitch contour all tend to build up gradually but subside quickly (“ramp archetype”). Hopkins (1990) shows that complex, multi-phased abatements correlating many musical dimensions characteristically lead to closure in Mahler’s symphonies. Eitan’s study of melodic peaks in Haydn, Chopin, and Berg (1997) indicates that such peaks (the highest tones in a piece or segments) tend to correlate with peaks of intensity in other dimensions, such as dynamics or the size of melodic intervals. Finally, Cohen, in a series of studies (e.g., Cohen, 1971; Cohen & Granot, 1995; Cohen & Wagner, 2000), discusses the roles of two contrasting archetypical intensity curves: an inverted U (convex) curve, used to attain an emotionally balanced, calm musical expression, and a U-shaped (concave) curve which represents a model of excited, unpredictable expression. Both shapes may be realized by different musical parameters, includ-

ing pitch, dynamics, melodic intervals, and attack rate. These studies, drawing on examples from diverse musical cultures, as well as from speech intonation, birdsong, and ERP studies, suggest that the expressive functions of these contrasting intensity shapes are innate and universal.³

Correlated intensities in music performance

How would intensity-based correlations of different musical dimensions, such as those reported above, affect the performance of music? One may examine such correlations in (at least) three different contexts. First, how different dimensions (such as duration and loudness) are associated in performing the various musical *accents* and emphases suggested by the score. Second, whether, within a grouping unit such as a phrase, the *contours* of different musical parameters (e.g., melodic contour and progressive tempo change) are correlated in performance. Third, examining whether the *overall level* in one parameter (e.g., pitch) affects that of another (e.g., tempo). Below, I survey some of the empirical studies examining such associations (for further discussion, see Gabrielsson 1999, 2003).

Accents. Different parameters correlate to enhance musical emphasis in performance. In emphasizing metrical downbeats, agogic, dynamic, and articulation (i.e., more legato) accents usually correlate (Sloboda 1983, 1985; Gabrielsson, 1974). Melodic accents (jumps and turns) involve increase in loudness (Drake & Palmer, 1993). Such correlations also affect memory for melody, as tunes are reconstructed most accurately when melodic, agogic, and dynamic accents coincide (Drake, Dowling & Palmer, 1991). Further-

more, different parameters (duration, loudness, and articulation) sometimes substitute for one another in creating accent (Clarke, 1988). Correspondingly, Edlund (1994) found that articulation was used by harpsichord players to create emphasis where pianists used dynamics.

Contours. Experimental results and theoretical models suggest some correlation among different intensity contours (such as tempo and loudness change) in performance, and among such performed contours and facets of the written score, such as pitch contour or the progression of harmonic tension. However, such correlations are far from being simple or straightforward.

Some studies indeed indicate that tempo and loudness contours along a performed musical phrase correlate in both vocal (Gjerdingen, 1988) and instrumental (piano) performance (Gabrielsson, 1987; Palmer, 1996). Loudness was also shown to change congruently with pitch contour, both in classical singing (Gabrielsson & Johnson, 1985) and in piano playing (Gabrielsson, 1974). To account for such correspondences, Todd (1992) proposed a simple model relating tempo and loudness variations in performance to phrase structure. The model suggests that musical dynamics and tempo are coupled, such that “the faster the louder,” so creating together a compound “energy” profile. This profile (which, according to Todd, is also analogous to velocity change in physical movement) correlates with grouping structure, such that tempo and dynamics typically increase towards the middle of phrases and decrease toward their ends, creating an overall cross-dimensional curve. Note that since other (notated) aspects of musical intensity, such as pitch contour or harmonic tension, often create analogous curves, Todd’s model implicitly suggests correlation among intensity con-

tours in several musical dimensions, both composed and performed, not only in tempo and loudness.

A number of experiments examining Todd's model indicate, however, that the simple "faster-louder, slower-softer" relationship he suggests does not adequately describe the actual relationship of tempo and dynamics along a performed musical phrase (Palmer, 1996; Windsor & Clarke, 1997; Repp, 1999; Clarke & Windsor, 2000). Clarke & Windsor (2000) suggest that such simple tempo-dynamics relationships may serve as a basis for idiosyncratic deviations in performance. These deviations, or "residuals," may be measured against the model's predictions, such that the model generates implications against which specific performances are assessed (see Palmer, 1997; Gabrielsson, 2003; Widmer & Werner, 2004, for discussions of alternative models of performance expression).

Relationships of parametric levels in performance

While the effect of (hypothetical) intensity analogies on the performance of accents and on performed tempo and dynamic contours has been investigated empirically, there is little direct research investigating how overall (or mean) level in one musical parameter affects that of another in performance. Some studies suggest that an integrated representation of dimensions such as loudness and tempo levels plays a significant part in assessing musical performance. Timmers (2005) found that a compound feature, integrating overall tempo and loudness, is significantly associated with listeners' ratings of similarity among different performances of the same music, while loudness *per se* was rarely significant as a separate feature. Do performers' choices of the level of a specific parameter, then, affect their choices in other parameters? For instance:

(1) How would changing the tempo affect a performer's choices of dynamics?

(2) How would a transposition, or choosing a different pitch level (e.g., A4=415 vs. A4=440) affect tempo?

(3) How would an instrument's loudness limitations affect the frequency of ornamentation (e.g., clavichord vs. pianoforte)?

(4) How would the choice of tempo affect ornamentation?

Comparable questions may address listeners' evaluation of performance. For instance, in assessing the most adequate tempo for a given music, would increasing the pitch level result in listeners' preference for a faster tempo? Would changing overall dynamic level affect listeners' tempo preference?

Two conflicting hypotheses may be proposed concerning such parametric correlations. A *congruence hypothesis* would suggest that changing the level of parameter x in a specific direction would affect parameter y in the same direction (e.g., a faster tempo would generate louder overall dynamics), thus creating congruent changes in overall intensity, comparable to those found for accentuation. In contrast, a *compensation hypothesis* would suggest that changing the level of parameter x in a specific direction would affect parameter y in the opposite direction (e.g., a faster tempo would generate a softer overall dynamics), so that overall intensity level would remain constant. Palmer (1997), summarizing results of several empirical studies (Drake, 1993; Drake & Palmer, 1993; Kurakata, Kuwano & Namba, 1993; Palmer, 1996), suggests that performed expressive deviations may compensate for modulations, engendered by musical structure, in perceptual sensi-

tivity to temporal and intensity changes. For instance, performers instructed to play a sequence of tones with no change in intensity may play a note louder because in its context it is heard as softer. Thus, pianists played the second tone in each group louder (rather than the first, as expected), presumably to compensate for the higher perceived loudness of the preceding opening note (Kurakata, Kuwano & Namba, 1993). Similarly, when the perceived level of one parameter is affected by another (e.g. when, as Collier & Hubbard, 2001, indicate, perceived tempo change is modulated by pitch register) performers may compensate for the effect by altering values in the opposite direction (e.g., slowing down the pace of a melodic sequence when played a higher pitch register).

Note that in examining dimensional interaction in music performance, perceived values, rather than physical (acoustical) ones, are investigated. This distinction is important since perceived levels of auditory dimensions are often themselves affected by the interaction of several acoustic parameters. For instance, as is well known, the same sound-pressure level (in dB) may produce different levels of perceived loudness in different pitch registers (Fletcher & Munson, 1933). Such relationships should be controlled for (for instance, by using a relatively “flat” area of the equal-loudness curve) in experiments examining parametric interaction.

A tentative research plan

Below, I sketch some ideas for a research plan examining how changing the level of one musical parameter may affect that of another in performance. The proposed plan utilizes three experimental paradigms: analyzing relationships among parametric levels in recorded performances; controlling the level of a specific musical parameter in performance while examining

the ensuing effect on the level of other parameters; and examining the effect of different interactions of parametric levels on listeners' evaluation of performed music.

Several musical parameters may be investigated in the proposed experiments. Most may serve (in different experiments) as both independent and dependent variables. These include overall (or mean) dynamic level, as well as the degree of dynamic variability; mean tempo, and the degree of tempo variability (rubato); overall or average pitch range; and the extent of using ornamentation (e.g., measuring the number of performer-added ornaments per unit of time).

Analyzing recorded performances. Recordings of the same piece of music may considerably differ in choices of overall tempo, dynamics, and even pitch level (as historically-informed performances often use pitch levels lower than the modern A4=440 standard). The availability of a large number of recordings of well-known compositions enables a statistically reliable examination of the relationships among performers' choices in these domains. For instance:

- Is the mean tempo of recordings using a lower pitch level different from that of recordings using higher pitch levels?
- Are recordings using a lower pitch level different from higher-pitched ones with regard to their average dynamics?⁴
- How does the choice of tempo relate to dynamics in recordings?
- How does tempo variability (the degree of rubato) relate to dynamic variability (the degree of dynamic contrast) in recordings?

Controlling a performance parameter. A different approach to examining how the level of one parameter affects those of others would involve controlling the level of a specific parameter in actual performance. In this line of experiments, a performer is asked to play the same piece several times, in several conditions. In each condition, the level of a specific parameter would be set differently. The effect of these alterations on other performance parameters will be examined. For instance:

- A violinist is asked to perform a piece for violin and keyboard several times, in different tempi (tempo is forced in each performance by a pre-recorded accompaniment). The average dynamic level and the degree of dynamic variability in the different tempi are compared.
- A keyboardist is asked to perform the same piece several times, in each of which the keyboard is tuned to a different pitch level. Average tempo, tempo variability, average dynamics, and dynamic variability in the different tunings are compared.
- A keyboardist is asked to perform the same piece several times on an electronic keyboard. Available dynamic range is set differently in each performance condition, ranging from normal range of a concert Steinway to disabling loudness variability completely, such that key velocity would not affect loudness. Tempo, tempo variability and ornamentation in the different loudness conditions are compared.

The piece performed in the experiments suggested above will not have been known by the performer prior to the experiments. Performances in each condition will be recorded and analyzed twice: first on sight reading, and then after several hours of practice.

The effect of relationships between parametric levels on listeners' evaluation of performance. In this line of experiments, listeners' ratings of performances, rather than the performance characteristics themselves, are the dependent variables. Listeners are presented with different manipulations of a given recording, each exhibiting a different interaction of two parameters (e.g., tempo and dynamics), and are asked to rate each recording (see Table 1). For instance, with dynamics and tempo as the manipulated musical variables, the compared recordings could be:

1. The original performance (tempo and dynamics freely selected by the performer).
2. A recording based on the same performance, with electronically increased dynamic level.
3. A recording based on the same performance, with electronically decreased dynamic level.
4. A recording based on the same performance, with electronically accelerated tempo.
5. A recording based on the same performance, with electronically accelerated tempo and increased dynamic level.
6. A recording based on the same performance, with electronically accelerated tempo and decreased dynamic level.
7. A recording based on the same performance, with electronically decelerated tempo.
8. A recording based on the same performance, with electronically decelerated tempo and increased dynamic level.

9. A recording based on the same performance, with electronically decelerated tempo and decreased dynamic level.

Table 1 summarizes these options, which could be similarly applied to other parameter pairs.

Parameter A	Parameter B
0	0
0	+
0	-
+	0
+	+
+	-
-	0
-	+
-	-

Table 1. Combinations of a parameter pair in performance rating experiments.

0: parameter unaltered (i.e., as set in original recording).

+: Parameter increased in comparison to original performance.

-: Parameter decreased in comparison to original performance.

Conclusions

Shaping musical intensity (or energy) in time is what performers do. Controlled empirical methods will enable us to understand better how performers associate different musical dimensions in their search of an appropriate intensity levels and shapes. This article surveyed what such empirical investigations have yielded so far, and sketched several experimental paradigms enabling further investigation. In particular, we proposed an empirical approach into a basic issue which has not been sufficiently explored:

how the overall level of one musical parameter affects those of others. We suggest that interrelationships among dimensions such as mean tempo, loudness, and pitch register may play a significant role in performers' decisions and in the evaluation of music performances by listeners. The experimental paradigms outlined here may help investigating this suggesting, and provide insights into the ways the elusive dimension of intensity or musical "energy" is created and recreated in music performance.

Acknowledgments

Thanks are due to Renee Timmers, for many useful comments; to David Steinberg and Yulia Gavrilov, for their help in statistical analysis; and to Noa Ravid-Arazi, for her assistance in conducting the experiments. Research supported by the Israel Science Foundation, Grant no. 800/02-27.0

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¹ . Increase in discharge rates may not be the only mechanism for representing changes in intensity (e.g., Polley et al., 2004).

² . Boltz (manuscript in preparation) reports a related recent experiment. Using a paired comparison task, she found that when two melodies having the same tempo differ in pitch level or timbre, the one higher in pitch or timbre would be judged faster.

³ . Models explaining aspects of musical structure in terms of overall processes of intensification and abatement integrating different musical parameters were suggested by several music theorists, including Kurth (see 1991), Berry (1976), Meyer (1989) and Rink (1999), as well as by neuropsychologist Neil Todd (1992, 1999). For surveys of such approaches, see Eitan & Granot (2006, in press), and Shove & Repp (1995).

⁴ . Comparing measurements of dynamics in different sound recording raises complex methodological and technical issues. For examples and discussions of relevant methodologies see, e.g., Repp (1999) and Timmers (2005).