



BROOKLYN
YOUTH CHORUS

Summary of Cross-Choral Training Research

CHILDREN'S CHORAL RESEARCH: INVESTIGATIONS OF A PROFESSIONAL CHILDREN'S CHORUS BY TWO INDEPENDENT RESEARCHERS

– by Jeannette LoVetri

Research Data and Conclusions Compiled and Summarized:

- Research conducted by Dr. Richard Morris of Florida State University and Dr. Christopher Barlow of Southampton Solent University in England
- Both studies published in the Journal of Voice
- Chorus was chosen due to its unusual public profile and diversified repertoire of styles

Authors:

- **Richard Morris**, *PhD, Professor, Florida State University, Speech Language Pathology*. Research interests: singing voice, resonance issues, acoustic and physiologic phonetics
- **Sten Termström**, *PhD, Professor, Kungliga Tekniska Högskolan, Stockholm, Electronics Engineer*. Research interests: acoustic aspects of choir singing. Heads the KTH Music Acoustics lab of 12 researchers and is a choral singer
- **Christopher Barlow**, *PhD, Associate Professor Acoustics, Technology School, Southampton Solent University, England*. Research interests: acoustics of voice and hearing, noise monitoring, music technology, audiology, recording engineering
- **Dianne Berkun**, *Founder & Artistic Director, Brooklyn Youth Chorus*. Choral director, master clinician, guest conductor, author
- **Jeannette LoVetri**, *Director, The Voice Workshop, NYC*. Singing Specialist, Brooklyn Youth Chorus, Visiting Artist, Shenandoah Conservatory, VA, researcher, author, master clinician

Purpose of Research:

- To gather acoustic data on a youth chorus regarding comparative adjustments in vocal production in different qualities and at different volumes (Morris)
- To examine the measurable parameters of individual female adolescent students in classical and MT styles (Barlow)
- To develop the beginnings of a model of the voices of young theater singers (in a choral setting) (Barlow)

Chorus Background (at the time of research)

- Treble Chorus consisting of 41 girls aged 11 to 18 [med. 14.2 yrs] and 6 boys aged 11 to 14 [med 12.2 yrs]
- All children had studied at least 9 consecutive months with Brooklyn Youth Chorus. Longest amount of training for this study was 8 years.
- Rehearsals are twice a week for two hours each session

Dr. Morris – Methods and Procedures:

- Choristers sang Happy Birthday twice, providing 30 seconds of sound
- Used the vowel /a/ alternating with the vowel /i/ in syllable strings of /nananini/ and /nininana
- Used nasal /n/ for all consonants — used to reduce effects of sibilants on LTS
- Effect of /n/ phonemes on overall spectrum was minimal due to low amplitude and short duration
- Vowels selected provided widest range of first and second formant values
- Sang HB three times at “piano” (soft) and “forte” (loud)
- Sang each in “head,” “mix,” and “chest” registers (specific vocal qualities)
- 18 total productions of song
- Microphone, room acoustics, recording volumes, and other parameters were standardized
- Chorus stood in a semicircle around microphone, director cued volume, pitch and register quality, sung in random order
- Data Analyzed using KayPentax Speech Lab Model 4500 hardware/software system. Used LTAS function, adjusted to account for SPL differences
- Differences determined by variances of the LTAS in spectral tilt or drop in amplitude from F1 to F3, and above 1,000 Hz and below 1,000 Hz, minus room reverberations
- Three sets of comparisons were used to indicate probable physiologic adjustments of singers to make dynamic and register changes in singing:
 - Spectral tilt (alpha ratios to Leq)
 - Comparison of H2-H1 differences to Leq:
 - H2-H1 difference was the amplitude difference between 2nd and 1st harmonic from LTAS spectrum of three /a/ vowels from HB sung at 320Hz

Morris Conclusions:

- Choristers exhibited different LTAS patterns across two dynamic levels on the same pitches and syllables
- Forte differed from piano in one register – chest. Mix and head were more related to each other and different than chest.
- Forte for all registers was sung at greater Leq levels and with H2-H1 differences than those at piano
- Mixed register vowels were sung similarly to the head register vowels for piano and similarly to the chest register for forte volumes
- Choristers were able to repeatedly and accurately adjust their singing to each style and dynamic level regardless of the previous examples for each random repetition
- Results consistent within each group of vocal qualities
- Spectral differences occurred in each register and in each volume level on consistent pitches
- Choristers reproduced typical alpha ratios when singing in the three registers.
- Results consistent with data analyzed in Barlow study

Barlow – Methods & Procedures:

- 20 choristers between 12 and 17 yrs. recorded speaking and singing
- Recordings made using laryngograph headset mounted to an electret reference microphone at 9 cm from mouth and laryngograph to record Lx signal
- Lx signal viewed on oscilloscope to ensure adequate amplitude
- Students given first note and tempo, and sang at *mf*
- 20 choristers between 12 and 17 yrs. recorded speaking and singing
- Recordings made using laryngograph headset mounted to an electret reference microphone at 9 cm from mouth and laryngograph to record Lx signal
- Lx signal viewed on oscilloscope to ensure adequate amplitude
- Students given first note and tempo, and sang at *mf*
- Comparisons include vocal function and acoustic output
- 10 most experienced students analyzed further
 - Length of training: 4-9 years with Brooklyn Youth Chorus
 - Aged 14-17 yrs
 - Used /ae/ "happy", /ɜ/ "birth", and /u/ "to" and "you"

Barlow Conclusions:

- Mean spectral slope in LTAS was similar between styles over lowest notes
- From about 350 Hz, spectral slope for "classical" steeper than for "theater" with a mean intensity 3 dB higher
- "Theater" voice demonstrated higher relative amplitudes than "classical" across all harmonics up to 6th, particularly the 3rd
- For many notes in "theater" — first three harmonics stronger than fundamental
- Compared to studies of classically trained students in England the "classical" sound of Brooklyn Youth Chorus was nearly the same as the UK classically trained chorus
- The "theater" style had higher mean CQ values for most pitches
- Results clearly showed consistent differentiation in both vocal function and acoustic output between the two different singing styles (Classical/MT).
- AVS showed stronger harmonics relative to fundamental for theater voice compared to classical style
- Results correspond to that found subsequently by Morris
- Results indicate there are significant and quantifiable differences in vocal production and acoustic output of young singers between the two styles
- Suggests that a combination of acoustic analysis and voice source analysis could be used to give detailed model of the progression of young voices with training within a specific vocal genre

Other conclusions:

- Both studies suggest:
 - It is possible to train children in vocal function tasks within a choral setting
 - It is possible to train children to sing in deliberate registers and with deliberate volume changes without adjusting pitch or lyrics or changing expressive response to music
 - It is possible to train children to sing authentically in styles other than classical without causing undue stress to the vocal mechanism
 - It is possible to quantify data related to vocal production of children and adolescents without regard to specific musical criteria
- Further research is needed for comparison of youth choirs not trained in vocal function with those that are
- Further research is needed to determine the effects of vocal training over a larger group of youngsters

Implications:

1. There are new and different ways to train children to sing
2. This approach is effective in a choral setting
3. The choristers remain vocally healthy
4. It does not cause any negative effects in long term vocal function in any style
5. It allows for greater variation and stylistic authenticity in a variety of musical genres
6. It supports expressivity and gives the conductor more choices in a musical pallet
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RESEARCH PAPERS

- Long-Term Average Spectra From a Youth Choir Singing in Three Vocal Registers and Two Dynamic Levels
 - By Dr. Richard J. Morris, Dr. Sten Ternström, Jeannette LoVetri, and Dianne Berkun
 - Published online November 8, 2010
 - JOV: Volume 26, Issue 1, pgs. 30-36, January 2012

- Closed Quotient and Spectral Measures of Female Adolescent Singers in Different Singing Styles
 - By Christopher Barlow and Jeannette LoVetri
 - JOV: Volume 24, Issue 3, pgs. 314-318, November 2010