Can Genre Be "Heard" in Scale as Well as Song Tasks? An Exploratory Study of Female Singing in Western Lyric and Musical Theater Styles

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Summary: Objectives. Using an empirical design, this study investigated perceptual and acoustic differences between the recorded vocal products of songs and scales of professional female singers of classical Western Lyric (WL) and non-legit Musical Theater (MT) styles.
Methods. A total of 54 audio-recorded samples of songs and scales from professional female singers were rated in a blind randomized testing process by seven expert listeners as being performed by either a WL or MT singer. Songs and scales that were accurately perceived by genre were then analyzed intra- and inter-genre using long-term average spectrum analysis.
Results. A high level of agreement was found between judges in ratings for both songs and scales according to genre ($P < 0.0001$). Judges were more successful in locating WL than MT, but accuracy was always >50%. For the long-term average spectrum analysis intra-genre, song and scale matched better than chance. The highest spectral peak for the WL singers was at the mean fundamental frequency, whereas this spectral area was weaker for the MT singers, who showed a marked peak at 1 kHz. The other main inter-genre difference appeared in the higher frequency region, with a peak in the MT spectrum between 4 and 5 kHz—the region of the "speaker's formant."
Conclusions. In comparing female singers of WL and MT styles, scales as well as song tasks appear to be indicative of singer genre behavior. This implied difference in vocal production may be useful to teachers and clinicians dealing with multiple genres. The addition of a scale-in-genre task may be useful in future research seeking to identify genre-distinctive behaviors.
Key Words: Female singing–Genre differences–LTAS–Perception–Classical–Musical Theater.

INTRODUCTION

The vocal performance styles of Musical Theater (MT) singing and Western Lyric (WL) singing are considered to be somewhat different, evidenced especially in musicals composed post-1970.[1–4] The term Western Lyric has been used to embrace the performance practice of Western classical music across epochs and geographical regions.[5,6] The differences between these two styles have cultural origins, in that WL music is primarily a written tradition and far older than MT, the latter emerging as distinctive form only in the 1920s.[7,8] The performance practice and pedagogy of WL singing is thus well documented with records dating at least as far back as the 13th century.[9,10] MT is a relatively new performance genre with varied origins: European operetta, American Vaudeville, and British Musical Comedy are among those noted.[11] Although strongly influenced by neighboring Contemporary Commercial Music (CCM) styles, for example, Blues, Jazz, Rock, and Pop, MT is essentially theatrical in nature.[3,12] Thus, MT is better considered a distinct genre within the umbrella of a meta-genre identified by pedagogues and practitioners as CCM.[12–14] Because of these ongoing CCM influences, it may well be that no one specific mode of vocal production is pre-

dominant in MT singing.[2,4,15,16] Key stylistic differences between the genres are discussed in more detail below.

In MT singing, intelligibility of text is paramount,[3,12] whereas in WL singing beauty of voice is usually considered to prevail over the needs of text.[17] Typically, in MT singing, there is a shorter vowel-to-consonant relationship than in WL, and consonants are likely to be louder.[14,18] WL singers customarily perform without the aid of microphones and are able to amplify the upper harmonics of their sound output in a region where the orchestral sound is weaker, allowing their voice to be heard above a group of musical instruments.[19] By contrast, since the late 1950s, MT singers are routinely amplified during performance and, in current practice, each artist's voice will be amplified using head microphones and mixed with the orchestral sound via a sound desk. This allows for the use of sound qualities and pitch ranges that are more conversational because there is no need for the voices to project acoustically through an orchestra.[3,12,17,20] In terms of desirable voice quality, a stated goal of WL singing in the traditional *bel canto* style is that of *chiaroscuro*, a tonal quality that is perceived as having both clarity and depth.[18–21] This tonal ideal is thought to be achieved with a relatively low-held larynx, a widened pharynx, and articulatory strategies to achieve relatively equal resonance across the vowel set, and fullness and "ring" overall in the sound.[22–26]

Taking into account the various voice categories, female singers as a collective might cover the fundamental frequency range of 160–2000 Hz,[27] implying use of different register mechanisms. Of these, "chest" and "head" registers are the most relevant to the present study. The aesthetic of WL music demands an extensive use of head register in female voice. Chest register is confined to the lower portion of the pitch-range and

considered detrimental if taken above F_4-G_4.[26,28–30] In general, the expected tessitura in MT singing for female voice is lower than in WL singing and the pitch range less wide.[3,4,31] In MT singing, it is considered essential for female performers to be proficient in both chest and head registers. These singers are documented as taking chest register up to D_5 (590 Hz) and beyond.[3,20,31,32] In MT performance practice, the term "legit" is typically used to describe a sound quality considered closest to classical head register.[4,15,29,33] Voice science studies comparing the spectra of chest and head register concur that "chest" register is characterized by a less steeply sloping spectrum envelope than "head" register, the latter having its highest spectral energy at the fundamental frequency.[29,34–38]

Of the substantial body of research in voice science, relatively little has been devoted to so-called "non-classical" singing styles in female voice, including the MT genre.[39,40] Many existing studies of MT singing in female voice focus on the phenomenon of "belting." Belting is a voice quality considered to be based on chest register, apparently produced with a high laryngeal posture.[4,41] Early single-subject studies indicated a high closed quotient of >50%.[42–44] However, in a later study of a larger subject group, Lebowitz and Baken[45] reported mean closed contact quotient to be <50% in both "belting" and in "legit" styles, and noted a consistently higher speed of closure in "belting." As regards laryngeal height in belting, LoVetri et al[13] reported that four of seven female subjects lowered their larynx during belting, whereas two retained the same laryngeal height. The study does not discuss whether use of the "dark" or "bright" vowels used in its protocols made any difference to laryngeal height. Comparisons have been made between "belting" and "classical" or "operatic," as well as between "belting" and "legit," and "belting" and "neutral."[41–43,45,46] Other studies have investigated chest, "chest-mix, and 'head-mix," or compared "MT" style with "classical style"; similarly, "Broadway" with "Operatic".[35,47] According to Kochis-Jennings,[35] "chest-mix" is a voice quality used in commercial singing (which would include the MT genre), whereas in classical singing "head-mix" is used. In further reports of the same study of seven female singers, spectral tilt[48] was found to increase incrementally as the singers moved from "chest" to "chest-mix" and "head-mix" to "head."[49,50]

To meet the distinctive performing expectations of these two contrasting genres—WL and MT—different training regimes have evolved to meet their respective needs.[3,12,17,33,51] It has also been suggested that this need for a different professional preparation may well be more acute in the case of female MT singers because of the expectation that they will need to take their sung chest register higher than their WL counterparts when singing contemporary MT repertoire.[51] Additionally, because of the specific needs of their performing industry, working professional MT singers are noted as being subject to heavy vocal loading, which might imply an increased risk of vocal health problems.[52] Introspection suggests that if female MT singers use their voices differently compared to their WL counterparts, such differences might be detectable in sung products, such as music scales (as used in vocal warm-up exercises), as well as in their respective song repertoires. An investigation of both vocal and perceptual relationships of these two genre communities might assist in clinical pedagogical understanding of issues that are faced by individual singers.

RESEARCH AIMS AND METHODOLOGY

This study was exploratory in nature: its empirical design allowed for investigation of vocal and perceptual relationships in a small group of singers from professional backgrounds with different musical genre biases. Drawing from established case study methodology, each singer was allowed to sing a different song for a song performance test. To further improve ecological validity of the investigation, the song products were from singers' normal and current repertoire. An important and novel aspect of the study was an additional Scale-in-Genre task. This task was designed to investigate whether or not any genre-distinctive use of voice detected in the song performances of individual singers could also be detected in their sung scale tasks. The overall aim was to gain a better understanding of similarities and differences that might exist within the group studied, which might be revealing of genre distinctive behavior. Embedded in the research design were two specific foci:

a. To ascertain from perceptual tests whether or not a singer's Intended Sung Genre could be detected in sung scale tasks as well as in songs; and

b. To examine those spectra of singers' tasks clearly identified as belonging to a particular genre for any timbral characteristics that might be genre-distinctive, and therefore indicative of differences in use of voice that are perceptually accessible.

Participants

In this exploratory study, seven female professional singers with a mean age of 29 years (SD 6.46, range 20–38) were recorded performing song and scale tasks. All participants completed a questionnaire about their training and professional activities, which included a matrix derived from a Taxonomy of Singers Used as Subjects in Scientific Research,[53] according to "type" and "category," relabeled as Genre and Level for this study. Of the seven singers, two self-identified as WL and five as MT. However, of the MT singers, two had trained early and extensively in the WL style of singing before retraining for MT. Of these two singers, one was recorded three times on different occasions, performing in both WL and MT genres, the intention being that her song and scale tasks would act as "genre blind" samples for the perceptual tests. The singer subject group, type, and category are summarized in Table 1. For the listening test, seven judges were

TABLE 1.
Participant Group Summary: Age, Level, and Genre

Participant	Age	Level	Genre
Singer 1	38	2	WL
Singer 2	25	4	MT
Singer 3	28	4	WL and MT
Singer 4	21	3	MT
Singer 5	20	4	MT
Singer 6	37	3 (6)	WL
Singer 7	34	3 (6)	WL and MT

Note: Where two genres are indicated, the first is the original training for that singer.