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String Musicians and Vocal Expressivity in Early and Modern Recordings of Schubert's *Ave Maria*

Abstract

Portamento use by classical singers and string players in recordings of *Ave Maria* by Schubert from two different time periods (1906–1931 and 1999–2020) is examined in this study to compare the presence of voice-mimicking characteristics in performances by cellists and violinists. Furthermore, an additional detailed analysis of the main motive inquired into alternative expressive strategies by modern string players that mirror vocal expressivity. Findings included clear evidence of voice-mimicking portamento by string players from the beginning of the century but hardly any by modern performers. The second analysis showed clear divergence between the expressive strategies of string musicians and singers, but also several instances of similarities that point to the possibility of modern string musicians emulating vocal expressivity through alternative means (dynamic phrasing, timbre, and vibrato).

Keywords: cello, violin, portamento, recording analysis, vocal expressivity

Introduction

The idea of the human voice as a model for string instrument performance has a long history, present in academic and educational literature (Geminiani, 1751; Baillot, 1804; Joachim and Moser, 1905; Auer, 1921; Feuillard, 1925, Flesch, 1923–1928) as well as in musical discourse in general. Daniel Leech-Wilkinson summarized twenty years ago that "the modelling of vocal communication plays an evidently central role in all kinds of musical expressivity" (2006, p.240) and within the field of Performance Studies, a lot of research has placed vocal communication as the primary historical model for string instrument performance through the analysis of expressive features, particularly

portamento (Brown, 2009; Bennet Wadsworth, 2017; Potter, 2006; Milsom, 2003 and 2020; Fabian, Timmer and Schubert, 2014; Da Costa and Milsom, 2014; Fabian, 2017). As an example, David Milsom studied the ideal of vocality in particular detail regarding nineteenth-century violin performance and its relation to both singing ("the bel canto ideal"), and speech ("the declamatory ideal"), highlighting portamento and vibrato as the two elements most closely linked to singing and repeatedly mentioned in the pedagogical literature of the time (2020).[1]

Through a comparative analysis with recordings of Schubert's *Ave Maria* by singers, violinists, and cellists from two different time periods, in this paper we addressed the question of how expressivity in played and sung music might have been connected over time, given that the use of performance elements like portamento and vibrato has changed drastically over the last century. Unlike the eighteenth- and nineteenth centuries that provided clear instructions in the pedagogical literature on how string musicians should emulate the voice, both spoken and sung, current expressive models are less overtly defined as vocal. Vocal expressivity is still referenced in modern string instrument pedagogical literature, but there seems to be less focus on the possible mechanisms to achieve this goal for classical string instrumentalists (Milsom, 2020, Chalakov, 2023; Draiblate, 2019; Healy, 2018; Knapik, 2014; Solovieva, 2017).

Aesthetic changes in classical music performance during the twentieth century

It would be difficult to assert just how stable previous periods were in terms of performance aesthetics due to the more limited source material, but it is not unreasonable to assume that the accelerating societal and cultural shifts over time have

[1] Expressive portamento is defined as the audible, continuous connection between two notes with an expressive intent.

also had their effect on the rate of change in classical music performance. Recent research with early recordings has detailed many expressive characteristics that are foreign to our current aesthetics, including the lack of strict coordination between voices, use of accelerando, articulation, and phrasing ideals, looser adherence to the musical score and the extensive use of portamento (Sung and Fabian, 2011; Milsom and Peres Da Costa, 2014). Portamento has received a lot of attention from researchers since most string instrument performers stopped employing this expressive tool during the first part of the twentieth century, making it a rarity in recordings after the Second World War. Several hypotheses have been proposed regarding the reasons for these changes, including the technological revolution resulting in a "phonograph effect" (Katz, 2010), the two world wars resulting in a move away from sentimentalism (Leech-Wilkinson, 2006), or the emergence of American popular music creating a need for differentiation, coupled the changes to expressivity through new postmodern vocal techniques (Potter, 1998).

Research Questions

Three research questions were posited at the beginning of the study.

Research Question 1 (RQ1): How does portamento use differ between recordings from a hundred years ago and contemporary recordings?

Research Question 2 (RQ2): How does the portamento use of string players differ to that of singers a hundred years ago and now?

Research Question 3 (RQ3): Is there any evidence for other voice-mimicking expressive features in recordings by contemporary string players?

Method

Sample

We selected eighteen recordings of *Ave Maria* by Franz Schubert from two different periods (1906–1931 and 1999–2020) by well-known musicians for this study (Table 1). The selection constitutes a representative sample of commercially available recordings within the stipulated time frames (pre-World War 2 versus contemporary) that have a sole protagonist playing or singing at least one whole repetition of the melody with enough technological clarity to make a detailed analysis possible. The work *Ave Maria* was chosen due to large number of commercial recordings available both by cellists, violinists, and singers during both time periods. In the group of early recordings ten musicians from Holland, Ireland, England, Belgium, and Germany were included, while the sample of modern recordings included eight recordings by performers from Spain, Italy, France, the USA, Russia, and China.

Table 1. The recordings used for the present study in chronological order.

Basic performance metrics were retrieved manually from all recordings: average tempo, tempo flexibility, and portamento frequency and then complemented with input from the software program *Sonic Visualiser* (developed by Centre for Digital Music at Queen Mary, University of London) with the functions *Spectrogram*, *Time instants layer,* and *Time values layer*. Portamento frequency was calculated dividing the number of audible portamenti by number of measures performed by the soloist, while the tempo rubato was calculated dividing the highest BPM recorded in any measure by the soloist by the lowest BPM recorded by the soloist. There was a qualitative analysis of all audible portamento regarding type, placements, and characteristics, expressive or not. The only exception to this rule were the octavated double-stops in the second verse by some violinists (Bell, Heifetz, Menges) since double-stops require constant technical sliding which would skew the results.

Focus was placed on portamento due to its known importance for voice-mimicking and we analyzed tempo flexibility givenits known historical connection to portamento (Leech-Wilkinson, 2013; Milsom, 2020).

After this first analysis, we conducted a further examination of the main motive of the song, looking for other possible voice-mimicking characteristics. Characteristics analyzed included timbre (harmonics and note attack), vibrato (shape, speed, and amplitude), dynamics (sound volume), and small-scale tempo variation (within the phrase). Additional plug-ins for *Sonic Visualiser* complemented this part of the analysis, including *Smoothed Power Curve* (developed by The Mazurka project), and *Harmonic Spectrum*. The vibrato speed and width were derived using three different values of oscillations (in seconds) and amplitude (in cents) from one and the same note and then calculating the mean for those three values. Since some musicians performed the fragment several times the role of each verse was considered in the analysis. Finally, the bivariate correlations between tempo flexibility and portamento frequency, as well as between vibrato amplitude and vibrato speed, were examined.

The musical editions used by the performers

There were little discrepancies to be found between song editions, except regarding the expressions of embellishments notes and the tonality changes to accommodate different voice types. The arrangements for violin and cello included more creative liberties, such as the popular August Willhelmj arrangement in C Major from the late nineteenth century that includes a large amount of double-stops and other similar transcriptions for cello. Hempel, Heifetz, Flesch, and Bell all used the Willhelmj arrangement, and the cellists also used a variety of arrangements that changed keys, registers, and add double stops. Performance elements such as vibrato or portamento were not indicated in any of the editions.

Categorization of portamenti

We stipulated three requirements for a portamento used by a string performer to be included in the category of voice-mimicking expressivity:

1) The portamento is used in instances where instrument-technical necessity does not explain its use.

2) The auditive effect of the portamento is similar to that of vocal sliding in singing or in spoken language.

3) The same type of portamento is also used by the singers in the sample.

Three types of portamento clearly fit into this category, titled in the ensuing discussion as *Scoops*, *Parabolic portamento/L-portamento,* and *Vibrato-glissando*. The two former types are well-known and described in detail both in pre-twentieth-century pedagogical methods and recent research literature. The *scoop* (also called *Intonazione* and *librar la voce* as seen in previous sources) and *digitación expresiva* refer to a slide before the start of a note, which can involve a slide from a lower pitch up to the note in question or even a small change down and up in pitch (Köpp, 2010; Williams, 2019; Zurita, 2016). The second type of slide comes in many variants, which are referred to either as *L-portamento*, *Parabolic portamento* or portamento *trainé*, as well as *portamento prosódico* and ultimately refers to slide with changes in speed (Zurita, 2016; Flesch, 9123-1928). On string instruments, the finger of the last note performs the slide, and the audible change in fingers and shape of the portamento resembles the effect of the parabolic portamento used by singers, which includes a change in speed during the pitch change. In both cases, there is a plateau-effect in the middle of the slide, which sometimes also displays a small gap. The last slide with obvious vocal connotations refers to a technique where the vibrato is used to move the pitch in a gradual manner,

referred to as *vibrato-glissando*. This slide also has a quite conspicuous effect and is normally used sparingly.

Results

Regarding RQ1 and RQ2, there were similar amounts both of tempo rubato and portamento in the early recordings of *Ave Maria* between string players and singers (mean range of 2.39 for string players versus 2.33 for singers). In the modern recordings, the picture was quite different, especially regarding the number of portamento: the modern singers slid twice as often as the modern string performers in the sample (mean of 1.08 slides per measure, compared to 0.55). As predicted, there was also a stronger presence regarding vocal types of portamento in all early recordings, but the disappearance in the modern recordings was more pronounced among string performers, while the modern singers still used these slides in their performances (See Table 2).

Table 2. Portamento with vocal characteristics in the recording sample.

Both tempo flexibility and portamento frequency were much lower in the group of modern recordings, compared to the early recordings (see Figure 1 and Table 2). There was also a significant correlation between these two parameters. Pearson's correlation for this relationship was $r(16) = 0.61$, $p = .008$. However, there was no declining tendency throughout the early sample (from 1906 to 1931), which points towards a later change in stylistic conventions than the range of the sample.

Figure 1. Tempo flexibility and portamento frequency of the recording sample in chronological order. The black line indicates the separation between early and modern recordings.

Regarding RQ3, there were some findings that suggested alternative voice-mimicking strategies in the practice of modern string players, particularly the convergence of approaches between Bonney and several string players (Ma, Capuçon and Bell) regarding the lack of high harmonics, soft dynamics, unfocused attacks, narrow and limited vibrato. Interestingly, the statistical analysis showed no statistically significant correlation between vibrato speed and width.

Discussion

The fact that string players and singers diverged much more in their portamento use today than in the early twentieth century aligns with the idea of voice emulation among string musicians as being part of a historic, now-abandoned aesthetic ideal (Katz, 2010; Leech-Wilkinson, 2006). However, much more significant than the amount of portamento were the types, speeds, and placements, since all these parameters compound to very different audible effects. Even when modern performers used portamento in an expressive manner, they slid more discretely and used portamenti that are usually both faster, softer, and less conspicuous in character compared to performances in early recordings.As an exemple, the L-portamento by Vengerov in Example 5 lasts 0.19 seconds, which can be compared to Lehmanns's slide in Example 4 of 0.26 seconds or Foldesy's slide in Example 6, which last 0.33 seconds. To this point, the parabolic or L-type portamento underwent the greatest reduction in the sample, even given the pronounced individual differences in both the early and the modern recordings (Table 2). These changes are all indications of how portamento has lost the central role in a string musicians' expressive toolkit it once held.

Scoops

Among the three portamento types with vocal connotations, the scoop was the most expressively varied in the study. Singers used scoops most commonly to position their voices after a pause or an interval, and many singers consider this element a more or less integral part of their vocal habits (Plack, 2008). However, the expressive intent of the scoops becomes clear through the discriminative use of them as well as in their diverging qualities. In Example 1, Bonney attacked the note without a scoop and then began the next one with a clear scoop, thereby emphasizing the high note of the musical phrase (Audio 1). Similarly, In Example 3, Lehmann used a scoop to emphasize a repeated note (Audio 3). In this sample, scoops were also used by string performers, not only at the beginning of a phrase or after a pause but also in the middle of phrases, as seen here by Heifetz when he's changing double-stops (Example 2, Audio 2).

Example 1. Spectrogram picture created in *Sonic Visualiser* of Barbary Bonney singing m. 13 of *Ave Maria*.

Example 2. Spectrogram picture created in *Sonic Visualiser* of Heifetz using scoops for expressive emphasis of the changing double-stops, m. 24, *Ave Maria*.

Example 3. Spectrogram picture created in *Sonic Visualiser* of Lehmann using a scoop to a repeated note in m. 20, *Ave Maria*.

Parabolic portamento

Parabolic portamento tended to be reserved for certain occasions, due to its conspicuous effect. This was especially true for the modern performers, who used it very rarely and subtly. Among early recordings, this type of portamento was used more often by string performers than singers and with a strong expressive emphasis due to the finger change in the middle, which provided it with the identifiable plateau-effect. Among singers, this slide often included a small gap in the middle, as seen here by Lehmann, who combined it with a falling vibrato-glissando to momentously expand the

sixteenth notes at the end of the phrase (Example 4, Audio 4). One of the few instances of modern string performers using this portamento was Vengerov's short L-portamento, which functioned as a scoop to the first note in m. 12 to create a subtle, vocally inspired upward movement (seen in Example 5 and heard in Audio 5). The most vocally mimicking L-portamento, however, was displayed by the cellist Földesy, who played a couple of parabolic-typed scoops in m. 14 that provided small pushes for the descending semitones with small gaps and agogic accents between each note (Example 6, Audio 6).

Example 4. Spectrogram picture created in *Sonic Visualiser* of Lehmann performing m. 17 of *Ave Maria*.

Example 5. Spectrogram picture created in *Sonic Visualiser* of Vengerov playing a subtle L-portamento in m. 12, *Ave Maria*.

Example 6. Spectrogram picture created in *Sonic Visualiser* of Foldesy performing m. 14, *Ave Maria*.

Vibrato-glissando

The vibrato-glissando, similarly to the L-portamento, focuses the attention of the listener and is therefore not as variable as the scoop. Nevertheless, it was used in both subtle and poignant ways throughout this sample. An illustrative example is Frida Hempel, who in m. 25 used it to connect the appoggiatura with the main note at the first beat, creating a very noticeable effect not unlike a parabolic portamento (Example 7 and Audio 7). Among modern singers, Fleming showed a particular predilection for this kind of portamento and used it to highlight the high point of the phrase in m. 10, as seen below in Example 8 and heard in Audio 8. The vibrato-glissando was used much less by string performers in this sample, perhaps because it is less instrument-technically intuitive. However, but we see how, for example, Carl Flesch in m. 6, uses this same

resource to connect the two same eight notes at the second beat in a way that clearly emulates singing (Example 9, Audio 9).

Example 7. Spectrogram picture created in *Sonic Visualiser* of Hempel performing m. 25, *Ave Maria*.

Example 8. Spectrogram picture created in *Sonic Visualiser* of Fleming singing m. 10, *Ave Maria*.

Example 9. Spectrogram picture created in *Sonic Visualiser* of Flesch performing m. 6, *Ave Maria*.

It is important to note that the string players do not merely imitate the sliding patterns of the singers but use the same types of slides as the singers at different instances and with changing qualities. This suggests an integrated expressivity approach influenced by the voice, rather than a case of instrumentalists simply mimicking specific performances or artists. On the other hand, the modern instrumentalists in the sample not only slid much less and more discretely in general but also used much less vocally mimicking portamento.

Possible strategies for emulating vocal expressivity in the twenty-first century

The second analysis of the main motive in the modern recordings focused on tempo phrasing, timbre, vibrato, and dynamics and produced some relevant findings regarding possible alternative voice-mimicking strategies. Like the previous analysis, the criteria for considering an expressive element as a possible candidate for voice-mimicking included whether an element was used in a similar way by singers, that it was not due to instrument-technical necessity and that its audible effect was similar to vocal expressivity.

Concerning the importance of tempo variation and dynamics for expressivity, Cheng and Chew stated in their study on recordings of unaccompanied Bach pieces for violin

that, compared to tempo variation, loudness was a more consistent indicator or phrasing strategies (2008, pp. 325). The present study yielded more nuanced results.[2] In general, as seen in Figure 4 and Table 3, the detailed performance characteristics analyzed here in the modern recordings, except for Bonney's last verse, pointed to clear differences between string players and singers in terms of expressive strategies. First, looking at the tempo variation for the motive, the variations in the string performances were more differentiated than among the singers (Figures 2 and 3). In the latter case, the phrasing in all versions followed a similar (although not identical) strategy of slowing down before the strong third beat in the measure (marked as beat 5) as well as an even more pronounced ritardando around the first beat in the second measure (marked beat 9). Among the string performers, there were importantdifferences in where the rubato was used, and there were also changes between the different verses: Joshua Bell and Maxim Vengerov both performed each of the two verses markedly different in terms of tempo variation.

Figure 2. Score example of the last two measures of *Ave Maria* and the tempo variation counted in beats (quarter notes) in the recordings by modern string performers. The Y-axis describes the tempo (bpm) based on duration since the previous item and the X-axis describes the time passed in seconds.

Figure 3. Score example of the last two measures of *Ave Maria* and the tempo variation counted in beats (quarter notes) in the recordings by modern singers. The Y-axis describes the tempo (bpm) based on duration since the previous item and the X-axis describes the time passed in seconds.

[2] Audio examples for the fragment used for this analysis: Audio Example 10: Barbara Bonney; Audio Example 11: Josua Bell; Audio Example 12: Maxim Vengerov; Audio Example 13: Yo-Yo Ma; Audio Example 14: René Fleming; Audio Example 15: Plácido Domingo; Audio Example 16: Gautier Capucon; Audio Example 17: Andrea Bocelli.

These results show that the string performers in the sample relied to a greater extent on tempo rubato as an expressive device, for example to differentiate between repetitions when there are several verses. However, there were no clear indications of small-scale tempo changes being used for emulating the voice by string players. The singers that sang more than one verse instead used differences in dynamics (relative sound volume) to vary their performances and several different performance approaches to dynamics were identified.

Regarding timbre, an interesting finding concerned how the soprano Barbara Bonney sang the third and last verse. Bonney attacked the note with more air escape, sang with soft modulating dynamics, and displayed very few high harmonics, which resulted in a somewhat whispery timbre (Ishi, Ishiguro and Kahita, 2009, Example 10). Several string players (Ma, Capuçon) performed this motive in a similar way and that appear to emulate vocal expressivity.

Example 10. Spectrogram picture (left) and harmonic spectrum picture (right) created in *Sonic Visualiser* and dynamic curve (*Smoothed Power*), two last measures of the recording by Bonney.

As shown by Example 11, Yo-Yo Ma displayed soft sound-volume, soft unfocused attacks, few high harmonics, and an audible impression that was similar to Bonney's last verse. The other string players (Bell, Vengerov, Capuçon) also displayed some or all of these characteristics for one or several of the appearances of this motive. This can be compared with tenor Plácido Domingo, who presented a more intense, sustained sound volume, and higher harmonics, (for example, number 25-28 as seen in Example 12).

Example 11. Spectrogram picture (left) and harmonic spectrum picture (right) created in *Sonic Visualiser* and dynamic curve (*Smoothed Power*), two last measures of the recording by Ma.

Example 12. Spectrogram picture (left) and harmonic spectrum picture (right) created in *Sonic Visualiser*, dynamic curve (*Smoothed Power*), last two measures of the recording by Domingo.

In terms of vibrato characteristics, the singers generally used a much wider vibrato (mean vibrato width of 1 semitone and 42 cents, compared to 65 cents for string players), while the speed of the oscillations varied much less. The last verse of Bonney again was an anomalyoutlier here, employing a narrow and restricted vibrato that was similar to several of the string performers (Ma, Capuçon)..

Figure 4. Modern recordings of the main motive ordered chronologically.

Table 3. Vibrato characteristics for all modern performers.

In summary, the only indication found here of possible voice emulation by string players was the interesting convergence of approaches between Bonney and several string players regarding specific features, such as a lack of high harmonics, soft dynamics, unfocused attacks, narrow and limited vibrato that, combined, sound like voice emulation. These characteristics complied with the requirements set for identification of voice-mimicking but, since this combination of elements wereemployed by one of the singers in an already small sample, it is not enough to draw any wider conclusions.

A review of violin and cello performances available on *YouTube* of the *Ave Maria* showed varied musical approaches, but some of the most watched versions by classical string musicians (often with hundreds of thousands of views) employed the “Bonney

strategy" for the main motive at some point, including cellists like Jian Wang and Jamal Aliyev and violinists like Tjasa Kastelic and Arthur Grumieux (Wang 2009; Aliyev, 2020; Kastelic, 2022; Grumieux, 2018). It is possible that these musicians wereaware of, Barbara Bonney's recording — which predates all the mentioned recordings — but it is also possible that we are looking at a more generalized performance strategy here, whether consciously connected to vocal expressivity or not.

Conclusion

It is exceedingly common for string performers to use the human voice as a metaphor when describing their musical expressivity[3] and it has been a very common imagery historically, connected with our deep attachment to the expressivity of the human voice. Indeed, research in music psychology and neurology has shown similarities in the mechanisms used to decode emotions expressed by vocal communication and those expressed by instrumental music

[3] Examples by some of the string players in this sample: "I love the instruments I play. But I also like to be separate from them. And so, I think the image I have of the four strings of the instrument and the bow I use is that, the bow, which draws out sound, are the lungs. And the strings that are on the instrument are the vocal cords. So, I think of instruments as sort of the extension of the lungs and the vocal cords." Yo-Yo Ma (Tippet, 2014). "It was the connection between the notes, sostenuto, singing. Even if you have to play fast there is always a connection between the notes. It's like a chain of notes that takes shape into the phrase and this connection between the notes is what creates the energy. [..] Even if there are spaces between the notes, you breathe. You take it as singing." Maxim Vengerov, on his training within the Franco-Belgian school. (Clarke, 2022).

"It's simply the most beautiful instrument! The closest to the human voice, the most sensual by its sound, its shape and the way you play it." Gautier Capuçon, commenting on the characteristics of the cello. (Capuçon, 2015).

(Paquette et al, 2018; Paquette et al, 2020; Juslin and Laukka, 2003). During the twentieth century string performers progressively stopped using expressive portamento, even as singers during the same period continued to use it intermittingly. This development has opened for speculation regarding a more disembodied, non-vocal approach emerging in string performance, aided by the ever-expanding possibilities of recording technology to create what was previously impossible. The present analysis of *Ave Maria*-recordings has solidified the case for clear voice-mimicking use of expressive portamento in early recordings by cellists and violinists, which is all but gone in modern string recordings. The qualitative analysis of the main motive showed clear divergence in the strategies employed by singers and string players regarding tempo phrasing, dynamics, and vibrato, but also the possibility of modern voice-mimicking strategies found in the performances by Ma, Capuçon, Bell and Vengerov. In 2006, Leech-Wilkinson presented an argument for "generalized trends in performance style away from expressivity achieved through pitch (portamento) and timing (rubato) toward expressivity through declamation and dynamics" during the twentieth century and it would be worthwhile to investigate further whether there indeed is a generalized increase in declamatory and volume-based expressivity among string musicians today (p. 258). Burgess and Haynes warned against confusing the persistence of the analogy of the human voice for stylistic consistency in performance and Healy underscored how "vocality has wide-ranging meaning potential: it can be manipulated and reimagined in an endless variety of ways" (Burgess and Haynes, 2004; Healy, 2018).

Furthermore, we have the question of how expressivity and specifically portamento is taught in the current string instrument classroom and how this

might change due to the slow but steady increase of historically informed musicians employing expressive portamento to a greater extent in Romantic and post-Romantic repertoire. Musicians often establish their views on expressive characteristics in their formative years, and the habits acquired usually last overtime (Lee, 2006). A more explicit approach towards vocal expressivity by string teachers, including presenting a variety of portamento uses, would likely widen the expressive horizon of students and encourage more heterogenous approaches towards the string instrument repertoire of the last 300 years and its connection to vocal communication.

Limitations and Future Research

Even when endeavoring to create a representative sample, recordings by musicians are highly personal and therefore presents challenges for any extrapolation of the findings. Without a doubt, further, more quantitative analysis on modern string recordings, using classical repertoire with different style profiles, from different time periods and with varied instrumentations would be needed in order to establish more general trends of possible voice-mimicking features among musicians today. Other, complementary analysis parameters, not fulltexplored here, such as dynamic variability, timbre, or the relationship between phrasing and intonation could also contribute to our understanding of modern string instrument recordings.

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