Commentary on De Souza, Dvorsky, and Oyon (2024): Texture and Sonata Form in Classical String Quartets

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ABSTRACT: The corpus study reported by De Souza, Dvorsky, and Oyon (2024) investigates texture in sonata form movements of classical string quartets (by Joseph Haydn, Wolfgang Amadeus Mozart, and Ludwig van Beethoven) using onset synchrony. The following commentary provides some additional discussion on the behavior of various measures of onset synchrony when applied to this genre, and the potential of this research to be more widely generalizable.

Submitted 2024 November 7; accepted 2024 November 27.
Published 2025 March 3; https://doi.org/10.18061/emr.v19i2.10276

KEYWORDS: *sonata form, texture, polyphony, onset synchrony, string quartets, commentary*

IN this article, De Souza, Dvorsky, and Oyon (2024) report on a corpus study investigating structural properties of texture in sonata form in classical string quartets. As a proxy for texture, the authors used a measure of onset synchrony between parts, following the assumption that passages with a greater degree of polyphonic or contrapuntal texture would possess lower degrees of onset synchrony. For a given passage of music, a directional measure of synchrony was calculated between pairs of parts as the number of shared onsets, normalized by the total number of onsets in the first of these parts. Values were averaged across all possible pairings.

The study is a compact one, limited to two areas of focus. First, it compares differences in onset synchrony between exposition and development sections of 23 movements from classical string quartets. This results in the key finding of significant differences between the textures of these sections, which also provides some evidence that onset synchrony can provide a broadly effective measure of polyphonic texture. Second, differences in onset synchrony between exposition subsections (i.e., primary themes, transitions, secondary themes, and closing zones, as analyzed by Duane, 2017) are explored; however, this fails to find significant evidence of differences between the textures of subsections.

The potential of this paper's findings to be more widely generalizable hinges on two main considerations. The first, and simplest, one is that the corpus of movements used is small—just nine movements by Joseph Haydn, nine by Wolfgang Amadeus Mozart, and five by Ludwig van Beethoven. This makes it somewhat difficult to judge how well findings can be generalized to other works in the genre. The applicability of these findings to other composers is also key, particularly given some of the substantial differences found between the three composers used (such as the interaction between composer and exposition/development texture, and the differences in composers' exposition section textures). The second is the extent to which onset synchrony, as calculated here, can capture polyphony in this setting.

ONSET SYNCHRONY IN CLASSICAL STRING QUARTETS

As acknowledged by the authors, characterizing polyphonic texture solely by onset synchrony is somewhat reductive. To a certain extent, the characterization of texture can be understood as a property of auditory streaming, where more polyphonic textures comprise a greater number of, and altogether more independent, voices. Ignoring pitch information means that many common harmonic or melodic cues for segmentation are not considered. However, previous research suggests that the degree to which onsets coincide is a key factor in perceiving multiple auditory streams; sounds that occur at the same time (or close-enough to be grouped together) are more likely to be considered as arising from a single event (Bregman, 1990; Huron, 1993).

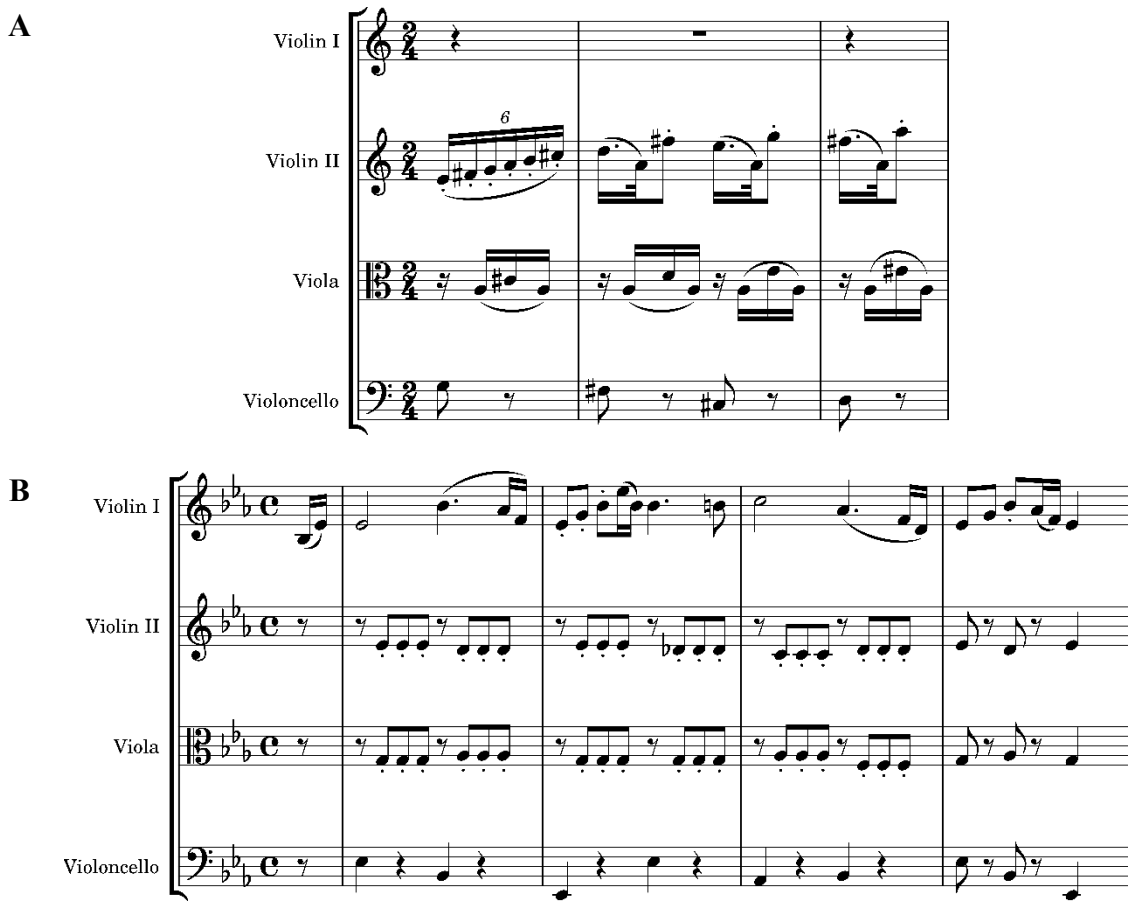

Fig. 1. Examples of voice combination in melody and accompaniment textures. **(A)** Ludwig van Beethoven, String Quartet No. 2 in G major, Op. 18, No. 2, first movement, mm. 61–63. **(B)** Joseph Haydn, String Quartet in E-flat major, Op. 33, No. 2, first movement, mm. 1–4.

Measures of onset synchrony have been used successfully to characterize polyphonic textures in works such as Johann Sebastian Bach's *Two-Part Inventions* (Huron, 1993, 2016), where each part is assumed to form a stream. Applying similar measures to the genre of classical string quartets raises some interesting points. In particular, there are two broad problems that must be resolved. First, synchrony measures must be adapted for more than two parts. In a two-part work, an onset is either shared by both parts or by none; in works with a greater number of instruments or voices, there is variation in the number of parts across which an onset can be shared. How this is handled has implications for how certain textures are characterized. Second, the greater number of instruments or voices makes it more likely that passages will occur in which fewer streams than parts are perceived. This may happen due to perceptual limitations of the number of streams that can be attended to, or through compositional or orchestration conventions when working with more instruments. When this happens, the assumption that each part forms a single stream is broken.

To address the first point, the measure averages the synchrony scores of all pairwise combinations of parts. While this, for the most part, creates a robust measure of total synchrony, it is interesting to consider the effect of tacet sections. If an instrument or voice does not produce any onsets (either by an extended period of rest or, to a lesser extent, a long-held note), measured onset synchrony will decrease. It is debatable whether this decrease should be considered indicative of a more polyphonic texture or whether judgments of texture should apply only to the remaining three parts. Phrases in which one or more parts are silent are not uncommon in the corpus. For example, see Beethoven, Op. 18, No. 6, or the opening of Haydn, Op. 76, No. 1, where not only are parts silent, but melodic lines are passed between instruments.

The second point, perhaps, is more challenging to overcome. The larger number of voices provides more opportunities for multiple parts to merge into singular streams. This is further compounded by the various common stylistic features found in string quartets. These patterns—particularly accompaniment figurations—may decrease onset synchrony for passages that are not necessarily any more polyphonic in texture. A common example can be seen in the accompanying patterns shared among the viola and cello parts in Figure 1A (Beethoven, Op. 18, No. 2, mm. 61–63). It could be argued that together these parts form a single stream, accompanying the second violin melody, rather than being perceived as independent voices. The total lack of synchronous onsets between the viola and the cello (results in a relatively low onset synchrony for this passage, particularly when compared to that if the lower parts were to be treated as one. Another similar common pattern can be seen in Figure 1B (Haydn, Op. 33, No. 2). Even though the onsets of the second violin and viola overlap completely, the lack of concurrent onsets between them and the cello results in a low synchrony score for this passage (0.467, compared to 0.604 if all accompanying parts are treated as one). However, in this example, it should be noted that the cello is somewhat distinct from the other accompanying parts, given differences in pitch register and articulation. This internal layering of the accompaniment is likely to have a lesser influence on perceived stream separation than the melody/accompaniment distinction of the complete texture; it, therefore, suggests a more hierarchical relationship between streams.

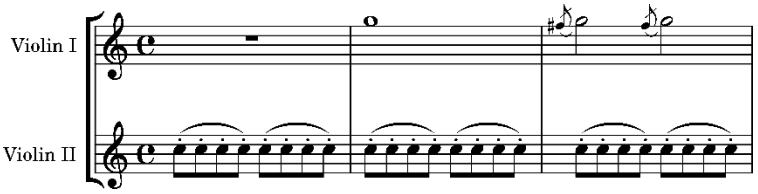

Fig. 2. Joseph Haydn, String Quartet in C major, Op. 33, No. 3, first movement, mm. 1–3.

Likewise, the use of note repetitions in a single part will impact onset synchrony. Repeating a single pitch to create a sustained effect (such as in Haydn, Op. 33, No. 3, see Figure 2) may lower synchrony as the number of onsets in one part increases. Changing the frequency of repetitions, either increasing to sixteenth notes or decreasing to quarter notes, will change the synchrony between parts but may not affect perceived strength of stream separation.

Even though these features are common in the classical string quartet repertoire, none of this is to say that onset synchrony is a particularly unsuitable measure of overall polyphonic or contrapuntal texture, but rather to highlight that these features introduce noise and uncertainty that should be considered when interpreting the results of this corpus study.

CONCLUSIONS

As an exercise in empirical musicology, it is interesting to see how far De Souza, Dvorsky, and Oyon's (2024) measure of polyphonic texture can be taken before more concrete considerations of streaming are needed. In this case, the evidence suggests that the measure is sufficient to make meaningful comparisons between exposition and development section textures—indeed, developments possessed significantly lower onset synchrony than expositions.

There are several useful possible extensions to this research. Foremost among these is the need for further experiments that use a greater number of string quartet sonata form movements and from a greater variety of composers. This would provide much more convincing evidence of larger stylistic trends in the structural use of texture. Extending these same methods to other sonata form works, such as classical piano sonatas, would also likely be fruitful; however, this may require some reformulation of the measure to account for more arbitrary creation and merging of voices—becoming even more reliant on perceptual theories of stream segregation.

While it seems inevitable that a more complete measure of texture will eventually have to incorporate harmonic and melodic pitch information, an interesting extension of the present work could explore more nuanced onset synchrony measures. Some alternative measures may be more robust to the problems presented by string quartet writing discussed above, such as dealing with tacet sections or multiple-

instrument accompaniment patterns. It would also be interesting to see if onset density can be used to predict section texture (on its own or in combination with onset synchrony).

Finally, the comparison of onset synchrony within exposition subsections failed to find any significant differences between primary themes, transitions, secondary themes, and closing zones. However, the contrast in textures of primary and secondary themes might be more interesting at this level, rather than the extent to which one section is more polyphonic than another.

ACKNOWLEDGMENTS

This article was copyedited by Niels Chr. Hansen and layout-edited by Jonathan Tang.

NOTES

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