Towards a Hybrid Theoretical Model for Neoclassical Music: Schenkerian, Neo-Riemannian and Pitch-Class Set Theories

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Towards a Hybrid Theoretical Model for Neoclassical Music: Schenkerian, Neo-Riemannian and Pitch-Class Set Theories
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Abstract

This thesis explores the necessity for theoretical hybridity as an analytical tool to overcome the challenges faced in works that embody both tonal and post-tonal elements. This hybridised model responds to the lack of a single theory that accounts for neoclassical harmonic practices: Schenkerian methods prove useful in drawing out different structural levels whilst Neo-Riemannian theory recognises non-traditional chordal relationships, and the application of set theory can fill the gaps where none of the aforementioned methods are applicable. Although some have responded to this problem by extending the individual methods' application (e.g. Baker, 1990) or by simultaneously using more than one analytical approach (e.g. Cinnamon, 1993; Pople, 1989), none of these authors have fully integrated the methods into one unified approach. And despite the large body of research that has examined perceptions of tension in tonal (Lerdahl and Jackendoff, 1983) and atonal (Dibben 1999) harmonies, there is no work that explores the perception of post-tonal harmonies.

The project begins with an appraisal of literature surrounding the conceptual issues around hybridity within music and various existing combined approaches to analyse music. This is then followed by the methodology – Voice-leading (VL) Reduction, Rhythmic Segmentation and Calculation, Beat-Class BC Set Theory, and an experimental enquiry into the measurement of post-tonal harmonic tension – exemplified through selected sections from a small number of studies: *Mathis der Mahler* by Paul Hindemith, "Tanec Loutek" (No. 5) from *Puppets* by Bohuslav Martinu, *Passacaglia* by Aaron Copland, *Violin Concerto in D Minor* by Ralph Vaughan Williams, *Sonata No. 3* by George Enescu, *Sonatine* by Maurice Ravel, *Piano Sonata No. 2* by Paul Hindemith, and *Concerto for Piano and Wind Instruments* by Igor Stravinsky.

The application of the model is then carried out through two complete case studies: First Movement of Hindemith's Second Piano Sonata, and the first movement of Stravinsky's *Concerto for Piano and Wind Instruments*. My analyses first perform the three approaches separately, before synthesising the results. To determine which pitch collections will be examined, the music is segmented into its core beat classes. My voice-leading analysis overlays three systems (treble and bass voice-leading reductions, pitch collection), describing the transformation between pitch collections. Line graphs chart the voice-leading movement between pitch collections against the treble voice-leading reduction, capturing the correlation between the melodic and harmonic factors. The rhythmic-phrase analysis is then integrated into the diagrams as a set of tables detailing its different hierarchies. The results reveal the correlation between middleground layers and phrase design, and between rhythmic features

and other musical parameters. In all, the detailed examination of different musical parameters reveals that this hybridised model enables a comprehensive structural narrative for each piece, filling in existing theories' lacunae by revealing a more detailed explanation of the harmonic content, an enriched middleground chart, and its articulation in other musical parameters. This thus reveals the model's potential to revolutionise analytical approaches to neoclassical compositions and to understand their compositional techniques. Current findings also indicate that these graphical representations account for all types of chords as pitch collections and illustrate the relationship between each vertical sonority; that the aggregated voice-leading movement (AVL) – the total amount of voice-leading movement – can better account for the identification of post-tonal closure, and the results from the empirical study suggest that external factors need to be accounted for along with the AVL in order to relate theoretical to perceived tension.[1]

This research will therefore not only contribute to post-tonal theory and analysis but also to music perception, to understand better how we conceive harmonic tension in music that embodies tonal and atonal elements.

[1] Not all analytical charts were digitised due to its complex nature.

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Chapter 1

Background

1.1 Introduction

How would one employ musical theories and analytical approaches to tackle the analysis of music that encompasses both tonal and post-tonal qualities? Would one method suffice or would multiple methods need to be used simultaneously? Theoretical hybridity is one way to address this, by employing more than method to explore the different features within the music, but what problems would one encounter when using more than one theory? What are the problems inherent in the target repertoire that necessitate a synthetic approach? Neoclassical music is one such body of music that embodies post-tonal and tonal qualities and requires a synthetic approach.

Neoclassicism, an early twentieth-century trend, can be defined as a mode of composition that revisits and adapts eighteenth-century forms while employing expanded or post-tonal harmonic means. This term however, does have problematic roots. What exactly constitutes neoclassical music? Does this comprise a corpus of works composed within a time specific period, from 1910 to 1950? Or is it the use of specific forms, genres and styles of pre-Romantic period by composers? Or is it the treatment of harmony, a mixed use of tonal and post-tonal elements? This trend of music, which originated in France to rebel against German Romanticism, has been associated with traits such as irrationality, yearning, individualism, nationalism and intense emotions.[2] Burkholder for instance, has stated that "the combination of classic and new traits is quintessentially neoclassical"[3] As such, the underlying compositional processes in this repertoire will tend to be of a mixed nature, which then poses several different problems, from historical, compositional and analytical perspectives.

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[2] *Le Tombeau de Couperin* by Ravel is one such example, borrowing ideas from different kinds of music – French art, popular national traditions, Viennese waltz rhythms, Romani style, Spanish idioms, Classical traits (minuet rhythm, melodic style, ornaments) – invoking a style reminiscent of Couperin. Paul Hindemith's symphony, *Mathis der Maler*, reflects Classical traits in through his contrapuntal writing as well as a chromatically driven harmony. Similarly, Igor Stravinsky's choral symphony, *Symphony of Psalms* consisted of the use of the octatonic scale as well as the use of fugal counterpoint, reminiscent of Renaissance and Baroque church music.

[3] J. Peter Burkholder, Donald Jay Grout and Claude V. Palisca, *A History of Western Music* (W.W Norton and Company: New York, 2014) 798.

Focusing on a theoretical and analytical viewpoint, one conceptual issue that arises from this is of theoretical ambiguity. What readings would these theories offer? There are indeed many different analytical tools that can assist with this repertory, for instance, a Schenkerian perspective would draw out the work's tonal structure and syntax; neo-Riemannian theory would draw out triadic relationships in chromatic music; and beat-class set theory, defined formally by analogy to pitch-class set theory, would draw out sets of rhythmic and phrase features to analyse such music.

These three well-known approaches when used separately will undoubtedly provide insights in accordance to its theory but what if elements of these methods are combined? This may provide an enriched and more thorough reading of neoclassical music. The challenging task therefore, is to find the point of intersection where different bodies of theory can coexist and complement each other. Although theorists in the past have attempted to use more than one approach simultaneously to delve into the analysis, none have fully attempted to integrate the methods together.

Given the overarching concerns driven by neoclassicism and the lack of an analytical tool that can fully delve into this body of music, there is perhaps one solution to tackle the analytical issues posed by neoclassical repertoire: hybridity.

1.2 Hybridity – Definition and Background

The term hybridity invokes and essentially suggests mixture – the combination of two separate elements. Hybridity has been used across a wide range of disciplines, originating as a term in the biological sciences[4] before being used in discussion of topics and issues relating to globalisation[5], law and human rights[6], multiculturalism, art[7], linguistics[8], education and post-colonialism[9]. Outside of its use in the sciences, hybridity was first used to describe the key feature of colonial racism, categorising and separating different "races".[10] There are

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[4] Hybridity in biology implies mixture, which can occur naturally or with human influence. This has been regarded as an aberration and at times, as a weaker or diseased mutation.

[5] An example of globalisation includes the notion of cultural pluralism and hybridity being seen as a disaster risk reduction, an interrelation of global processes, mixing indigenous people with locals to assist in disaster risk reduction (Rachel Shannon, Max Hope and John McCloskey, "The Bengkulu Premonition: Cultural Pluralism and Hybridity in Disaster Risk Reduction," *Area* 43.4 (2011): 449–455) Another example includes cultural hybridisation as a globalisation of culture, encouraging plural coexistence of inter-Asian cultures. This discourse provides a richer theoretical alternative, an adaptation and active articulation of global processes as well as reimagining regional identities through reciprocal cultural exchanges in local/global contexts (Woongjae Ryoo, "Globalization, or the Logic of Cultural Hybridization: The Case of the Korean Wave," *Asian Journal of Communication* 19.2 (2009): 137–15).

[6] Numerous scholars such as Visoka, Lemay-Hébert and Freedman suggest that hybridisation is necessary, as a critical lens that can assist in systematic and empirical analyses (Gëzim Visoka, "From Hybrid to Cybrid? The Formation and Regulation of Online 'Hybrid' Identities," in *Hybridity: Law, Culture and Development*, edited by Nicolas Lemay-Hebert and Rosa Freedman (New York: Routledge, 2017), 218–234. More references can be found in the Bibliography.

[7] Art shares concerns with other disciplines where one would reflect on social, political, emotional and philosophical aspects of life. When combined with electronical components – unpredictable qualities of conversational interaction with reciprocal rhythms, body language, speech patterns – you will become engaged in a process of meaning. One will therefore be engaging in active forms between two entities (Eduardo Kac, "Negotiating Meaning: The Dialogic Imagination in Electronic Art," *Proceedings of Computers in Art and Design Education Conference* (1999): http://www.ekac.org/dialogicimag.html)

[8] Linguistic examples include languages such as pidgin and creole, both of which prompted the initial use of the term by Mikhail Bakhtin, a linguist and cultural theorist, who used it to discuss the disruptive and ever-changing power of multivocal language situations as well as multivocal narratives. This explores the "dual dynamics" of the active and passive voice, between organic/unconscious hybridity or intentional hybridity (Bob Fecho and Stergios Botzakis, "Feasts of becoming: imagining a literacy classroom based on dialogic beliefs: Mikhail Bakhtin's writings on the dialogic nature of language are the framework for this article," Journal of Adolescen*t and Adult Literacy* 50.7 (2007):548-558)

[9] In postcolonial discourses, hybridity challenges the idea of essentialism, the notion of identity and form.

[10] (Bill, Ashcroft, Gareth Griffiths, and Helen Tiffin *Post-Colonial Studies: The Key Concepts* (London: Taylor & Francis Routledge, 2000); Robert Young, *Colonial Desire: Hybridity in Theory, Culture, and Race* (Oxford: Routledge, 1995); Peter Burke, *Cultural Hybridity* (Cambridge: Polity Press, 2009); Kelvin Meethan, "Mobile Cultures? Hybridity, Tourism and Cultural Change," *Tourism and Cultural Change* 1.1 (2003): 11–28; Nikos

however, conceptual ambiguities with this term: although a combination of elements can create an “enlightened diversity”, chaos can occur.[11] To what extent does one element prevail over another? Are these elements balanced?

More recent use of hybridity carries a more positive connotation, as a positive representation of cultural change and creativity and acknowledgement that hybridity is created through “an encounter with difference.”[12]

One leading scholar in this field, Homi Bhabha, advocates hybridity as a fusion of existing cultures, the process of the emergence of a culture, where elements are continually transformed or developed through different “encounters.”[13] He locates the margin where cultural differences that come into contact and conflict, thereby suggesting that hybridity invents new connections. Bhabha also proposes that hybridity implies the creation of a “third space of enunciation”, in which elements of distinct entities converge into a shared environment.[14] He states,

> It is significant that the productive capacities of this Third Space have a colonial or postcolonial provenance. For a willingness to descend into that alien territory . . . may open the way to conceptualizing an international culture, based not on the exoticism of multiculturalism or the diversity of cultures, but on the inscription and articulation of culture’s hybridity.[15]

In other words, hybridity can be perceived as a model, comprising an “n space”, whereby n can constitute any number of elements, converging into a shared space. Likewise, Robert Young’s contribution to post-colonial discourse analysis suggests that hybridity

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Papastergiadis, “Tracing Hybridity in Theory,” in *Debating Cultural Hybridity Multi-Cultural Identities and the Politics of Antiracism*, edited by Pnina Werbner and Tariq Modood (London: Zed Books Ltd., 1997), 257–281; Peter Wade, “Hybridity Theory and Kinship Thinking,” *Cultural Studies* 19.5 (2005): 602–621.

[11] Marwan M. Kraidy, *Hybridity, or the Cultural Logic of Globalization* (Philadelphia: Temple University Press, 2005)

[12] “Hybridity,” *Oxford Reference,* published January 2009, https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095952517. Despite racial assertions for purity, the crossing of racial and cultural boundaries have been argued to be a normative feature in the development of society

[13] Homi Bhabha, *The Location of Culture* (Oxford: Routledge, 1994).

[14] Bhabha, *The Location of Culture*, 38.

[15] Bhabha, *The Location of Culture*, 38.

> …provides a significant framework for that other work by emphasising that all perspectives on colonialism share and have to deal with a common discursive medium which was also that of colonialism itself: . . . Colonial discourse analysis can therefore look at the wide variety of texts of colonialism as something more than mere documentation or 'evidence'.[16]

Young however, like Bhabha, advocates a more positive use of the term, that there are claims to its own authenticity and argues for a less political application.[17] Kraidy also suggests an "intercontextual theory of hybridity" in cultural globalization, where under certain conditions and contexts, ideological elements will coalesce in a certain discourse of hybridity, a tool to assist in answering questions and resolving issues.[18]

Hybridity can be contrasted with its polar opposite concept, authenticity, and this can be further extended to two other binary concepts:

Authenticity	VS	Hybridity
Singularity	VS	Plurality
Monologism	VS	Dialogism

Figure 1. Hybridity and Binary Concepts

From one perspective, "authenticity" can be viewed as a form of singularity, the embodiment of an identity true to one's self.[19] Plurality can therefore be seen as a product of hybridity, a

[16] Young, *Colonial Desire*, 163.
[17] For example, Michael Bakhtin employs a political use of the term, embracing subversion and challenge of division and separation, setting different views against each other, creating conflict, which creates "a certain elemental, organic energy and openendedness" (Young, *Colonial Desire*, 21–22).
[18] Marwan M. Kraidy, "Hybridity in Cultural Globalization," *Communication Theory* 12.3 (2006): 316–339.
[19] The term, authenticity, is used in psychology, philosophy, cultural studies and aesthetics. In existential philosophy, authenticity is linked to one's identity. In music, philosophers long debated whether jazz can be seen as authentic and inauthentic and whether subcultures such as punk rock and heavy metal are authentic or simply created from popular culture. ("Authenticity", *Stanford Encyclopedia of Philosophy*, published September 2014, https://plato.stanford.edu/entries/authenticity/; Alex Wood, P. Alex Linley and John Maltby,

combination or mixing of several distinct elements. Although the polarisation of these concepts can be extended in many other ways, the stark contrast between monologism and dialogism in particular is important to highlight as there are parallels with hybridity as well. In education, practitioners are advocating for a dialogic over a monologic learning environment, employing Bakhtin's dialogism, celebrating polyphony and heteroglossia, claiming that this will contribute to a modern and effective theoretical framework for learning and teaching processes.[20] The idea of celebrating polyphony and heteroglossia are two key concepts crucial to hybridity, essentially establishing the importance of the coexistence of differences, distinct elements and varying viewpoints. If the concept of hybridity is an integral process and component for learning and research in various other disciplines, surely there is a place for it in music. How can we then theorise hybridity as an integral "component" in our musical scholarship?

1.3 Hybridity and Musicology

In music, the application of hybridity can be first seen in the late 1980s and 1990s, explored by scholars and critics in North America, as a way to describe "musical mixtures that are explicitly enmeshed in identity politics, most often involving racial and ethnic identity, and its effect on culture".[21] This perspective transcends previous definitions of hybridity, which often referred to "mixture involving genre or form". One of the most well-known ways in

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"The Authentic Personality: A Theoretical and Empirical Conceptualization and the Development of the Authenticity Scale," *Journal of Counseling Psychology* 55.3 (2008): 385-399; Hugh Barker and Yuval Taylor, *Faking it: The Quest for Authenticity in Popular Music* (New York: WW Norton and Co, 2007).

[20] Hybridity in education can be seen in two ways: dialogism vs monologism and how hybridity is needed for modern education and teaching practices. (Gomilko, Olga, Denys Svyrydenko and Sergii Terepyshchyi. "Hybridity in the Higher Education of Ukraine: Global Logic or Local Idiosyncrasy?" *International Society of Philosophy and Cosmology* 17 (2016): 177–199; Ali Jamali Nesari, "Dialogism versus Monologism: A Bakhtinian Approach to Teaching," *ScienceDirect* 205 (2015): 642–7; Allan Irving and Tom Young, "Paradigm for Pluralism: Mikhail Bakhtin and Social Work Practice," *Social Work* 47.1 (2002): 19–29; Fatemeh Shirkhani and Ali Jamalinesari, "Monologism versus Dialogism: A Bakhtinian Approach to Teaching" *Journal of Advances in English Language Teaching* 3.2 (2015): 27–40.

[21] Kariann Goldschmitt, "Hybridity," *Grove Music Online*, published January 31, 2014, https://www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-1002256796. A more rudimentary view of hybrid in music can be seen in instruments that embody features of two or more different types. For instance, examples of modern hybrid instruments include bassoforte (electric bass, guitar and piano) and experibass (parts of bowed instruments). The earliest presence of the hybrid instrument can be seen in the Renaissance. ("Hybrid," Laurence Libin, *Oxford Music Online*, last modified March 26, 2018, http://www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-3000000087)

which hybridity can be seen in music, therefore, is within cross-cultural music studies, raising the problematic of authenticity or musical purity against multiculturalism.[22]

Over time, these hybrids could be perceived as "authentic musical expressions" through a mixture of genres, demonstrating a confusion and entanglement between two opposite concepts.[23] Theorising hybridity in this context raises two key issues: balance and assimilation;[24] and a postmodernism.[25] As stated by Bruno Nettl, hybridity plays a large role in postcolonial music, as a result of cultural changes (e.g. within realms such as literature, art and music), how the colonised and the colonists affected and influenced one another.[26] Beyond the scope of cross-cultural musical studies, hybridity can be seen in composition, performance, musicology and more importantly, within music theory and analysis.

Within composition, hybridity can be seen across throughout the course of history, from the beginning of Renaissance to contemporary music today. Composers would frequently explore and combine different compositional techniques (e.g. Vaughan Williams' interest in Renaissance music combined with fashionable trends of the time), mixing different nationalistic features (e.g. folk music influences in the music of Vaughan Williams; French

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[22] Further examples include combinations of eastern and western musical elements, representation of different cultures in pop media, emergence of nationalistic music from colonialism. (Paul Gilroy, *The Black Atlantic: Modernity and Double Consciousness* (Cambridge: Verso, 1993); George Lipsitz, *Dangerous Crossroads: Popular Music, Postmodernism, and the Poetics of Place* (London: Verso, 1994); Lonán Ó Briain, *Musical Minorities: The Sounds of Hmong Ethnicity in Northern Vietnam* (Oxford: Oxford University Press, 2018); Steven T.S. Terpenning, "Choral Music, Hybridity, and Postcolonial Consciousness in Ghana" (Ph.D., University of Colorado, 2017); Edwin Seroussi, "Translating from Nothing and Everything: Israel's Habrera Hativeet ('Natural Gathering') in Retrospective," *Journal of Mediterranean Studies* 21.2 (2012): 277–293; Jo Haynes, "World Music and the Search for Difference," *Ethnicities* 5.3 (2005): 365–385; Olivia Ashley Bloechl, Melanie Diane Lowe and Jeffrey Kallberg, *Rethinking Difference in Music Scholarship* (Cambridge: Cambridge University Press, 2015).

[23] Simon Frith, "The Discourse of World Music," in *Western Music and Its Others: Difference, Representation, and Appropriation*, eds. Georgina Born and David Hesmondhalgh (Berkeley: University of California Press, 2000), 305-322; Timothy Taylor, *Beyond Exoticism: Western Music and the World* (Durham: Duke University Press, 2007); This can also be seen in music production, where world music and ethnic music hybrids coexist in electronic dance music, replicating colonial power imbalances (John Hutnyk, *Critique of Exotica: Music, Politics, and the Culture Industry* (London: Pluto Press, 2000))

[24] Sunaina Maira, *Desis in the House: Indian American Youth in New York City* (Philadelphia: Temple University Press, 2002); Alejandro Madrid, *Nor-Tec Rifa! Electronic Dance Music from Tijuana to the World* (New York: Oxford University Press, 2008)

[25] Nestor García Canclini, *Hybrid Cultures: Strategies for Entering and Leaving Modernity* (Minneapolis: University of Minnesota Press, 1995)

[26] Migrants will undoubtedly bring on board their own culture, which will contribute to the fusion of different cultures, musical instruments, sound, structure. The result of this therefore, is a new sound that simply cannot be compartmentalised into a single cultural category. Nettl provides three common responses to Western influences: one, retaining one's own culture; two, complete Westernisation and three, adaptation towards modernization (Bruno Nettl, *The Study of Ethnomusicology: Twenty-nine Issues and Concepts* (Urbana: University of Illinois Press, 1983).

and Spanish influences in the second movement of Claude Debussy's *Estampes*; presence of exoticism in Ravel's *Daphnis et Chloé* and Debussy's *Syrinx for Flute Solo*; the influence of orientalism in 19th century Russian operas such as Nikolai Rimsky-Korsakov's *Scheherazade*, Alexander Borodin's *Prince Igor* and Mily Balakirev's *Islamey*) and often as a result, the creation of a work of a new style or of a mixed nature, an amalgamation or synthesis of different elements.[27] In many cases today, the use of non-western and western musical elements into compositions is attractive to both composers and academics, to explore its potential and the rich insights that they will produce.[28] This encourages a sense of musical plurality, the understanding of different nations and cultures, which therefore necessitates a systematised approach for study.

Beyond the appearance of hybridity in composition, the underpinnings of this concept are also apparent in performance studies as well. The act of performing can be seen as a hybridised process. When one realises music, many thought processes come into play: the extent of historically informed practices (HIP), engagement with external influences such as listening and learning from professional recordings, the extent to which one can embody their own musical identity and interpretation within performances.[29] From this, there are two key topics that relate directly to hybridity: one, interpretation: the process in which one realises the music stems from a hybrid approach (e.g. learning from teacher/s, professional recordings and adding) and two; Authenticity: what constitutes an authentic performance? Does authenticity mean a strict adherence to stylistic practices of the time? How much personal identity can one have in a performance? [30]

[27] Christopher Adler, "Cross-cultural Hybridity in Music Composition," [Unpublished Work] 1998, *www.christopheradler.com/hybridity98.pdf;* Orlando Figes, *Natasha's Dance: A Cultural History of Russia* (New York: Metropolitan Books, 2002).

[28] For example, Lou Harrison describes the increasing use of non-western musical elements into compositions and Wim van der Meer proposes a systematic approach to study hybridity of music cultures (Audrey Wozniak, "Orientalism, Regionalism, Cosmopolitanism: Musical Manifestations of Cultural Hybridity" (Honours Diss., Wellesley College, 2014), 1–28; Wim van der Meer, "The Systematic Approach in Studying Hybridity of Music-Cultures," *Journal of the Indian Musicological Society* (2006): 17–29)

[29] John Butt, *Playing with History* (Cambridge: Cambridge University Press, 2002); Jeffrey Kite-Power, Stewart Carter and Steward Carter, *A Performer's Guide to Seventeenth Century Music* (Bloomington: Indiana University Press, 2012)

[30] Peter Walls, "Historical Performance and the Modern Performer," in *Musical Performance: A Guide to Understanding*, edited by John Rink (Cambridge: Cambridge University Press, 2002), 17-34; Stan Godlovitch, "Performance Authenticity Possible, Practical, Virtuous," in *Performance and Authenticity in the Arts*, edited by Salim Kemal and Ivan Gaskell (Cambridge: Cambridge University Press); 154-74

As for musicology, this broad domain of study encompasses a wide range of different branches, from historical to philosophical to psychological perspectives. It can be argued that each of these differing perspectives will undoubtedly employ the third space, whereby the discussion of one's findings will employ the music and the relevant branches. For instance, a historical musicological study can consist of an understanding of the music through an in-depth discussion of the performance reception, criticism and historical context. There are many existing studies covering a wide scope of music, which delve into differing branches of musicology, produce findings that can be considered of a hybrid nature, an amalgamation of musical and extra-musical elements.[31]

Hybridity however, can extend beyond the realms of these three categories (composition, performance, musicology), and can similarly be applied into an interdisciplinary study within music. But more specifically, for musical analysis, some common approaches can include the following: analysis and philosophy[32]; analysis and history[33]; analysis and performance[34]; and analysis and music cognition[35]. By employing two interdisciplinary approaches, this will undoubtedly reveal different insights to the work, further enhancing the analysis of the music. Given the inherent theoretical issues one faces when tackling neoclassical music, hybridity is one way to answer this. The analytical application of hybridity, which creates a multi-layered space, and can afford deeper insights into neo-classical music. Though hybridity is apparent in other subdisciplines within musicology, what does hybridity mean for music theory and

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[31] Some common examples include the perception of Wagner's leitmotivs, Brahms and the sublime and the understanding of the historical context surrounding compositions, like Schubert. (David Baker and Daniel Müllensiefen, "Perception of Leitmotives in Richard Wagner's Der Ring des Nibelungen," *Frontiers in Psychology* 8.662 (2017), https://doi.org/10.3389/fpsyg.2017.00662; Michael Vaillancourt, "Brahms and the Historical Sublime," *International Review of the Aesthetics and Sociology of Music* 46.1 (2015): 73–94; Lauri Suurpää, *Death in Winterreise: Musico-Poetic Associations in Schubert's Song Cycle* (Bloomington: Indianna University Press, 2014))

[32] Stephen Davies, *Musical Understandings & Other Essays on the Philosophy of Music* (Oxford: Oxford University Press, 2011), 21–33; Julian Dodd, "Musical Works: Ontology and Meta-ontology," *Philosophy Compass* 3.6 (2008): 1113–1134

[33] Milena Medic and Milos Zatkalik eds. *Histories and Narratives of Music Analysis* (Cambridge: Cambridge University Press, 2013); Leon Platinga, *Romantic Music: A History of Musical Style in Nineteenth-Century Europe* (New York: Norton, 1984)

[34] Nicholas Cook, "Methods for Analysing Recordings," in *The Cambridge Companion to Recorded Music* , edited by Nicholas Cook, Eric Clarke, Daniel Leech-Wilkinson and John Rink (Cambridge: Cambridge University Press, 2011), 221-45; Janet Schmalfeldt, "On the Relation of Analysis to Performance: Beethoven's 'Bagatelles' Op. 126, Nos. 2 and 5," *Journal of Music Theory* 29.1 (1985): 1–31

[35] Ian Cross, "Music Analysis and Music Perception," *Music Analysis* 17.1 (1998): 3-20; Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge, MA: MIT Press, 1983); Eugene Narmour, *The Analysis and Cognition of Melodic Complexity: The Implication-Realization Model* (Chicago: Chicago University Press, 1990); Lawrence M. Zbikowski, *Conceptualizing Music: Cognitive Structure, Theory, and Analysis* (Oxford: Oxford University Press, 2005)

analysis? Is this necessary? As discussed earlier, the idea of hybridity does encourage a sense of plurality, stimulating multi-faceted thinking and approaches. Much like its problematic use in non-music disciplines, the positive and negative valencies seen through the different applications of hybridity in the wider discipline can be seen in music theory as well.

Although the application from multiple bodies of theories would produce analyses that encompasses more than one parameter, there is still a bigger question that needs to be resolved. As stated by Cohn, in response to an article by Cook, "the great challenge for music analysis is to find a way to chart the processes of contradiction between plural autonomous entities in individual compositions, and the great challenge for music theory is to map the terrain on which the plural unities engage with one another."[36]

How can different music theories work together? Is it better to achieve synthesis, an approach that combines different elements? Or is it more fruitful to create a shared space, an environment where the different theories can coexist without any significant merging? I propose that the tension and conflict created from performing a synthesis of music theories generates tensions which ultimately may be unresolvable. As such, I argue that in order for theoretical hybridity to be effective, especially when dealing with theories that bear no mutual relationships, for this to become a useful analytical tool, it is more efficient to allow the theories' strengths to be individually expressed; the challenging task then lies ultimately with the theorist to seek out meaningful ways to employ the different methods, to give a voice to the respective method. In addition, there must be a purpose for performing theoretical hybridity: How will this add to our knowledge of the music? What are the limitations of existing analytical tools that necessitate a synthetic approach? What is its significance?

In 1989, Kofi Agawu stated, in an article as part of a special issue, "The Future of Theory," that the future of music theory lies in pluralism.[37] Agawu believes that pluralism devalues the significance of music theory as there is a growing need for the discipline to expand into interdisciplinary areas, resulting in what he would call a shift from 'hard' to 'soft' theory.[38]

[36] Richard Cohn, "Schenker's Theory, Schenkerian Theory: Pure Unity or Constructive Conflict?," *Indiana Theory Review* 13.1 (1992): 1–19.
[37] Kofi Agawu, "The Future of Music Theory," *Indiana Theory Review* 10 (1989): 66–67.
[38] Agawu 67.

However, this need not be the case; we should encourage plurality, particularly if we want to obtain an enriched set of data from music. As we are all well aware that different analytical tools will yield significantly different results, playing to theory's strengths, in order to obtain a holistic view of the piece, other analytical techniques will need to be considered, perhaps by using more than one tool in the analytical process. Is it possible to have a total theory? Can there be a theory that is "complete"[39]?

Another author from the same issue, Fred Maus, supports the idea of plurality, particularly in examining repertories beyond tonality and early twentieth-century modernism. [40] He states,

> If music theorists actively pursue discursive diversity, the "theory community" will not be analytical, theoretical, or metatheoretical approaches. Instead, there will be overlapping subcommunities, constituted by shared musical and linguistic preferences. The richer the variety that theorists achieve, the greater the certainty of mutual incomprehensibility among some music theorists. We should think of it as exciting, rather than problematic, that people will talk about music in ways that we cannot immediately understand.[41]

From a musical perspective, pluralism can perhaps be likened to a fugue, a polyphony of discourses, potentially a powerful tool in the discipline of theory and analysis. It can perhaps be suggested that a pluralistic approach is a pathway that analysts can take, especially when an analytical tool cannot fully account for certain musical features, in order to fill in the gaps in works.

Although Maus' article was published 1989, there is something that needs to be said, a unifying theme amongst the responses: that music theory will evolve into a discipline that can be used alongside other subdisciplines within musicology (e.g. history, performance, psychology, philosophy) and as a result, developing invaluable interdisciplinary skillsets. Therefore, it can be stated that music theory is an ever-evolving discipline, not a static one. As the previous section has provided several examples engaged in music hybridity within its

[39] This ultimately suggests that hybridity is indigenous to all music theories, and not limited to those that explicitly deal with heterogenous repertoire
[40] Fred Everett Maus, "The Future of Music Theory," *Indiana Theory Review* 10 (1989): 92–95.
[41] Maus 95.

different disciplines, this section will engage with music hybridity within music theories. One way therefore, to demonstrate pluralism, a subset of hybridity, is by employing more than one theoretical approach and embedding different analytical techniques in our musical examination. Attempts have been made to extend some existing methodologies as well as applying theoretical approaches in conjunction with interdisciplinary areas. Some common hybrid approaches include the combination of Schenkerian and Neo-Riemannian Theories; Neo-Riemannian Theory and Pitch-class Set Theory; and Formal Theory and Schenkerian Theory.

1.4 Theoretical Hybridity in Post-Tonal Music

One recurring approach that theorists often pursue when analysing post-classical repertoire is the extension of various existing methods. Extending existing theories with a well-established syntax, such as Schenkerian theory, comes with its own problems and has been greeted with hostility.[42] But if Schenkerian theory for example, were to be treated as a purely conceptual framework, its application can go beyond the tonal realm.[43]

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[42] Theorists such as Ernst Oster believes that modifications of the Schenkerian principles would undermine its concept of closed systems, resulting with a meaningless analysis (Ernst Oster, "Re: A New Concept of Tonality (?)," *Journal of Music Theory* 4 (1960): 96). Similarly, Adele Katz believes that a new technique or approach is needed to deal with post-tonal repertoire as this music embodies a different concept of coherence and unity, breaking away from triadic tonality (Adele T. Katz, *Challenge to Musical Tradition: A New Concept of Tonality,* New York: Da Capo, 1972). George Perle also believes that the unique structures that are embodied in atonal composition need to be analysed within its own context (George Perle, *Serial Composition and Atonality,* Berkeley: University of California Press, 1977).

[43] As a means of extending the Schenkerian theory post twentieth century works, Schenkerian theory has also been utilised in jazz repertory. The difficulties when analysing jazz music using strict Schenkerian method occurs in two folds: the idea of a linear motion towards a goal; and the notion that prolongation is more important than progression (e.g. cadential goal). Hybridisation in this instance can be seen in the amalgamation of jazz elements into a Schenkerian reading. Although the theory's application to jazz can somewhat be regarded as unusual, it does show the integration of its different formal sections as well as the interaction of different instrumental parts. For example, Steve Larson incorporates jazz harmonic idioms into a Schenkerian reading of a jazz piece, by acknowledging 9$^{\text{th}}$s and 11$^{\text{th}}$s as integral components of a chord. (Steve Larson, *Analyzing Jazz: A Schenkerian Approach.* New York: Pendragon Press: 2009.) This can also be seen David Heyer's work into analysing "mainstream" jazz. As this corpus of repertoire is still tonal, a relationship to common-practice music can be established through the use of the Schenkerian method yet Heyer demonstrates ways in which the method can be transcended, in order to better account for the jazz harmonic idioms. (David J. Heyer, "Applying Schenkerian Theory to Mainstream Jazz: A Justification for an Orthodox Approach," *Music Theory Online* 18.3 (2012): 1–13.) Similarly, Henry Martin sketches new forms of the *Urlinie*, a list of modifications to Schenkerian theory, for a renewed insight of tonal jazz repertoire. (Henry Martin, "More Than Just Guide Tones: Steve Larson – Steve Larson's *Analyzing Jazz – A Schenkerian Approach*," *Journbal of Jazz Studies* 7.1 (2011): 121–144; Henry Martin, "Schenker and the Tonal Jazz Repertory," *Tijdschrift voor Muziektheorie* 16.1 (2011): 1–20.) However, with the use of theoretical hybridity, theoretical hybridity is necessary in overcoming the inherent problems when analysing jazz music, and more specifically, tonal jazz repertoire. All this simply illustrates how a conceptual framework can spur the development of new or enhanced theoretical systems.

An instance of hybridity can be seen in extending the notion of voice-leading and application of pitch class set theory, a concept Kim introduced to approach atonal music based on cognitive considerations, where there is an emphasis on establishing smooth voice-leading, organising pitch class sets with the same cardinality.[44] She incorporates Schoenberg's signature set, the 6-Z44 hexachord, Cohn's four systems of maximally smooth cycles and Forte's PC sets to create a smooth voice-leading system.[45] This voice-leading system will be extremely applicable to atonal music, in understanding the interval contents that play a crucial role in progressions of pitch class sets. Her introduction of voice-leading systems being grouped by pitch-class sets' string interval contents also contain a strong consideration of motives, how listeners hear the music, acknowledging the role of cognitive psychology in this method.[46] Another example of theoretical hybridity can be seen through Schenkerian method and pitch-class set theory. Schenkerian method has often been used in conjunction with pitch-class set theory, in order to better account for the melodic and harmonic content of the music.[47] Miguel Roig-Francoli for instance, suggests that for pedagogical purposes, it is possible to employ what he named "pitch-class set extension" in place of conventional Schenkerian long-range pitch connection.[48]

Literature engaging with post-tonal repertoire has repeatedly exposed problems of hybridity.[49] Post-tonal music, particularly in the neoclassical repertoire, poses the dilemma of how one represents its tonal and atonal organisational principles. As Roy Travis states, music can be described as tonal "when its motion unfolds through time a particular tone, interval or chord" and if the terms "unfolding" and "prolongation" are interchangeable in post-tonal music, then this will imply that prolongation is created by motion between statements of the tonic "sonority". As such, a post-tonal work can be described as tonal when "any pitch or

[44] Yeajin Kim, "Smooth Voice- Leading Systems for Atonal Music" (Ph.D., Ohio State University, 2013), 1-129.
[45] Kim, "Smooth Voice- Leading," 61-128.
[46] Ibid 17-19.
[47] Michiel Schuijer, *Analyzing Atonal Music: Pitch-class Set Theory and Its Contexts* (Rochester: University Rochester Press, 2008)
[48] Miguel A. Roig-Francoli, "A Theory of Pitch-Class-Set Extension in Atonal Music," *College Music Symposium* 41(2001), https://symposium.music.org/index.php/41/item/2179-a-theory-of-pitch-class-set-extension-in-atonal-music#x2
[49] The concept of hybridity was theorised by Homi Bhabha, a leading figure in contemporary cultural discourse. He proposes that hybridity evokes a "third space," in which elements of distinct entities converge into a shared environment (Homi K. Bhabha, "Frontlines/Borderposts," in *Displacements: Cultural Identites in Question*, ed. A. Bammer. (Bloomington: Indiana University Press, 1994), 269–72; Homi K. Bhabha, "Cultures in Between," *Questions of Cultural Identity*, eds. S. Hall and P. Du Gay. (London: Sage Publications, 1996))

sonority is made the focus of harmonic or linear motion."[50] Described as "directed motion" by Travis, a "tonic sonority" can therefore be established if these criteria are met.[51]

There are various ways in which an analyst could employ hybridity to address the practice Travis describes. As mentioned in the previous section, one may find it fruitful to employ extension – by extending the principles and concepts of existing theories or through combination – where one could amalgamate concepts from different theories to analyse the work. As such, the challenge is to find a compromise: how far can existing theories be extended or modified in order to accommodate the music?

Some commentators have responded to this problem by stressing post-tonal music's tonal basis, thereby extending tonally based approaches. Analysts including Salzer, Baker, Hicken, Lewis and Morrison have sought to demonstrate how theories that typically capture tonal practices, such as Schenkerian theory, can be applied to early twentieth-century music that still retains the notion of tonal centricity.[52] These studies base their analyses on tonal procedures – where atonal features stem from tonality – and as a result, post-triadic features are not treated with the same regard as common-practice harmony.[53] Preda-Ulita also advocates for the use of the Schenkerian method to post-tonal music, particularly in identifying its tonal features.[54] Although an "abstract" traditional background structure may not be attainable in such repertoire, she believes that the Schenkerian method can be adapted, without straying too far from its conceptual framework. She states that identifying a "two voice contextual contrapuntal background after a reduction of a post-tonal piece allows analysts a great range of flexibility." These "contrapuntal" structures can then represent a piece as much as an *Ursatz* represents a piece. Extending Schenkerian principles of structural levels and prolongation can produce meaningful results, particularly to music that retains its

[50] Travis, "Towards a New Concept of Tonality," 261.
[51] Roy Travis, "Directed Motion in Two Brief Pieces by Schoenberg and Webern," *Perspectives of New Music* 4 (1966): 85–89.
[52] James M. Baker, "Scriabin's Implicit Tonality," *Music Theory Spectrum* 2 (1980): 1–18; Kenneth Hicken, "Schoenberg's 'Atonality': Fused Bitonality?" *Tempo* 109 (1974): 27–36; Christopher Lewis, "Tonal Focus in Atonal Music: Berg's op. 5/3," *Music Theory Spectrum* 3 (1981): 84–97; Charles D. Morrison, "Prolongation in the Final Movement of Bartók's String Quartet No. 4," *Music Theory Spectrum* 13.2 (1991): 179–96.
[53] Morrison discusses the applicability of prolongational structures in post-tonal music, a concept that originally stems from tonal principles, and how these principles do not apply to post-tonal music. Reinforced by Lerdahl, he states that unlike tonal music, "atonal music almost by definition does not have (the same) stability conditions." Lewis' analysis of Berg's *Vier Stücke* contrastingly highlights how tonal concepts can be found within atonal works.
[54] Anca Preda-Ulita, "Adaptations of the Schenkerian Analysis to Post-tonal Music," *Bulletin of the Transilvania University of Brasov* 6.2 (2013): 85–90.

tonal centricity. This can similarly be seen in Baker's study, which focuses on "transitional" music – Liszt, Scriabin, Schoenberg. His analysis of Scriabin's "Enigme," employs a more liberal Schenkerian approach and as a result, revealed vital information about the piece's structure – the tonal forces that form the overall coherence of the work. As this work can be perceived as a transition between tonal and atonal practices, Baker also illustrates how whole-tone features are a crucial part of the dominant function and how nontonal features connect the different sections of the piece. The post-tonal application of Schenkerian methods has consequently been criticised by Joseph Straus,[55] who argues that a tonal approach would view post-tonal elements as "its point of departure" and would "view the idiomatic surface of the piece as a distortion or deformation of 'normal' processes."[56]

Straus instead proposes a "motivic/associational approach" as a way to understand middleground organisation in the post-tonal repertoire. This allows the analyst to view "tonal allusions from the standpoint of post-tonal musical structure" and, in turn, to demonstrate the "power" of this music, creating a sense of coherence while conveying the relationship to "conventions of the past."[57] Like Straus, Lerdahl also recognises the limited scope of such a tonally centric method.[58] He suggests that extending the Schenkerian method can be fruitful for twentieth-century music, particularly in works that do contain some stabilising tonal element. Additionally, Lerdahl proposes that in the case of atonal repertoire, the Schenkerian concept of prolongation can be understood in terms of its salience conditions[59] rather than its stability conditions. Other perspectives stress the diatonic origins of extended chromatic harmony.[60] Although Charles Smith for example, proposes a "simple syntax" in which the fundamental structure can then be elaborated to account for more complex chromatic passages, in late nineteenth-century repertoire, this idea can be extended to later music, in the post-tonal realm.[61] Matthew Brown similarly believes that chromaticism is not a substitution

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55 Joseph N. Straus, "The Problem of Prolongation in Post-Tonal Music," *Journal of Music Theory* 31.1 (1987): 1–21.
56 Straus, "The Problem of Prolongation in Post-Tonal Music," 19.
57 Ibid 19.
58 Fred Lerdahl, "Atonal Prolongational Structure," *Contemporary Music Review* 4 (1989): 65–87.
59 Salience conditions can encompass a number of factors such as dynamics (louder sounds), metrical position, register (high or low position), texture, rhythm (longer rhythmic value), motive (e.g. important motivic event) whilst stability conditions are driven by its consonance and its spatially close distance to the local tonic (Lerdahl, "Atonal Prolongational Structure," 73–74).
60 This notion can especially be seen in Richard Cohn's *Audacious Euphony*, where he argues that chromatic harmony is derived from the voice-leading logic of the consonant diatonic triad (Oxford: Oxford University, 2012): 1–13.
61 Charles J. Smith, "The Functional Extravagance of Chromatic Chords," *Music Theory Spectrum* 8 (1986): 94–139, at 111.

for or an elaboration of the diatonic, but that they originate from the tonic triad and consequently there is no need for a separate tonal system based on the chromatic scale.[62] A different approach is adopted by Kenneth Smith, who proposes the use of qualitative and quantitative data to model the entropic processes as a way to overcome the tonal challenges faced in early twentieth century music.[63] This interesting study employs probability theory to explore the strength of the music's tonal drive and upon its application to works by Skryabin, Debussy and Schoenberg, Smith successfully identifies the strengths of the tonal drives in various contexts and moments in the selected works .

The difficulty here is that, in the later nineteenth-century, chromatic and diatonic triadic harmony often have equal importance. It may well be the case that chromatic features are part of the music's fundamental structure and therefore middleground levels will contain unorthodox melodic features, which are not part of a governing tonality. Echoing Schoenberg, Mitchell, Marra, McCreless and Proctor, all of whom consequently advocate the need for a "'chromatic' scale that incorporates tonal function as well as the mechanics of transformation."[64] Inspired by Schoenberg's work, Proctor in particular states that there is a strong need to establish a theoretical foundation for a tonal system that has the chromatic scale as background pitch structure, so that chromatic events are treated as their own entities without relating back to any diatonic origins, meaning that chromatic movement will be seen as inherent rather than extrinsic.[65] This concept is applied by Nicolette to selected works by Gustav Mahler, as this music "exhibits an inordinate amount of chromaticism" while "the pillars of functional tonality are still operative."[66] Nicolette makes clear that the diatonic scale does not govern the background pitch-class content of the music and therefore the chromatic aggregate is more suitable as its foundational basis.

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[62] Matthew Brown, "The Diatonic and the Chromatic in Schenker's 'Theory of Harmonic Relations,'" *Journal of Music Theory* 30.1 (1986): 1–33.
[63] Kenneth Smith, "The Enigma of Entropy in Extended Tonality," *Music Theory Spectrum* 43.1 (2021): 1–18.
[64] James Marra, "The Tonal Chromatic Scale as a Model for Functional Chromaticism," *Music Perception: An Interdisciplinary Journal* 4.1 (1986): 69–84; Patrick McCreless, "Ernst Kurth and the Analysis of the Chromatic Music of the Late Nineteenth Century," *Music Theory Spectrum* 5 (1983): 56-75; McCreless, "Syntagmatics and Paradigmatics: Some Implications for the Analysis of Chromaticism in Tonal Music," *Music Theory Spectrum* 13.2 (1991): 147-78; William J. Mitchell, "The Study of Chromaticism," *Journal of Music Theory* 6.1 (1962): 2–31; Gregory Proctor, "Technical Bases of Nineteenth-Century Chromatic Tonality: A Study in Chromaticism" (Ph.D. diss., Princeton University, 1978); See also Arnold Schoenberg, *Theory of Harmony*, translated by Roy E. Carter (California: University Presses of California, Columbia and Princeton, 2010), 384–389.
[65] Proctor, "Technical Bases of Nineteenth-Century Chromatic Tonality," 140. X
[66] Andrew David Nicolette, "A Model of the Tonal-Chromatic System and Its Application to Selected Works of Gustav Mahler" (Ph.D. diss., Louisiana State University, 2015), 1–166.

James Baker likewise considers how the "unfolding of the twelve pitch-classes of the chromatic universe" is a "form-defining principle" that can be seen in tonal music, even in works going back to Bach.[67] As Baker claims, there is evidence in treatises of the Classical period that there was a "growing awareness" of the interrelationships between chromaticism, periodicity and form.[68] While he exemplifies middleground traces of chromaticism in his case study (Haydn's String Quartet Op. 76 No. 6), which are evidently drawn from the foreground, this is not reflected in the background structure, as they are treated as embellishments diverging from the tonal structure. As such, it would not be impossible to argue for the presence of an *Ursatz* containing chromatic and unorthodox features as a work's overarching structure, albeit more applicable to music from the later nineteenth-century. Baker acknowledges the importance of such features by representing chromatic unfoldings in Schenkerian charts which play a role in illustrating large-scale structural tensions.[69] This modification to the Schenkerian graph is also adopted by analysts such as Forte and Travis.[70] Furthermore, Baker utilises pitch-class integers to designate the multiple functions of pitch classes in their respective contexts. Similarly, Väisälä investigates intervallic conceptions of set theory (octave equivalence and treatment of intervals in relation to the equal division of the octave) in conjunction with a "Schenkerian" methodology to explore post-tonal prolongation.[71]

As stated by Väisälä, early post-tonal music contains harmonic elements that are quite comparable to "triadic" practice, but which neither a full application of set theory nor a Schenkerian approach can adequately explain.[72] He acknowledges that the "conception of harmony and consonance" in post-tonal music is non-traditional and it is therefore imperative to build this into the analytical process. The idea of prolongation is nevertheless sometimes applicable. Consequently, he adopts the concept of the harmonic series and integrates this

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[67] James M. Baker, "Chromaticism, Form, and Expression in Haydn's String Quartet Op. 76, No. 6," *Journal of Music Theory* 47.1 (2003): 42.
[68] Baker's analyses of Haydn's Op. 76 Quartets reveal that they contain a large amount of chromaticism, atypical to the Classical period (Baker, "Chromaticism, Form, and Expression," 41–101).
[69] Ibid 49.
[70] Allen Forte, "Schoenberg's Creative Evolution: The Path to Atonality," *Musical Quarterly* 64.2 (1978): 133–176; Roy Travis, "Towards a New Concept of Tonality," *Journal of Music Perspectives of New Music* 4.2 (1959): 257–284.
[71] Olli Väisälä, "Prolongation of Harmonies Related to the Harmonic Series in Early Post-Tonal Music," *Journal of Music Theory* 46/1-2 (2002): 271.
[72] Väisälä, "Prolongation of Harmonies," 207–283.

into a less rigid Schenkerian and set-theoretical approach to the analysis of Debussy, Scriabin, Webern and Berg. Väisälä for instance analyses Scriabin's *Vers la flamme* in correspondence with the harmonic series, and emphasises the importance of the root note's primary status in the overall formal organisation of the work, which is to be "granted to harmonies that consist of pitches approximating those in the harmonic series up to the eleventh harmonic."[73] These harmonies do not only function as "foreground sonorities," but can have some significance in the bigger picture, that is, in the Schenkerian concept of prolongational organization.[74]

Beyond the extension of individual methods, theoretical hybridity can also encompass the simultaneous use of methods. The application of Schenkerian principles in conjunction with aspects of pitch-class set theory for example, can be seen in Forte's work, in his "Schoenberg's Creative Evolution: The Path to Atonality," which provides a comprehensive insight into how tonal and set-theoretical processes can function and coexist.[75] Elsewhere, Cinnamon, Salzer, Pople and Travis have also adopted a more flexible Schenkerian approach, in some cases interlaced with some pc-set theoretical principles, particularly in dealing with harmonies, functions and tonal relationships.[76] Cinnamon notes that if a piece exhibits substantial tonal elements, they can be taken as the "starting point" for the analysis; and with pieces that do not convey such strong tonal tendencies, tonal elements can still be identified as a "source of non-tonal relationships."[77] Other figures such as Baker, Pople and Wilson have combined some elements of Schenkerian theory with pitch-class set analysis, but none of these studies has fully integrated the two different methods into one analytical model.[78] It can also be observed in these studies that concepts of structural levels are retained and some extended harmonies are incorporated into the *Urlinie*.

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[73] Ibid 225.
[74] Ibid 208.
[75] Allen Forte, "Schoenberg's Creative Evolution," 133–176, and see also Allen Forte, "New Approaches to the Linear Analysis of Music," *Journal of the American Musicological Society* 41.2 (1988): 315–348.
[76] Howard Cinnamon, "Tonal Elements and Unfolding Nontriadic Harmonies in the Second of Schoenberg's "Drei Klavierstücke," *Theory and Practice* 18 (1993): 127–170; Felix Salzer, *Structural Hearing* (New York: Dover, 1962); Travis, "Towards a New Concept of Tonality," 257–284.
[77] Cinnamon, "Tonal Elements and Unfolding Nontriadic Harmonies," 166.
[78] James M. Baker, "Schenkerian Analysis and Post-Tonal Music," in *Aspects of Schenkerian Theory*, ed. David Beach (New Haven: Yale University Press, 1983), 153-186; James M. Baker, "Voice-Leading in Post-Tonal Music: Suggestions for Extending Schenker's Theory," *Music Analysis* 9.2 (1990): 177–200; Anthony Pople, *Skryabin and Stravinsky 1908-1914: Studies in Theory and Analysis*, (New York: Garland Publishing, 1989); Paul Wilson, "Concepts of Prolongation and Bartók's Op. 20," *Music Theory Spectrum* 6 (1984): 79–89.

Other combinations of existing theoretical models, such as Neo-Riemannian theory (NRT) with Schenker, have been also been carried by figures such as Baker, Clark, Rifkin and Rusch, who draw elements from NRT and Schenker to analyse works by Schubert, Prokofiev and Wagner.[79] Rifkin in particular utilises the Schenkerian method and NRT to analyse Prokofiev's music, to provide an insight into the composer's chromatic language. Her study revealed that using Neo-Riemannian principles – assessing for the theoretical and analytical implications of three different types of motives (systemic, function pitch-class and non-functional pitch-class) – in conjunction with the Schenkerian method provides a useful insight into the composer's music. Rusch argues from her study that due to the conflict between contrapuntal VL and parsimonious VL, these two theories are incompatible.[80] But as can be seen in Rifkin's study on Prokofiev, the possibility of applying Neo-Riemanninan principles whilst considering Schenker's method is useful in providing useful insights to the music.

Combinations of other theories have also been attempted: Pieslak analyses Debussy's and Scriabin's works using concepts from Schenkerian, Schoenbergian and Neo-Riemannian methodologies, Plotkin integrates elements of NRT with chordal space theory for the analysis of works by Chopin and Wagner, and Sayrs combines Schenkerian elements with "neo-traditional" theories to approach the harmonic analysis of Wolf's works.[81] But much like studies that have sought to combine Schenker with pitch-class set theories, the individual methods are not truly integrated in the analytical process and are rather treated as coexisting entities.

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[79] Steven Scott Baker, "Neo-Riemannian Transformations and Prolongational Structures in Wagner's "Parsifal"" (PhD Thesis. Florida State University, 2003); Suzannah Clark, *Analyzing Schubert* (Cambridge: Cambridge University Press, 2011); Deborah Rifkin, "A Theory of Motives for Prokofiev's Music," *Music Theory Spectrum* 26.2 (2004): 265–90; René Rusch, "Schenkerian Theory, Neo- Riemannian Theory and Late Schubert," *Journal of the Society for Musicology in Ireland* 8 (2012–13): 3–20; Baker's use of Neo-Riemannian and Schenkerian approaches, applied to selected sections of Wagner's *Parsifal*, revealed that the application of the methods alone are insufficient to analyse the chromatic passages and the methods need to be extended to overcome such issues (Baker, "Neo-Riemannian Transformations," 152–155).

[80] Rusch also demonstrates how an understanding of Schubert's late tonal works can be gained through amalgamating the Schenkerian method and NRT, supported with a Schenkerian graph and a Neo-Riemannian analysis. (Rusch, "Schenkerian Theory, Neo- Riemannian Theory and Late Schubert," 5.)

[81] Jonathan Robert Pieslak, "Conflicting Analytical Approaches to Late Nineteenth- and Early Twentieth-Century Tonal Music: A Meta- Theoretical Study" (Ph.D., University of Michigan, 2003); Richard James Plotkin, "Transforming Transformational Analysis: Applications of Filtered Point- Symmetry," (Ph.D., University of Chicago, 2010); Elizabeth Paige Sayrs, "Approaches to Wolf: Schenker, Transformation, Function" (Ph.D., Ohio State University, 1997).

This thesis therefore presents one example of theoretical hybridity, the application of three distinct theories – Schenkerian theory; neo-Riemannian theory; and beat-class set theory, inspired by pitch-class set theory – an approach created as a platform to resolve analytical issues that are generated by neoclassical repertoire, its incorporation of tonal and post-tonal practices.

1.6 Hybrid Theoretical Model – Neoclassical Music

The mixture of tonal and post-triadic features in neoclassical music begs the question of which theoretical tools should be used in order to grasp the music.[82] Any approach committed to diatonic tonal models faces a number of theoretical problems, particularly concerning the treatment of harmony, not least the lack of functional progressions and the presence of unconventional chord entities. As yet, no one theoretical model fully accounts for such Neoclassical practices: a Schenkerian analysis will struggle to describe extended harmonies and post-tonal progressions; a Neo-Riemannian perspective does not fully acknowledge extended harmonies within chordal transformations, particularly on localised levels; the application of pitch-class set theory struggles to describe meaningful tonal relationships between melody and harmony in this repertoire; and a beat-class set theoretical approach struggles to present other critical musical features that are pertinent to a musical reading.

All of the appraised literature in this chapter emphasises that works for which one specific theoretical model cannot account require the use of more than one model simultaneously, or by extending existing models, thus enriching the analytical data: in brief, by invoking hybridity. As mentioned previously, hybridity encourages plurality, multi-faceted thinking and approaches and this can be particularly effective in the study of Neoclassical repertoire. Thus, by adopting Homi Bhabha's view on hybridity, the direction taken in this study can be seen in Figure 2, which demonstrates how more than one element, in this case, three, can co-exist in a "third" space, and this instance, a "fourth" space or more simply, a shared space containing elements from three different entities. Figure 3 therefore demonstrates its musical equivalent, a "fourth" space created from Schenkerian method, Neo-Riemannian, and beat-class set theories. This mixed method consists of voice-leading; rhythmic segmentation; and beat-class elements.

[82] Neoclassicism is commonly defined as a mode of composition that revisits and adapts eighteenth-century forms while employing expanded or post-tonal harmonic means. (Joseph Machlis, *Introduction to Contemporary Music* (New York: Norton, 1979), 160–161).

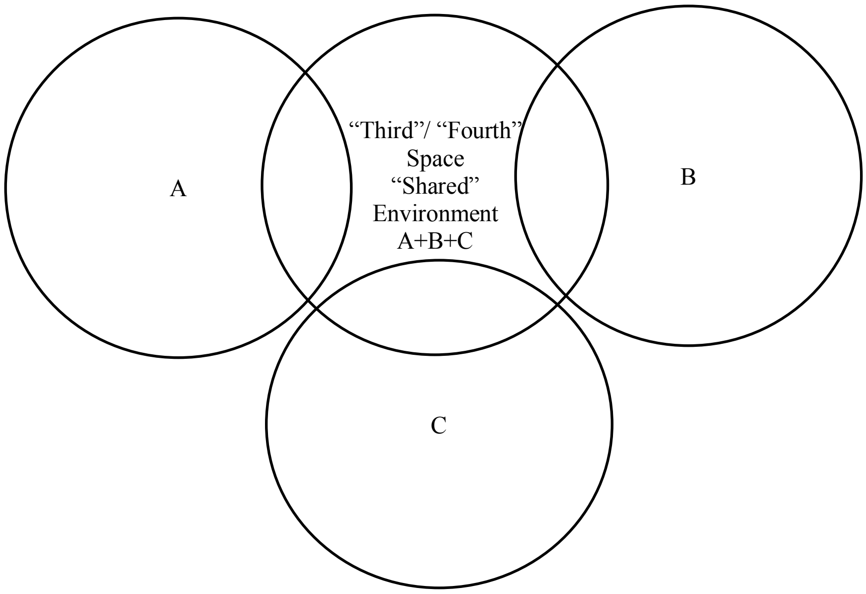

Figure 2. An Abstract View of the "Fourth" Space[83]

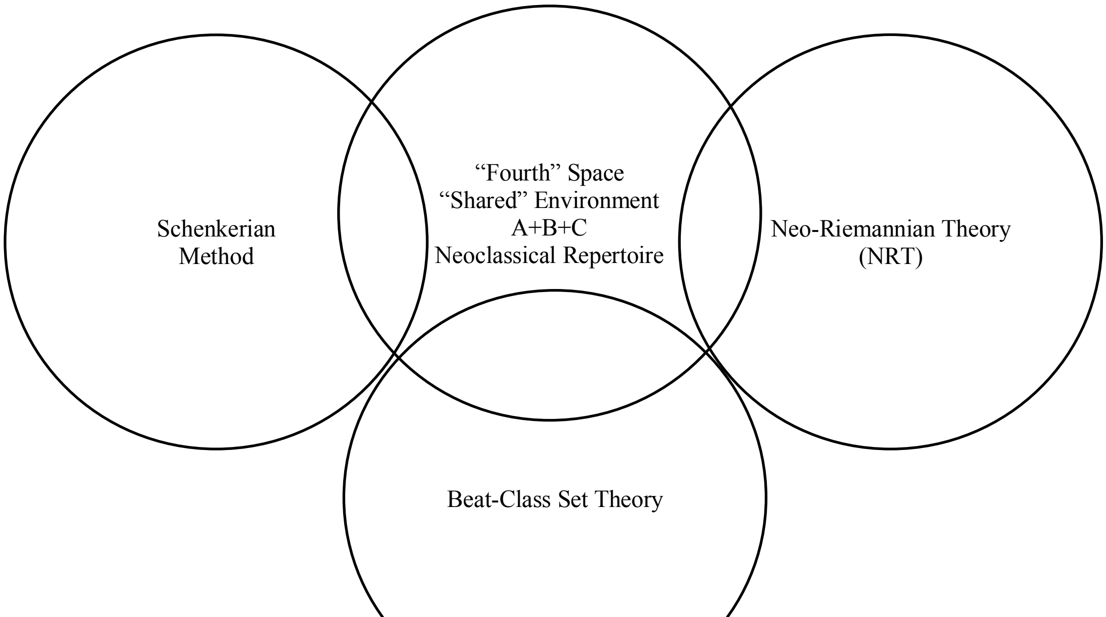

Figure 3. A Theoretical View of the "Fourth" Space for Neoclassical Music.

[83] Whilst sub combinations such as A+B, B+C and C+A can be created from the "shared" space, this model seeks to create a space that employs elements from three different theories.

In sum, the essential problem that this music raises is that of theoretical hybridity: as no single theory can account altogether for its compositional practices, a model is required that overcomes these inherent theoretical lacunae. One way to do this is to adopt Homi Bhabha's model, drawing core elements of the aforementioned theories into a hybrid theoretical model, as a way to overcome these theoretical lacunae. This study therefore develops a new analytical tool – encompassing a more flexible voice-leading approach, developed in conjunction with Schenkerian, Neo-Riemannian and set-theoretical attitudes and approaches to the relationship between melody and harmony – which can be applied to uncover the underlying structure of neoclassical works exhibiting a strong tonal centre.

This study is therefore organised into the following chapters: Chapter 2 explains the proposed methodology and its empirical implications – one, extending Schenker and Voice-Leading Analysis; two, Segmentation and Rhythmic Reduction; three, BC Set Theory and Analysis; and four, measuring harmonic tension in post-tonal repertoire – supported with a selected number of studies (*Mathis der Mahler* (Hindemith), "Tanec Loutek" (No. 5) from *Puppets* (Martinu), *Passacaglia* (Copland), *Violin Concerto in D Minor* (Vaughan Williams), *Sonata No. 3* (Enescu), *Sonatine* (Ravel), *Piano Sonata No. 2* (Hindemith), and *Concerto for Piano and Wind Instruments* (Stravinsky)); Chapters 3 and 4 comprise the application of the novel hybrid analytical method to two complete case studies: First Movement of Hindemith's Second Piano Sonata, and the first movement of Stravinsky's *Concerto for Piano and Wind Instruments* in five key sections (VL Reduction to AVL Data; Statistical Analysis; VL Movement; BCxVL Data; and BIP Local and Global Observations); and lastly, Chapter 5 offers its conclusions and speculates about directions in future research.

Chapter 2

Methodology – Part One

The following two chapters explore the different components that make up the hybrid model, and this will be segregated into its theoretical and empirical principles. Chapter 2 Part One sets up the theoretical premises (combining elements of Schenkerian, Neo-Riemannian and Beat-class theories): the first concerns post-tonal voice-leading analysis; the second concerns the rhythmic segmentation and reduction; the third concerns beat-class set analysis; and the fourth synthesises beat class and voice-leading analysis. Chapter 2 Part Two comprises the fifth element, which concerns the empirical study of correlating voice-leading calculations to perceptions of tension. Methodology – Part One begins with section 2.1 "Extending Schenker and Voice-Leading Analysis", which involves a commentary on existing work that employs a Schenkerian or, more broadly, a voice-leading approach to post-tonal music and how one can extend these principles for post-tonal analysis. Section 2.2 "Segmentation and Rhythmic Reduction" presents a novel approach, which incorporates a neo-Riemannian-inspired method – to better account for post-tonal harmonies – within the extended VL approach. The analysis of harmonies as such involves rhythmic reduction and segmentation and its calculations are then amalgamated with voice-leading analysis, presented as a series of line graphs and tables. Section 2.3 "BC Set Theory and Analysis" comprises a commentary on creating analytical representations of rhythmic elements and its hypermetrical levels to provide insights on how one can better perceive the music's local and global phrasal and structural levels. This analysis is then integrated with the VL analysis, to demonstrate the enriched detail obtained from the analysis.

Methodology – Part Two then comprises Section 2.4 "Measuring Harmonic Tension in Post-Tonal Repertoire", detailing an empirical study, in which listeners are to rate the amount of tension perceived in each sound clip. These sound clips are based on the segmentation of the selected works, applying the concept of calculating the total amount of voice-leading movement, to examine its relationship to our perception of tension and release. The idea of tension and release in music essentially comprises the build-up of musical intensity which subsequently relaxes. Echoing the words of Farbood[84], the phenomenon of tension is key to

[84] Morwared Farbood and Finn Upham, "Interpreting expressive performance through listener judgements of musical tension." *Frontiers in Psychology 4* (2013): 1–15, doi: http://dx.doi.org/10.3389/fpsyg.2013.00998

the listening experience and can be informally described in qualitative terms: increasing tension as the feeling of "rising intensity" or "impending climax and decreasing tension as relaxation or resolution. Ultimately, for a listener to both musically and non-musically trained, it is a moment of "instability" in the music that invokes resolution.

To support and exemplify the methodology, selected sections from the following case studies will be used: *Mathis der Mahler* (Hindemith), "Tanec Loutek" (No. 5) from *Puppets* (Martinu), *Passacaglia* (Copland), *Violin Concerto in D Minor* (Vaughan Williams), *Sonata No. 3* (Enescu), *Sonatine* (Ravel), *Piano Sonata No. 2* (Hindemith), and *Concerto for Piano and Wind Instruments* (Stravinsky).

2.1 Extending Schenker and Voice-Leading (VL) Analysis

A voice-leading reduction employing "loose" or extended Schenkerian principles can be applied to neoclassical repertoire, revealing an initial insight to the works' coherence due to its underlying pitch centricity, which will then act as a prompt to consider how post-tonal features could be incorporated into a Schenkerian-inspired framework. As James Baker states, however, when examining post-tonal music, one must consider two key questions: In what way is this piece tonal? And to what extent and how do atonal procedures also determine its structure?[85]

Given the mixed-economic nature of neoclassical music, a flexible application of existing methods to analyse tonal music such as a Schenkerian approach can be considered. There are essentially two significantly different positions that scholars have adopted in response to the application of Schenker to post-tonal music:

1. A "strict" approach whereby a work can be seen as tonal if it conforms to Schenker's principles, and any attempt to extend the method would be deem as invalid.
2. A "liberal" approach where alternative responses are explored, such as identifying prolongations and structure in the absence of a tonic-dominant tonal space and how one would treat the lack of archetypal harmonies are considered.

It is no hidden fact that the application of tonally based methods has been greeted by much animosity and not all believe in their effectiveness for post-tonal music. Such views are

[85] Baker 168.

strongly advocated by Ernst Oster, Adele Katz and George Perle. Oster, for example argues that the concept of unfolding is only applicable in tonal music as it ultimately originates from the triad to assist with its progression through time. He believes that any modifications to these principles would make the analysis invalid, as it breaks the closed system.[86] Similarly, Adele Katz's examination of works by Debussy, Stravinsky and Schoenberg revealed that as new techniques are visible in post-tonal music, its principles of coherence and unity operate in an entirely different manner to tonal music, and Schenkerian techniques are consequently inadequate in dealing with post-tonal music.[87] She concludes that "a new system of analysis is needed to understand the new concepts defined by the whole-tone, polytonal, and twelve-tonal systems and the new and different techniques they disclose."[88] Like Oster and Katz, Perle also believes that it is impossible to extend properties of the closed tonal system to atonality, that atonal procedures and properties are not reducible to a set of assumptions, and that each piece is of a unique construction and can only be analysed in a specific context.[89]

On the other end of the spectrum, scholars such as James Baker, Felix Salzer, Roy Travis, Milton Babbitt, Robert Morgan and Joel Lester have argued for the relevance of tonal centric approaches and their various benefits in analysing post-tonal compositions. To begin, in Baker's analysis of Scriabin's "Enigme" Op. 52, he uncovers that this is an important work where the composer broke "new harmonic ground", a work which captures both tonal and post-tonal elements, constructed within a framework that contains both fundamental structures of conventional tonality and chromatic features.[90] Baker firmly believes that "transitional" compositions should be looked at in terms of their "innovative" components as well as their "conventional tonal structures" and in the bigger picture, a closed system is yet to be developed for post-tonal music.[91] This sentiment is echoed by Robert Morgan who

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[86] Ernst Oster, "Re: A New Concept of Tonality (?)," *Journal of Music Theory* 4 (1960): 96.
[87] For instance, Debussy's *Voiles* is essentially based on an expanded augmented triad, and is developed through horizontalisation and repetition of melodic motives. In Schoenberg's *Verklärte Nacht*, the concept of tonality had little to do with Schoenberg's theoretical approach, and tonal unity was achieved through the prolongation of a tonic triad. Likewise, in *Petrushka*, it can be argued that the work has an underlying sense of a single tonality despite claims of polytonality (Adele T. Katz, *Challenge to Musical Tradition: A New Concept of Tonality* (New York: Da Capo, 1972)).
[88] Katz 293.
[89] George Perle, *Serial Composition and Atonality* (Berkeley and Los Angeles: University of California Press, 1977).
[90] Interestingly, Baker also discusses the form (ABA) on the basis of contrasting materials, voice-leading patterns and sets and he identified prolongation through the retention of the chord, as well as establishing structural bonds between contrasting sections of the piece (James Baker, "Schenkerian Analysis and Post-Tonal Music," in *Aspects of Schenkerian Theory*, ed. David Beach (New Haven: Yale University Press, 1983), 153-86.)
[91] Baker 186.

states that “Enigme” sits on the “borderline between non-ordered serialism and… extended tonality”.[92]

Additionally, Felix Salzer believes that the tonic-dominant axis cannot be the only framework for tonally directed motion and instead offers a more generalised definition to tonality, as a “prolonged motion within the framework of a single key-determining progression.”[93] In his examination of works by Stravinsky, Hindemith, Bartok, he insists that these works are fundamentally tonal in structure and that contrapuntal progression can assume structure significance.[94] Salzer goes on to describe that the distinction between consonance and dissonance in post-tonal works can be replaced by a distinction between “dissonances of lesser and greater intensity.”[95] His attempt to analyse such music tended to privilege tonal-like bass progressions and voice-leading motions as bases for prolongational structures. His idea is applicable to post-tonal music, yet there is still an emphasis on tonal key areas and other pitches are described as non-traditional and dissonant.

Roy Travis’s approach can also be likened to Salzer’s.[96] Through his examination of works by Webern, Schoenberg and Bartok, he provides a broad definition of tonality as a concept that is not bound to a key but to a pitch centre: that “music is tonal when its motion unfolds through time a particular tone, interval, chord.”[97] One drawback of his approach concerns the lack of specificity of the defining principles for these compositions and the basis of how one would determine fundamental and prolonged sonority. The roots of Travis and Salzer’s approach can be traced back to Milton Babbitt, who sought to find a balance between the two systems – tonality and atonality – in his analysis of Bartok’s String Quartets (written between 1909-1939), works that highlight a traditional tonal function against a contextual structure-defining process.[98] Babbitt ultimately uncovers that although there is a conventional background structure in Bartok’s works, the local levels contain new contextual features

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92 For Morgan, extended tonality is implicitly present in this work through the prolongation of a tonic sonority (particularly where the work comprises a five-note subset of the whole-tone scale, prolonging V of D flat). (Robert Morgan, “Dissonant Prolongation: Theoretical and Compositional Precedents,” *Journal of Music Theory* 20.1 (1976): 49–91.)
93 Felix Salzer, *Structural Hearing: Tonal Coherence in Music* (New York: Dover, 1962), 227.
94 Salzer 204.
95 Salzer 192.
96 Roy Travis, “Tonal Coherence in the First Movement of Bartók’s Fourth String Quartet,” *The Music Forum* 2 (1970).
97 Roy Travis, “Directed Motion in Schoenberg and Webern,” *Perspectives of New Music* 4 (1966): 85.
98 Milton Babbitt, “The String Quartets of Bartok,” *The Music Quarterly* 35.3 (1949): 377–385.

which necessitate an alternative approach to their explanation. Thus, despite efforts by Travis, Salzer and Babbitt, there is still a lack of consistency between the different structural levels.

Robert Morgan's approach is different again.[99] Morgan proposes that prolongation can be derived from dissonant chords (e.g. augmented or diminished triads), an approach that ultimately evolved from the tonal system. As dissonance eventually became more prominent in the nineteenth century, it is not unusual to encounter dissonances as a feature that is prolonged across entire compositions, and even in instances where assume a tonic function as well. The limitation with Morgan's proposal is that relationships between the two different types of musical structure could be more thoroughly discussed – how dissonant components work against consonant triads. Joel Lester also explored the boundaries of the tonal system to incorporate atonal elements through redefining certain aspects of tonality.[100] For instance, he suggests that the idea of tonality as a closed system in which tonal principles of division (skips) and proximity (steps) can be extended to atonality. His approach is however only evidenced in Schoenberg's Serenade Op. 24, but it is in Lester's idea that we get a first glimpse of a potential hierarchical system that can extend tonal principles to the atonal system.

Several other attempts in terms of structure are also worth highlighting: For example, in Allen Forte's application of set theory to Schoenberg,[101] he argues that every piece of music should be treated differently as each has its own unique musical structure. He believes that one should find the piece's own analytical procedures, and seeking out general types of characteristic events and factors that will formulate its structural events.[102] This in turn suggests that there may be no system that can span tonality and atonality. In addition, with reference to Schoenberg's *Harmonielehre*, Robert Suderburg analysed Schoenberg's music in

[99] Robert Morgan, "Dissonant Prolongations: Theoretical and Compositional Precedents," *Journal of Music Theory* 20 (1976): 49-91.
[100] Joel Lester, "A Theory of Atonal Prolongations as Used in an Analysis of the *Serenade* Op. 24 by Arnold Schoenberg," PhD Diss., Princeton University, 1970.
[101] Schoenberg's *Harmonielehre* is also useful as a precursor to these various attempts to extend the tonal system but ultimately, the concepts of prolongation and structural levels in tonal music are not fully developed. (Arnold Schoenberg, *Theory of Harmony* trans. Roy Carter (Berkeley: University of California Press, 1978).)
[102] Allen Forte, *Contemporary Tone Structures* (New York: Bureau of Publications, 1955). This was further highlighted in Forte's *The Structure of Atonal Music*, where he utilises pitch-class set theory as an alternative to describe harmonies (e.g. Webern, Schoenberg and Stravinsky) that transcends the tonal realm (Allen Forte, *The Structure of Atonal Music* (Yale: Yale University Press, 1973)).

terms of its serial procedures and he uncovered that the structure of these music results from the inherent properties of the set than from procedures and functions related to principles of tonal coherence.[103]

More recent literature also highlights the problems with the application of Schenkerian concepts to post-tonal music. The common theme that arises from each of these studies the lack of an approach that can analyse post-tonal prolongation and closure with the same rigour and effectiveness as the Schenkerian method. A study by David Huff, which appraises previous attempts to describe post-tonal prolongation (recalling works by Forte, Travis, Laufer and Vaisala), advocates the importance of reconceptualising and redefining tonality, codifying and formulating generalised principles for piece specific sonorities.[104] His examination of Berg's *Warm die Lüfte* attempts to demonstrate this methodology, a case-by-case handling of analysis, in identifying and understanding all the primary and secondary sonorities, registral changes, and contextual emphasis. Unique to this work was the understanding of specific intervallic structures such as the bass fifth and tritone that contributes to the stabilisation of both primary and secondary harmonies and its prolongation.

As the concept of prolongation is a critical issue when applying Schenker's principles, some have attempted to redefine and explore its applicability in post-tonal music. For instance, Joshua Mailman's study, which investigates a selection of Schoenberg's works, suggests that concepts of prolongation and structural levels are inappropriate for his music.[105] He states that "Making unfamiliar chords *comprehensible* ('emancipating' these chords by cultivating strategic comparisons between them) has really not much to do with generatively driven hierarchies of chords whose tones are 'conceptually sustained' over spans of time".[106] Despite the focus on Schoenberg's use of atonality, his study, which advocates the use of

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[103] Robert Suderberg, "Tonal Cohesion in Schoenberg's Twelve-Tone Music," PhD Diss., University of Pennysylvania, 1966. Allen Forte's later work, *The Structure of Atonal Music*, also supports this and suggests a set-theoretical framework for the systematic description of atonal structures, and he explored the interrelationships between procedure and hierarchies seen through interval vectors, discussion of invariance of pitch classes. However, structural hierarchies and prolongational procedures could be made more explicit in his approach and there is still a lack of explanation of the relationship between atonal structural features to its tonal counterpart. (Allen Forte, *The Structure of Atonal Music* (New Haven: Yale University Press, 1977).)

[104] David Huff, "Prolongation in Post-Tonal Music: A Survey of Analytical Techniques and Theoretical Concepts with an Analysis of Alban Berg's Op. 2 No. 4 "Warm die Lüfte"," MMus Diss., University of North Texas, 2010.

[105] Joshua Mailman, "Schoenberg's Chordal Experimentalism Revealed through Representational Hierarchy Association (RHA), Contour Motives, and Binary State Switching," *Music Theory Spectrum* 37.2 (2015): 224-52.

[106] Joshua Mailman, "Schoenberg's Chordal Experimentalism," 250.

Representational Hierarchy Association (RHA), suggests that we should move towards a more inclusive prolongational hierarchy, a representational hierarchy for models of music.[107] This originated from Joseph Straus' work, who highlights the issue of prolongation in post-tonal music in his study, advocating for an "associational/motivic" over a "tonal/prolongational" approach.[108]

Another issue that arises from a post-tonal application of Schenkerian principles is the concept of closure. Scholars such as Matthew Arndt, Clare Eng[109], and Patricia Howland, and have all investigated ways to describe better post-tonal closure in post-Romantic repertoire through redefining conceptual metaphors (such as components, parts and functions), utilising other musical parameters (such as density, dynamics, register and timbre) and understanding piece-specific features. For instance, in a case study of Schoenberg's Op. 11 No. 1 in conjunction with his own musical theories of form, Matthew Arndt argues for the inseparability of form and content, the close interrelationship between formal techniques and motivic origins in post-tonal music.[110] A different approach advocated by Howland, drawing on examples from Babbitt, Carter and Stockhausen, proposes audible phrase-like formal units, "integrated parametric structures" (IPS), analysing the actions of parameters such as density, dynamics, register and timbre to describe the music's structures.[111] Clare Eng's study on the other hand raises an important issue of the broad scope of post-tonality. Narrowing down to neo-tonal music, Eng builds upon Leonard B. Meyer's communication model of music and proposes that closure is a "relational" construct that is context-dependent: the individual work, composer's practice and the level of the corpus.

From appraising a small range of past and recent literature despite the broad scope of repertoire, extending beyond neoclassical ones, it can be seen that there have been few attempts to create a truly comprehensive system to analyse post-tonal music. Employing a Schenkerian approach with additional/extended principles encompassing atonal elements can be one way to address this deficit.

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[107] The idea of an inclusional hierarchy originated in Lerdahl and Jackendoff's tree-branching theory and later proposed explicitly by Allan Keiler in 1983.
[108] In Straus' "The Problem of Prolongation in Post-tonal Music" (1987), he demonstrates his idea of associational/motivic approach through examples of non-consecutive events, by choosing pcs in the outer voices to assist in forming middleground analyses of referential set classes.
[109] Clare Eng, "The Problem of Closure in Neo-Tonal Music," *Music Theory Spectrum* 41.2 (2019): 285-304.
[110] Matthew Arndt, "Form-Function-Content," *Music Theory Spectrum* 40.2 (2018): 208-226.
[111] Patricia Howland, "Formal Structures in Post-Tonal Music," *Music Theory Spectrum* 37.1 (2015): 71-97.

2.1.1 Method and Application

A voice-leading reduction rethought for the purpose of neoclassical repertoire will therefore employ a more "liberal" approach, adopting Schenker's principle of a closed system yet encompassing "atonal" or "chromaticised" harmonies. Much like a Schenkerian approach, this method will uncover the different hierarchical levels, from foreground through middleground to background. A post-tonal VL analysis will therefore employ the following steps:

1. Identifying key areas and labelling the harmonies with Roman numerals where appropriate, accounting for dissonant notes as part of the harmony as well as consonant ones. Identifying all the foreground elaborations.
2. Identifying underlying elaborations beneath the surface of the music – larger phrases, structures and unifying elements.
3. Demonstrating how the piece can be understood as an elaboration from a key scale degree. This can be through archetypal descending *Urlinie* from 3, 5, 8, in its chromatic and diatonic variant as well as its ascending counterpart. The key bass notes supporting the *Ursatz* may or may not conform to the I-V-I structure and could be replaced by other scale degrees to denote closure.

With the description of linear progressions, the labels "c-n", "c-arp" and "c-prg" replace the conventional "n", "arp" and "prg" description, a "chromatic" linear progression[112], capturing both tonal and post-tonal characteristics. These progressions will not simply comprise conjunct melodic motion (both inner and outer voices) that relate two harmony notes, but rather, acknowledging the prolonged stepwise motion from and to the respective pitches, without being tied to a single chord and accounting for the varied harmonic activity in the bass and using linear progressions to identify patterns and important structural activity. The same concept can also be applied to bass prolongations. Going beyond traditional bass prolongations that capture a prevailing dominant to tonic relation and an emphasis on the tonic, it can also be proposed that the journey between the starting and ending tonic is not bound to a series of "tonal" arpeggiations and passing notes limited to the key of the work, where chromatic and other non-tonal elements can occur to replace such features if there is an

[112] "c-n" will therefore mean a "chromatic neighbouring movement", "c-arp" will stand for "chromatic arpeggiation/arpeggio", and "c-prg" (3-c-prg, 4-c-prg etc.) will stand for "chromatic progression".

overriding sense of pitch prolongation. As a result, the concept Schenker calls *Stufen*[113] (scale-steps) can comprise a variety of forms and combinations, not simply I-V-I. The concept of tonicization can still exist in post-tonal reductions, where temporary tonics can often be related to the opening pitch centres by chromatic means. As such, these "c" labels are applied to both soprano and bass reductions at foreground and middleground levels.[114]

The following subsections explain how a voice-leading analysis operates in this repertoire through selected segments of three works embodying tonal and post-tonal traits: "Mouvement de Menuet" from Ravel's *Sonatine*, the first movement from Vaughan Williams' *Violin Concerto in D minor* and Copland's *Passacaglia*. There will be a focus on the results obtained from the background and middleground levels as it is these levels that will reveal how coherence is apparent in this repertoire.

Example: Copland - *Passacaglia*

The implicative title firstly suggests stylistic influences from the early Baroque musical form, as this may provide a clue to Copland's compositional approach.[115] The passacaglia, usually based on a bass ostinato pattern, employed a theme and variations structure which in turn had an influence when determining its relevant sections. One can also highlight the contrapuntal devices in this work such as augmentation, diminution, retrograde, canon, and invertible counterpoint. A breakdown of the different sections appears as follows:

Table 1. Identifying the *Passacaglia*'s theme and variations.

	Bars	Length
Theme	1 – 8	8
Variation 1	9 – 24	8+8
Variation 2	25 – 32	8
Variation 3	33 – 40 (add G# to treble and D# to bass at bar 33)	8
Variation 4	41 – 50	10

[113] Main harmonies represented as scale steps, and stated by Pankhurst, "they are more structurally important than ordinary harmonies because they represent the basic harmonic pillars of the piece" (52)
[114] Due to the post-tonal nature, the bass reductions can consist of both harmonic and melodic elements.
[115] Copland's *Passacaglia* is among one of his early works and has been said to be influenced by Nadia Boulanger and the French neoclassical school (William Brandt, *The Way of Music* (Boston: Allyn and Bacon, 1963): 571–2; Sammie Whitten, A Stylistic Comparison of Aaron Copland's Passacaglia, Piano variations, and Four piano Blues: A Lecture Recital, Together with Three Recitals of Selected Works of Beethoven, Brahms, Chopin and Others, PhD Diss., North Texas State University, 1981). In a brief biography, Andy Trudeau also states that Copland's early works tend to contain "a leanness of texture, starkness of colour, and driving angular rhythm" and they epitomise the American sound through its distinctively open intervals (Andy Trudeau, *The Aaron Copland Centennial – The Copland Story: An Artistic Biography* , accessed 3 March, 2019, https://www.npr.org/programs/specials/copland/coplandstory.html).

Variation 5	51 – 69	19
Variation 6	70 – 87	14
Variation 7	88 – 108	21
Variation 8	109 – 122	14
Variation 9	123 – 132	10
Conclusion	133 – 138	6

In this work, one way to interpret the overall structure is through the emphasis of the melody, where the conceptual soprano lies in the bass whilst the conceptual bass appears in the treble, correlating with one's listening of the music.[116] It is useful to highlight that with the exception of Variation 5, all the variations are based around the G# pitch centre. One reading of the background structure presents the following as shown in Figure 4 below.

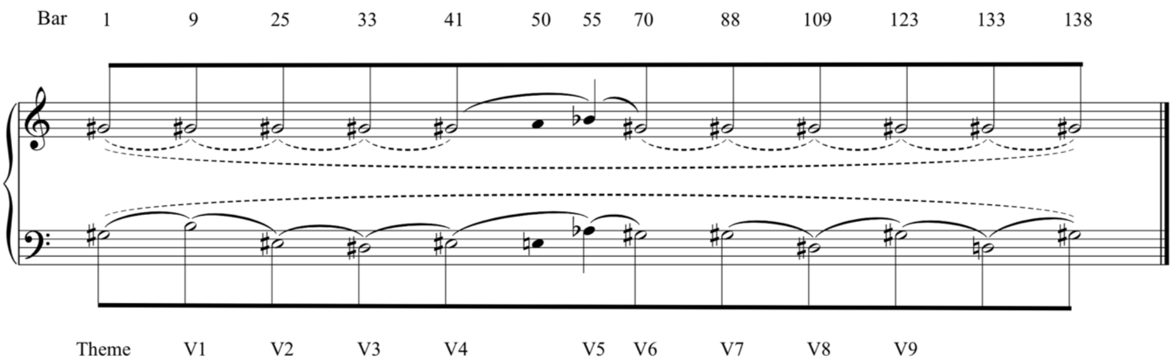


Figure 4. One reading of the *Passacaglia's* background structure.

This reading suggests that the entire piece is essentially a prolongation of G#, which is clearly reinforced in the opening and closing in each of the variations, overriding the bass. In this way, the conceptual soprano in this piece initially originates in the bass line, from the ground bass, aligning with melody which alternates between registers. Although there is no archetypal cadential moment in the work, in bar 137, there is a chord resembling a D7 on the last beat, resembling a potential PAC in G# major.[117] This could ultimately demonstrate a sense of closure to the piece. Interestingly within the conclusion, where the conceptual soprano is in the bass, the underpinning harmonic support resembles a D chord (with an absent F#).

Some additional features that can be seen in the background sketch, particularly the fifth and last variation. Firstly, the last note of Variation 4, as identified in Figure 4, forms a stepwise

[116] Another reading of this piece can illustrate a ^3 starting in bar 9 against a G# in the opening.
[117] The pitch D, from the D7 chord, can be perceived as a flattened 5th in G# major.

motion to the next section. Secondly, although Variation 5 begins in bar 51, B in bar 55 has been identified as the pitch containing more structural significance, as the melodic materials echo the same falling 4th figure from the thematic materials. Between the fourth and fifth variations, there is a skip from Bb to G#, but this could be perceived as a "chromatic" linear progression, as respelling Bb as A# would produce this result. Fourthly, with the final Variation, the soprano note derives from the right-hand line and not the bass, unlike the introduction. Conversely, the materials obtained in the last bar are derived from the treble reduction. Lastly, from the background sketch, it is evident that the G# sonority is reinforced in each of the variations, with the exception of Variation 5 due to the key change. From this reading, G# can be argued to be the *Kopfton* due to its prominence in the melodic line, with descents within each variation.

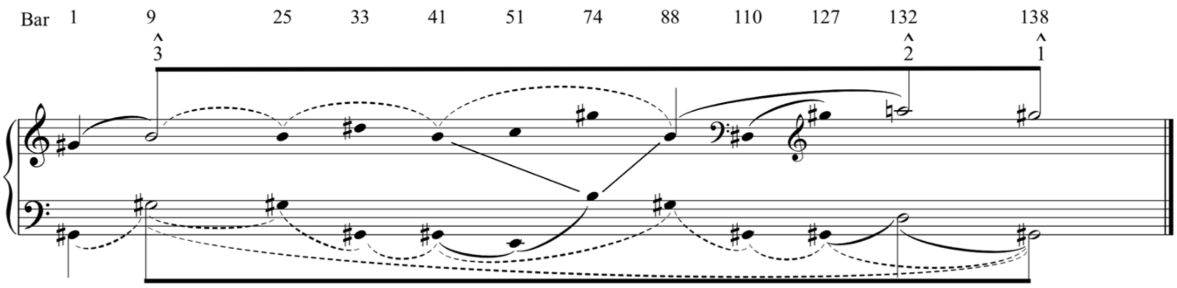


Figure 5. An alternate reading of the *Passacaglia's* background structure.

An alternate reading of the *Passacaglia* as shown in Figure 5 presents a ^3 line, with the opening bars acting as an initial ascent. ^3 can be seen across most of the piece before a descent towards the end. Much like the first reading, each of the key notes identified align with each variation, reinforcing the tonal structure of the work. As for the bass line, this is sustained by chord one, G# as well as a chord resembling chord V in bar 132 with ^2 before returning to its pitch centre, G#.

A closer examination of bars 41–55 and bars 70–83, in Figures 6 and 7 respectively, in its middleground level then reveals the following:

Figure 6. Middleground Level, Copland, *Passacaglia*, Bars 41–55.

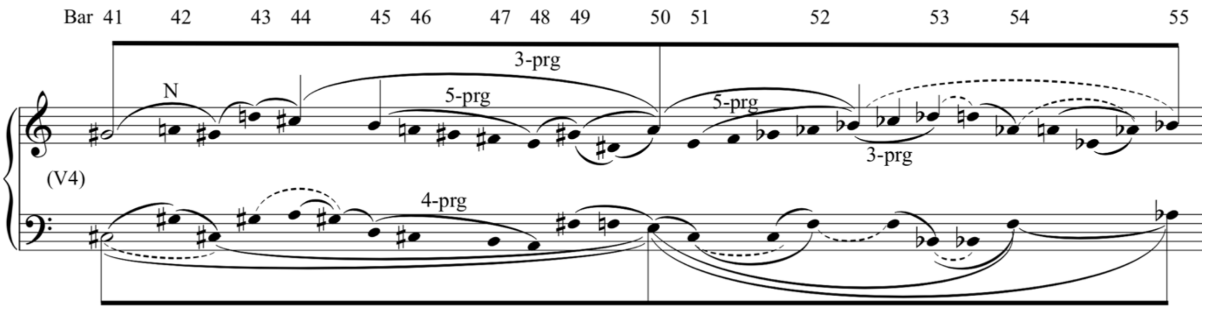
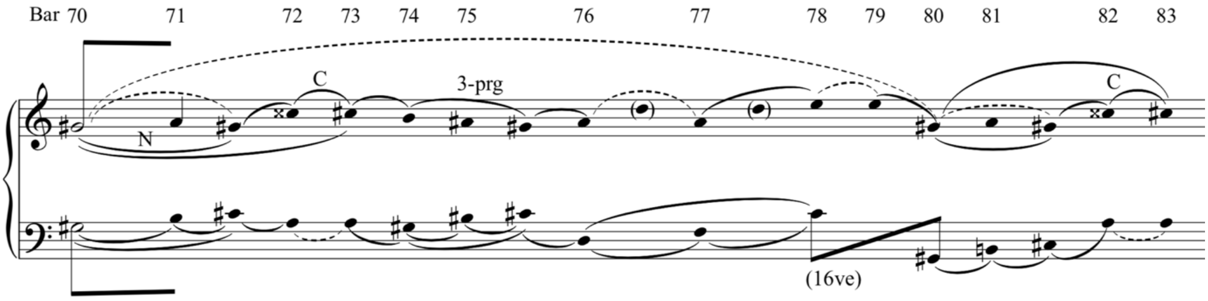


Figure 7. Middleground Level, Copland, *Passacaglia*, Bars 70–83.



Another interesting feature that lies in the section of bars 41–55, where we can observe that the section begins with the actual bass as the conceptual soprano and the actual soprano as the conceptual bass. This is due to the transfer of thematic materials, where the opening notes of the theme is now in the bass line. The linear spans in these few selected bars, include some inner stepwise progressions within a larger unit.

In the instance of bars 41–42, the note A has been identified as an upper neighbouring note to its principal note, G# and this note can be seen to have a chromatic relationship to G#. Similarly, the 5 c-prg in bars 45–48 is not bound to a single chord tone from the bass. The linear progression identified is purely based on its melodic content and patterns. As for the use of dotted slurs, they are used to denote short and long ranged prolongations reinforcing repeated and structurally important pitches.[118] Examples of this can be seen in bars 41–42, 51–52 and 53–54. Localised (shorter) embellishments in the bass are denoted with slurs above the notes but longer connections are represented with slurs under the notes.

In general, most notes were retained from the foreground but with bars 49–50 and bars 54–55, this indicate that whilst these notes could have been omitted at a middleground level, they

[118] This is line with the practice of Cadwallader and Gagne (Allen Cadwallader and David Gagne, *Analysis of Tonal Music: A Schenkerian Approach* (Oxford: Oxford University Press, 2011).

play a significant role as part of the cadential moment, contributing to a sense of closure. There are clear substitutes for the archetypal cadences in this chart. One instance of this can be seen at bars 49–50, two bars that mark the end of the phrase, which portrays a descending bass line, F#-F natural-E, supporting the end of the melodic phrase. Although this can be perceived to be an interrupted cadence due to its final pitch, E, bearing a submediant relation to the opening pitch centre, this can also be perceived as closure due to secondary parameters such as rhythm and repetition of melodic materials. There is also unconventional intervallic movement between the soprano and bass reductions, where there are consecutive dissonant intervals. An instance of this can be seen in bars 49–50 where a m2, A6 and P4 intervals are formed between soprano and bass.

In bars 70–83, it is firstly worth highlighting that the musical materials are repeated twice: bars 70–73, and bars 80–83. Much like the bars 41–55, stepwise movement is a recurring feature with similar linear progressions to the earlier bars and the notes identified are again not representative of the actual register, but rather a conceptual representation. A label interesting to point out can be in the treble reduction of bars 72–73, noted as “c”. This is to denote chromatic movement, whilst slurs in Schenkerian contexts generally suggest diatonic movement. In bars 72–73, this comprises a movement from Cx to C#, supported by an A in the bass, extended across these two bars. Between bars 76–78, there are two Ds in brackets on the chart and they represent melodic embellishments that are more prominent on a foreground level, but included on a middleground level to demonstrate repetition within the two musical fragments. These two bars are essentially a prolongation or extension of the pitch A.

As with the different types of elaborations – arpeggiation, neighbour notes, and linear progression – compound melodies such as unfoldings can be described in a post-tonal manner as well. Like tonal unfoldings, these are represented by diagonal lines or slurs; however, the unfolding of the primary note is not bound by pitches confined to the chord – this can comprise a combination of chromatic pitches as well as diatonic ones. In bars 78–80 for example, unfoldings are employed as a conceptual idea, where the notes are not representative of its actual register – e.g. C in bar 78 could have been written in the treble stave to better represent its registral that can be described in a post-tonal manner. Instead, C was written in the bass as a middle C, connecting to the actual G# in bar 80. This unfolding in the bass is supported by E and G# in the soprano, reinforcing the prolonged E in bars 78–79 and the arrival of same note of the last note in the unfolding, G#. This unorthodox representation of the descending line can be perceived as an unfolding as the materials are supported by the same harmonic materials.

Example: Vaughan Williams – *Violin Concerto in D minor*

The first movement from Vaughan Williams' *Violin Concerto in D minor* (*Concerto Accademico*) also raises some interesting issues pertaining to the treatment of linear progressions and the number of possibilities one can uncover as the background structure. Written in 1924-25, this Concerto was one of two works that Vaughan Williams composed for solo violin and orchestra.[119] Despite Vaughan Williams' exploration into neoclassicism however, he integrated his own musical idiom and temperament, particularly in elements such as harmony, mood, modality and part-writing.[120] Employing Baroque, twentieth-century and folk-like styles and characteristics, this work is challenging to analyse as it embodies both tonal and post-tonal features.

This movement is in a sonata-ritornello form and can be identified in terms of its motivic features. Table 2 presents the key sections identified through a sonata form and its bar numbers. As there are six identifiable motives that are used in various ways across the entire movement, Table 3 presents the identification of these motives and its variations.[121]

Table 2. Key Sections for Vaughan Williams' *Violin Concerto*.

Exposition	Development	Recapitulation	Coda
Bars 1–73	Bars 74–152	Bars 153–220	Bars 221–234

Table 3. Identification of the different motives in Vaughan Williams' *Violin Concerto*.[122]

Exposition	M1	Development	M3 (or M1)
	M2		M6
	M2 (variant)		M6
	M2 (variant)		M2
	M3		Cad
	M3 (variant)	Recapitulation	M4 (M3 variant)

[119] As stated by Harrison, this work, originally titled *Concerto Accademico*, can be initially perceived to be "backward-looking" and often associated with being written in the shadow of the *Sancta Civitas* oratorio, perhaps a homage to Bach. (Max Harrison, *Vaughan Williams: Symphony No. 4 in F Minor and Concerto Accademico*, 1988, Chandos, Colchester, England) Frank Howes also highlights Vaughan Williams' interest into music from the Middle Ages as he states that "this concerto proposes both organum and faburden discovered from the Middle Ages," and that this work embodies these medieval modes as well as modern features to create "neo-modal" music. (Frank Howes, *The Music of Ralph Vaughan Williams* (London: Oxford University Press, 1954), 100.)

[120] Michael Kennedy, *The Works of Ralph Vaughan Williams* (London: Oxford University Press, 1964), 193.

[121] The use of numbers such as x^1 and x.1 indicates variations from its motive (e.g. motive x).

[122] The score is attached as Volume 2: Appendix 3.

	Cad		M5
	M1		M1
	M2		M2
	M4		M2 (variant)
	M4 (or M3)		M2 (variant)
	M5		M2 var.
	M2		M6 frag
	M5.1		M^1
	M2	Coda	M2 var.
	M5.2		

To begin, there are several possible readings to derive the fundamental structure of the movement. Based on the structural features, there may be five different readings as shown below in Figures 8 to 12.

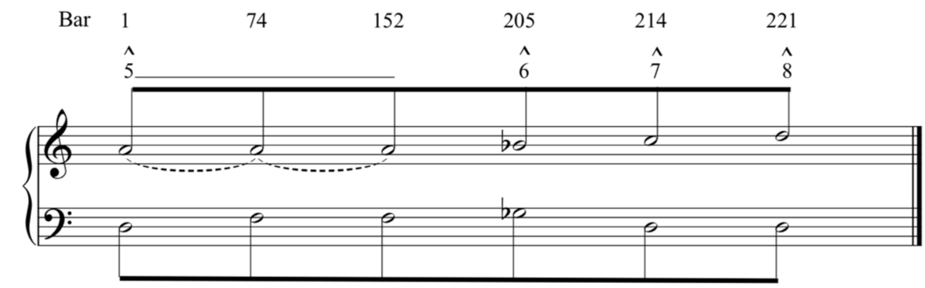


Figure 8. First reading of the *Violin Concerto*'s background structure.

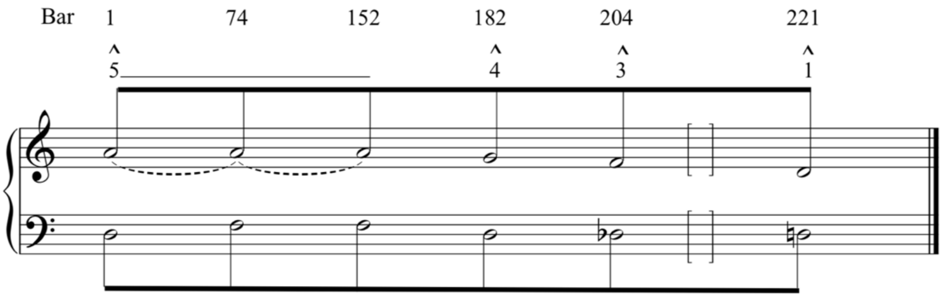


Figure 9. Second reading of the *Violin Concerto*'s background structure.

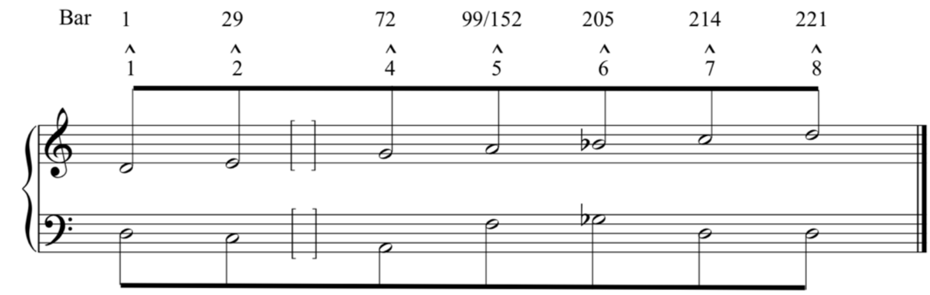


Figure 10. Third reading of the *Violin Concerto*'s background structure.

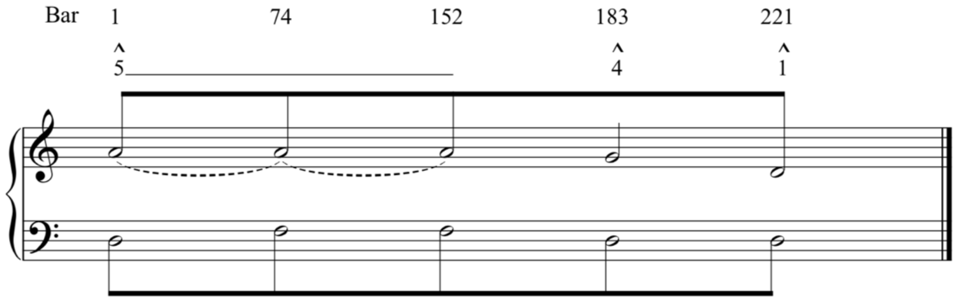


Figure 11. Fourth reading of the *Violin Concerto*'s background structure.

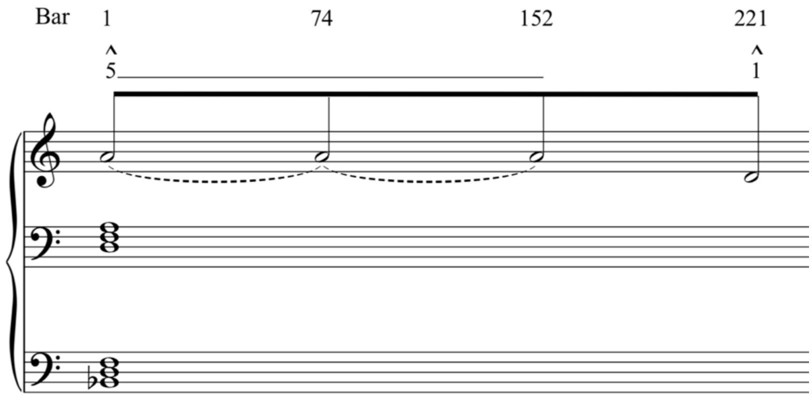


Figure 12. Fifth reading of the *Violin Concerto*'s background structure.

The first possibility (Figure 8) suggests an unorthodox reading, a rising soprano line from ^5 to ^8. Why can't ^1 or ^3 be considered as the starting point? The ^5, A, is very dominant across the entire movement and is frequently used as opposed to other tones. There is however, an ascent to the tonic in the coda. ^6 was identified in bar 205 but this is not the "strongest point" as this was derived from the second violins, an inner voice but it is part of the main motive. Figure 13 below presents bars 211 to 225, which comprises of the materials before the coda at bar 221. ^7 is situated in bar 214, a few bars before the coda, in the solo violin, which is very prominent in the texture and this is reinforced by the tonic pedal note, D in the bass line. The coda in this movement can be seen as a closing section where fragments of the opening materials in the exposition is repeated, reinforcing some of the earlier mentioned materials. Although there is an ascent, the prevalence of harmonies surrounding the tonic can suggest a sense of closure and finality to the movement.

Figure 13. Vaughan Williams, *Violin Concerto*, bars 211–225.

The second possibility (Figure 9) suggests a more orthodox descending ^5-line, where ^5 echoes through the exposition, development and recapitulation. But as the line descends, the crucial ^2 is notably absent. As a result, the archetypal dominant resolution is not present and there is a ^3 directly to ^1 descent instead. It can also be suggested from this reading that there may be a temporary key change at bar 201. Furthermore, ^3 is not entirely convincing as the conceptual soprano is located in the inner voice, a more prominent part played by the solo violins.

The third possibility (Figure 10) suggests a rising soprano line from ^1 to ^8. Although this has precedents in the Schenkerian literature, what makes it particularly unlikely in this context is that there is no clear candidate for ^3.[123] Furthermore, it is implied that all movement from the development to the start of the recapitulation revolves around ^5 and a significant amount of movement occurs in the exposition. It is not entirely convincing that the notes identified on ^2 and ^4 reflects the music accurately as they are not structurally prominent.

The fourth possibility (Figure 11) suggests a more radical but perhaps more plausible fundamental structure, containing a descent from ^5 to ^4 to ^1. This interpretation reinforces the strong A pitch centre and depicts a clear tonic-mediant relationship across the piece. ^4 is the only tone identified prior to the tonic as there are no strong candidates for ^3 and ^2 in the recapitulation. Incidentally, the ^4 is supported by the tonic note, which as a result, reaffirms the tonic pitch centre. This would be one of the stronger candidates for the fundamental structure as it has a closer representation to the score itself. ^4 reinforces some of the key centres for the identified motives and melodic figures. This reading will be used as the fundamental structure for this movement.

The fifth possibility (Figure 12) suggests a unique representation whereby there is modal dualism, suggesting that there are dual pitch centres where D minor and Bb major should be equally regarded. This is represented by an unconventional "bass figure", containing two sets of chords, suggesting two possible tonal centres: a D minor and Bb major sonority. Multiple keys can be heard throughout the movement and this may be one possible way of representing its dualistic nature.[124] D and F are common tones in both chords and the identified A in the soprano line would be ^5 in D minor and a ^7 from Bb major. The idea of mixed modality could be explored quite thoroughly especially for this work due to the presence of different modes. Representing two different keys on different staves will allow the two different key centres to have their own voices (with its own unique prolongations

[123] David Heyer's work into the application of Schenkerian theory to post-Classical music, into the jazz repertory, provides examples of music that do not necessarily need to have every single fundamental stepping tone in the *Urlinie* for a complete descent (David Heyer, "Applying Schenkerian Theory to Mainstream Jazz: A Justification for an Orthodox Approach," *Music Theory Online* 18.3 (2012): 1-13.)

[124] The idea of dualism can also be seen in Arnold Whittall's work on Vaughan Williams's Symphony in D major, where he highlights moments of tonal ambiguity and conflicting tonal centres within the work (Arnold Whittall, "'Symphony in D major': models and mutations," in *Vaughan Williams Studies*, ed. Alain Frogley (Cambridge: Cambridge University Press, 1996)).

within the background structure). This is supported by a sustained and prolonged ^5 for most of the movement before descending immediately to the tonic in the coda.[125]

Of all the five readings, the ones conveying a descent from ^5 are more plausible. In the first, second and fourth readings, the As identified have a core structural significance, marking the pitch centric importance in the exposition, development and recapitulation. And in all readings, the final note D in the soprano line is situated on the very first note of the coda. As the motives identified in the exposition does not appear in its exact order in the recapitulation, the notes in the recapitulation will not end on the same note. In all cases, the D minor/modal centre plays an important role, it can be heard and seen at the start, all the way through to the end. It is also implied from the skeletal sketches that there is a shift to the mediant key in the development and recapitulation and it only moves back to the "tonic" centre in the coda.

Bars 201–221 and 129–144 are selected for closer examination for a middleground level analysis and this is shown in Figures 14 and 15 respectively.

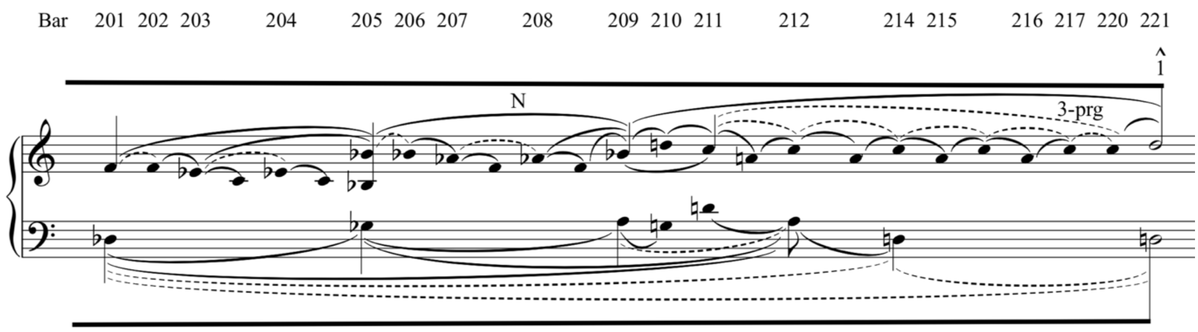


Figure 14. Middleground Level, Vaughan Williams, *Violin Concerto*, Bars 201–21.

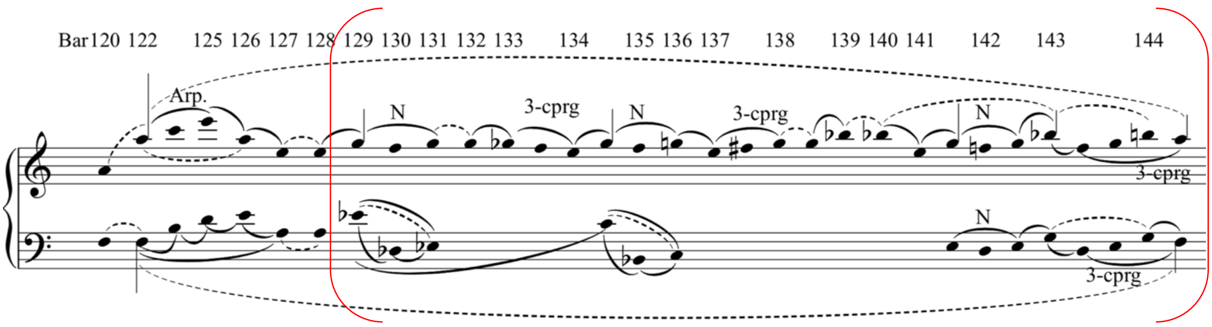


Figure 15. Middleground Level, Copland, *Passacaglia*, Bars 129–144.

125 From bar 152, ^5 can be seen in the solo violin, which is then reinforced in bar 173 in the violas and solo violin and appearing again in bar 214, the statement of the D minor chordal centre.

With the first section, bars 201–221, there are some interesting features that demonstrate both the applicability and challenges of a voice-leading analysis. From one perspective, it can be perceived that the Db identified in the bass in bar 201 anticipates the arrival of D natural in bar 221. This is however also supported by D in bar 214, a much stronger presence as it is sustained as a pedal tone leading to bar 221. The two additional notes that have a stem have a structural role and reinforce the repetition of the repeated melodic figure. The quaver stemmed note before bar 214, can act as the "dominant" sonority, giving the piece full closure as it returns back to the tonic note.

There is also a clear leading note rising to the tonic figure from bars 214–221 which is reinforced by a repeated C-A figure in bars 211–221. Ultimately, this section conveys a rising 3-c-prg from Bb to D from bars 209 – 221, embellished with a skip (F–Bb from bars 201–205) and an ascending passing note movement to C (by bar 211).

It is also interesting to point out that in bars 205–209, there is a skip of a minor 3rd from Ab to F, a third lower than its appearance in bars 211–216. Although this figure only appears twice in bars 205–209, this can be treated as a way to pre-empt its later appearance where the figure is employed four times. In addition, in bars 201–205, there is a minor 3rd figure alternating between Eb and C, a fourth lower than its appearance from bars 207–209. When comparing the materials in bars 201–205 to 205–209, although they are motivically similar, the key difference here is that in the latter, there is not a stepwise movement in the lead up to the next structural note. Finally, as bar 201 is preceded by G as the core structural note in the soprano reduction, the slight descent to F starting the section denotes a sense of continuity from the previous section. Furthermore, as this is also supported by D in the bass.

With the second excerpt, bars 129–144, the first thing one can observe is the long-range projection, the prolongation of A spanning beyond these bars, first appearing in bar 120 and concluding in bar 144. The soprano line of the first six bars that pre-empts bar 129 is simply a statement of an A minor sonority – supported by the tonic and dominant pitches. The middleground reduction of bars 129–144 also features repeated melodic and rhythmic figures. For instance, there is a lower neighbouring movement which is first stated in bars 129–131 and later repeated in bars 141–43, the first of which extends the G pitch centre into the following bar and the second is followed by a minor 3rd skip. The soprano line in general in this section is interlaced with ascending and descending 3-c-prgs. The Bb sonority which begins in bar 139, spans five bars and even encompasses the recurring neighbouring figure (G–F–G) and other linear progressions.

On a larger scale, this section could depict an overall upper neighbouring chromatic movement A–Bb– A in the soprano line. The neighbouring movement is supported by a repeated bass figure in bars 129–137, depicting an octave shift between each set of notes. The 3-c-prg in the soprano of bars 143–144 is also mirrored in the bass line well. From this analysis, one can observe that applicability of an extended VL analysis in neoclassical repertoire, being able to identify and describe the linear progressions, melodic features and establish an understanding of how these features play into the overarching structure of the movement.

<u>Example: Ravel – *Sonatine*, "Mouvement de Menuet"</u>

With Ravel's "Mouvement de Menuet", although this piece contains more diatonic properties than the first two examples, its analysis raises interesting issues.[126] Whilst a Schenkerian analysis can be applied to this movement, one faces numerous issues when describing its harmonies and its musical relationships. An interesting feature that binds the entire Sonatine, according to Orenstein, is the use of one single musical motif, a falling fourth idea or its inversion, a rising fifth interval.[127] This can indeed be seen in the opening of "Mouvement de Menuet", comprising an interval of a fifth in the melody, reminiscent from the first two pitches in the first movement, comprising a falling fourth.

From a formal perspective, it is firstly worth noting that the movement is in a ternary form with a three-bar coda. The first section A, comprises bars 1–32, the minuet proper, followed

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[126] Written in 1905 as part of his first stylistic period, this Sonatine was often called a "miniature jewel"; in the words of Roland-Manuel, it is "[a work that is] slight only in its architectonic dimensions; in its artistic content it is a major work, one of Ravel's finest, stamped with the double seal of youth and mastery." (David Ewen, *The Complete Book of 20th Century Music* (New Jersey: Prentice Hall, 1960), p. 314.) Comprising three movements, this work has been compared to sonatas of the Classical periods, by composers such as Mozart and Haydn, and to the Baroque style through the presence of figured bass-like material in the second movement, resembling Bach. Ivanchenko states that "neoclassical tendencies" are especially apparent in the second movement, "a quintessence of French *Menuet* in its elegance and sophistication." (Oleksii Ivanchenko, "Characteristics of Maurice Ravel's Compositional Language as Seen Through the Texture of his Selected Piano Works and the Piano Suite 'Gaspard de la Nuit'", PhD. Diss., University of Miami, 2015.) Similar sentiments were also expressed by Michael Puri as he stated that the value of the *Sonatine*'s recollected past is a combination of the following: its "implicit rejection of nineteenth-century Romaniticism", its "embrace of contrasting values typically associated with the eighteenth century", Ravel's "personal aesthetics" and a "desire to emulate. Neoclassical essays by his contemporaries" (Michael Puri, *Ravel the Decadent* (Oxford: Oxford University Press, 2011), 29).

[127] Arbie Orenstein, "Maurice Ravel's Creative Process," *The Musical Quarterly* 53.4 (1967): 467–81.

by a short trio comprising bars 33–52, and proceeded by the return of A, spanning bars 53–78 and the coda. On a more detailed level, the A sections can be further divided into smaller ideas, as shown in Table 4:

Table 4. Form and Key Sections for Ravel's "Mouvement de Menuet" (*Sonatine*)

Global Level	A		B	A^1		Coda
	Bars 1 – 32		Bars 33 – 52	Bars 53 – 78		Bars 79 – 82
Local Level	A	B	C	A^1	B^1	Coda
	Bars 1 – 12	Bars 13 – 32	Bars 33 – 52	Bars 53 – 64	Bars 65 – 78	Bars 79 – 82

Understanding the different motives and features that feed into the larger structure undoubtedly influences derivation of the background structure. One reading offers a descending ^8 line, where the start of the larger sections reinforces the Db sonority and the descent occurs within the A^1 section. Although Schenkerian readings do not consider coda materials to be part of the *Urlinie*, these analyses include the coda as a way to capture the entirety and full essence of the work. Much like the Vaughan Williams, there is an expanded cadence at the close of the recapitulation/opening materials and the true closure of the music is ultimately when the coda has made its statement. The reappearance of Db in bar 53 coincides with the entrance of the materials established in the beginning. As for the internal C# identified in bars 39 and 65 in the soprano line, these points coincide with the contrasting materials (local B level) in the movement as well as a temporary key change to C# minor. It can also be argued that as C# can enharmonically be spelled as Db, the entire movement can be perceived as a prolongation of Db before a descent towards the end.

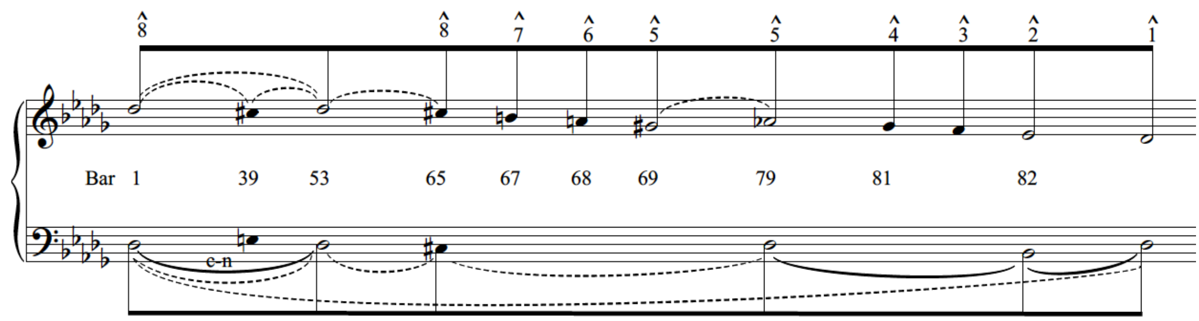

Figure 16. Deep Middleground Level 2, Ravel, "Mouvement de Menuet"

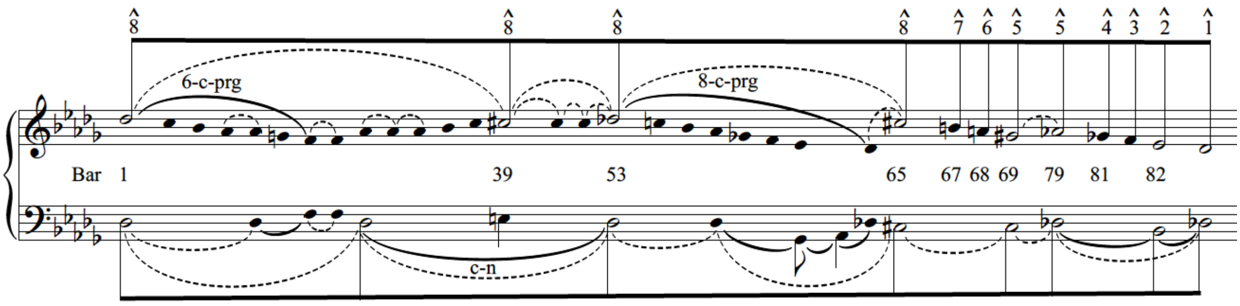

Figure 17. Deep Middleground Level 1, Ravel, "Mouvement de Menuet"

It is also interesting to note that another enharmonic inflection can be seen in bar 69, where G# is connected to Ab in bar 79. This is particularly significant as it acts as a transition back to the original key. Another striking feature is that due to the strong presence of C# minor, suggesting the identified keynotes, ^7 and ^6 are of an unorthodox nature. Given the strong presence of C# minor (the key of the Sonatine), upon its reappearance in bar 65, the next identified structural note occurs in bar 67 as B natural, followed by an A natural in bar 68. Although these two notes do not fit into the "tonal" scheme of Db major, we can see how the enharmonic relationship of Db and C# has allowed a coexistence of two key centres within the larger tonal framework. This reading also acknowledges the weak presence and unsupported spans of several key notes: ^7, ^6, ^4 and ^3. Closure in this piece is not achieved through a PAC but rather, a note that has a submediant relationship to the Db centre, reinforced by the tonic. Db in the bass line from bar 79 is essentially repeated across and extended into bar 81, supporting ^4 and ^3 in the soprano line.[128]

Another interesting feature is the 8-prg between bars 53–65, as seen in the detailed background graph. The identification of this linear progression within the larger framework can suggest an "initial order descent" (following strict Schenkerian terms) but in this particular context, this progression can be better argued as a linear progression critical in anticipating the actual descent from bar 65. This reading also presents an unorthodox closure to the work, possibly evoking a Phrygian cadence but the notes of the penultimate chord form a ii 4/3. This undoubtedly raises the issue of how closure would be defined in post-tonal contexts. It may well be the case that closure in Ravel example as well as the possibility of post-tonal music, is established through a combination of voice-leading and harmonic factors: the pull from the second to the first degree of the home key, as well as the voice-leading movement between chords ii to I.

[128] The score, highlighting the descent and its key notes, is attached in Volume 2: Appendix 3

A second reading of this movement (as shown in Figure 18) suggests a ^5 line, beginning on Ab and descends in the coda. The C# minor key areas are accounted for through its enharmonic equivalent, G#, before returning back to the original key in bar 79. This reading suggests that the bulk of the movement is a prolongation of ^5, encompassing both Db major and C# minor in the reading.

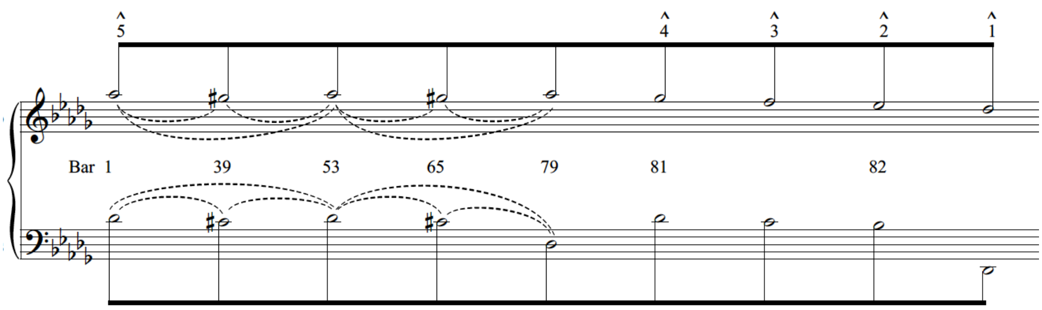

Figure 18. Deep Middleground Level 2 (Alternate), Ravel, "Mouvement de Menuet"

Another reading however, as shown in the figure below (Figure 19), demonstrates a closer interpretation according to Schenkerian principles, where ^3 to ^1 is identified between bars 61-4. There is an absent ^4 in this reading as there is no strong candidate for this tone. This reading therefore shows that the piece ends at bar 64 and the materials afterwards form a coda, a separate entity to the piece. There is however, a clear cadence, a dominant-tonic closure between bars 63–4. Although this reading may demonstrate a closer adherence to Schenkerian principles, dismissing the remaining bars of the piece suggest that these bars bear no relationship to the earlier sections and has its own unique qualities.

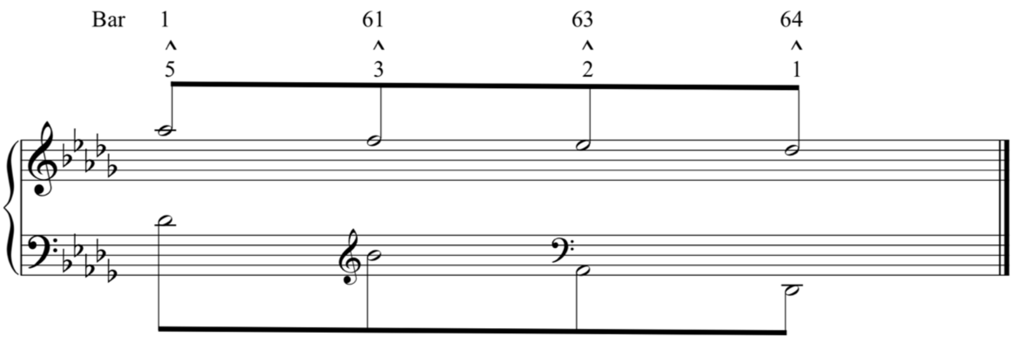

Figure 19. Background Level (Alternate Reading), Ravel, "Mouvement de Menuet"

On a localised level focussing on bars 1–12 and using the first chart as the preferred reading, we can firstly see that there is an overall 6-c-prg from Db to F, ^8 to ^3, a gradual descent from bars 1–12, as shown in Figure 20. We can also observe that this is embellished with a 3-c-prg in bars 5–8, with Db sustained in the first phrase with surrounding Ab as well as a bass line that reinforces the tonality with the 3rd and 5th stated within the first four bars. A temporary shift to F minor in the subsequent phrases also sees the bass supported with the tonic and dominant, embellished with passing note motion and consonant skips. The descent in the soprano line starts in bar 8, on the last quaver beat of the bar, Bb and Ab on the first semiquaver of the second beat of the subsequent two bars, G natural in bar 11 and F in bar 12.

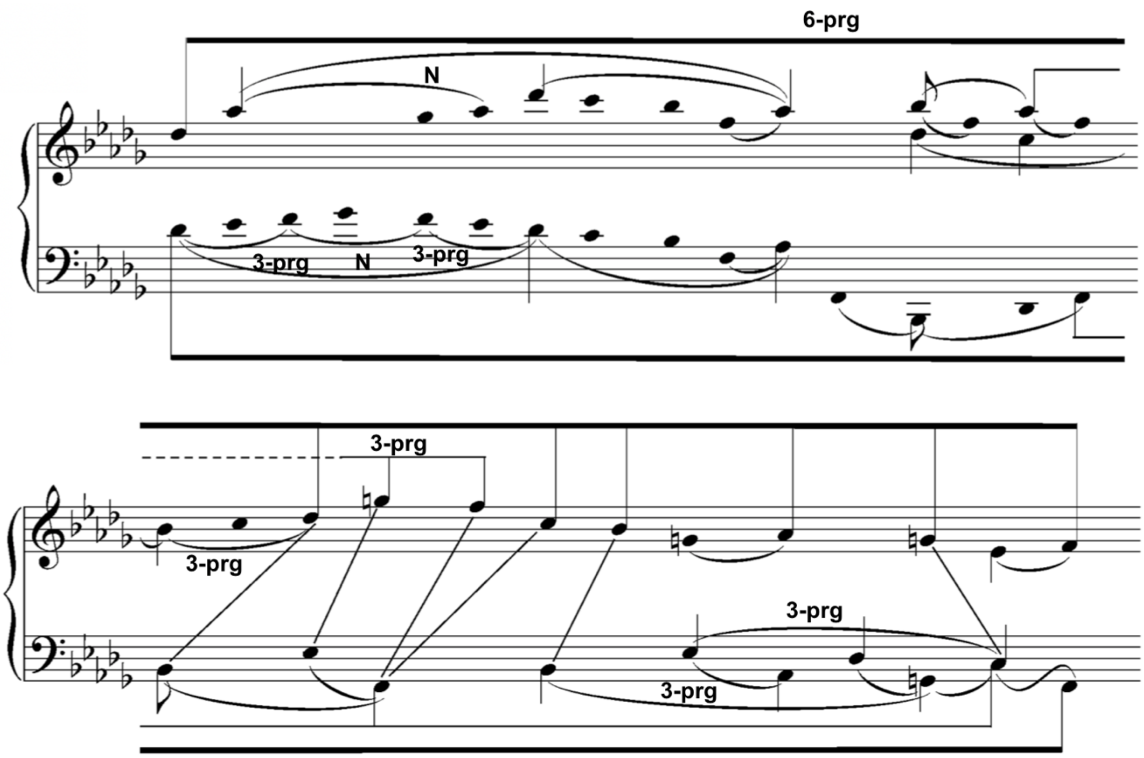

Figure 20. Deep Foreground Level, Bars 1–12, Ravel, "Mouvement de Menuet"

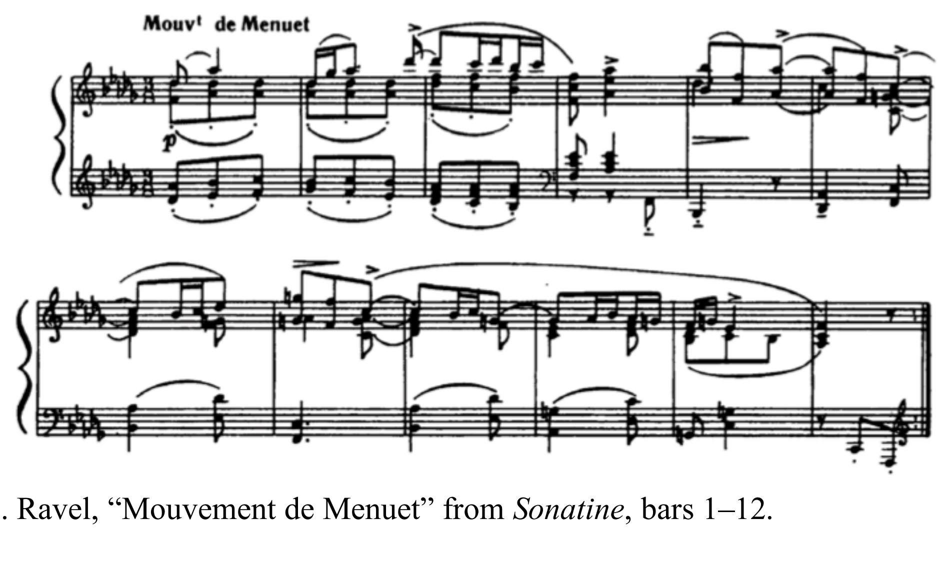

Figure 21. Ravel, "Mouvement de Menuet" from *Sonatine*, bars 1–12.

2.2 Harmonic Segmentation and Rhythmic Reduction

Despite the possibility of extending Schenker and devising a voice-leading analysis (where tonal and post-tonal characteristics are captured to better describe the music's melodic and harmonic relationships), in order to address the lack of tools to eloquently describe harmonies of neoclassical repertoire, one can look to other musical theories. As Schenker's approach is best suited to common-practice harmonies, there are more efficient approaches that can better describe neo-classical harmonies. Harmonies in this body of music can be broadly described as neo-tonal, which can be treated as a sub-branch of post-tonality, where a tonal centre is present and "asserted" in the piece, establishing pitch centricity – commonly through rhythmic emphasis, accents, register and timbre – alongside "non-functional" harmonies (in a traditional sense).[129] The function of these harmonies therefore requires further explanation and closer scrutiny in order to understand its relationship to its tonal centre. One such approach that one can turn to in place of common practice conventions is transformational theory, through the lens of a Neo-Riemannian[130] and pitch-class set theories.

Analyses by selected scholars such as Cohn, Broman, Ramirez and Tymoczko utilise NRT, and their work has revealed much about late-Romantic triadic progressions, voice-leading connections, set-class consistency and how this theory can bridge the gap between tonal and atonal techniques in theory pedagogy.[131] With the exception of Broman and Callender, who discuss pedagogical and VL prospects, it is particularly interesting to observe that these studies do not directly mention how NRT can be applied to other musical practices.[132] The application of this theory can also be extended to early twentieth century repertoire, particularly to neoclassical music where common-practice theories cannot fully reveal the music's harmonic mechanisms. Scholars such as Argentino, Ramirez and Smith have applied

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[129] Clare Eng also defines the various characteristics of neo-tonal harmonies and the concept of neo-tonality was also mentioned in an article by Richard Hermann describes a fusion of set theoretic and Schenkerian concepts to respond to the ambiguities raised in neo-tonal music ("Thoughts on Voice-leading and Set Theory in "Neo-Tonal" Works: the "Hymne" from Stravinsky's "Sérénade en la" *Theory and Practice* 12 (1987): 27–53.)

[130] Neo-Riemannian theory is known as a method that is able to analyse chromatic music and triadic textures, especially in late Romantic repertoire, in treating harmonies as a series of transformations rather than forming relationships relating to its key centre.

[131] Richard Cohn, "Maximally Smooth Cycles, Hexatonic Systems, and the Analysis of Late-Romantic Triadic Progressions," *Music Analysis* 15.1 (1996): 9-40; Per F. Broman, "Reger and Riemann: Some Analytical and Pedagogical Prospects," *Svensk Tidskrift för Musikforskning* [The Journal of the Swedish Musicological Society] 84 (2002): 13–25; Miguel Ramirez, "Chromatic-Third Relations in the Music of Bruckner: A Neo-Riemannian Perspective," *Music Analysis* 32.2 (2013): 155-209; Tymoczko, Dmitri. *A Geometry of Music: Harmony and Counterpoint in the Extended Common Practice*. New York: Oxford UP, 2011.

[132] Clifton Callender, "Voice-Leading Parsimony in the Music of Alexander Scriabin," *Journal of Music Theory* 42.2 (1988): 219–33.

NRT to late nineteenth to early twentieth-century works, including case studies of Schoenberg, Bruckner and Skryabin.[133] Another study by Deborah Rifkin employs not just neo-Riemannian but with a Schenkerian perspective in selective Prokofiev works, uncovering chromatic progressions through motives – systemic motives, pitch class motives – understanding these motivically optimised chromatic excursions.

Pitch-class set theory on the other hand, despite being developed out of the analysis of twelve-tone compositions, is initially a method to analyse pre-serial works, where its core concepts involve the representation of notes as numbers to better categorise these musical events and working with unordered sets. The application of set theory has been controversial, but it has been supported by key figures such as Beach and Forte. It can be argued that the understanding of set content will reveal a deeper relationship between melody and chords and between sections of the music.[134] Scholars such as Hasty, Ewell, Alegant and Lewin have applied pitch class set theories to early twentieth-century works that fall between the threshold of tonality and atonality.

For instance, Christopher Hasty applies the concept of segmentation and pitch class set theories to a variety of twentieth century compositions not limited to neoclassical works, which include Webern's second movement of Concerto Op. 24, Schoenberg's Five Piano Pieces, op. 23 and Stefan Wolpe's String Quartet (1969).[135] It is interesting to note that Hasty employs segmentation in a broader sense, using pc set theory for larger pieces, examining the role of structure within the music as well as using lower level analysis to reflect higher levels of structure. Similarly, Ewell also applies pitch-class set analysis to Webern's work.[136] Alongside a discussion of hemitonicism,[137] Ewell also establishes a subsystem of PC set theory, a valuable approach to understand intervallic, harmonic and motivic relationships, creating a closer link to musical phrasing and gesture to hemitonic fields, in turn assisting

[133] Joe Argentino, "Serialism and Neo-Riemannian Theory: Transformations and Hexatonic Cycles in Schoenberg's Modern Psalm Op. 50c." *Intégral* 26 (2012): 123-58; Miguel Ramirez, "Chromatic-Third Relations in the Music of Bruckner: A Neo-Riemannian Perspective: Chromatic-Third Relations in the Music of Bruckner," *Music Analysis* 32.2 (2013): 155–209; Kenneth Smith, "Skryabin's Revolving Harmonies, Lacanian Desire, and Riemannian *Funktionstheorie*," *Twentieth-Century Music* 7.2 (2010): 167–194.
[134] David W. Beach, "Pitch Structure and the Analytic Process in Atonal Music: An Interpretation of the Theory of Sets," *Music Theory Spectrum* 1 (1979): 7-22; Allen Forte, *The Structure of Atonal Music* (New Haven: Yale UP, 1973).
[135] Christopher Hasty, "Segmentation and Process in Post-Tonal Music," *Music Theory Spectrum* 3 (1981): 54–73.
[136] Phillip A. Ewell, "Russian Pitch-Class Set Analysis and the Music of Webern," *Gamut* 6.1 (2013): 219–76.
[137] (a similar set up to pc set theory, semitonal distance [pitch system defined by semitone and chromaticism])

with hearing pc sets. He privileged hemitonicism over chromaticism, a system based on semitonal movement not twelve tones.[138] Ewell's study is useful in exploring other possibilities besides chromaticism, the idea of hemitonicism as a way to account for intervallic, harmonic and motivic relationships can be useful as an alternative option. In addition, Alegant carries out a study that creates a model for pitch structure of Webern's "Das dunkle Herz", applying properties of transformation of the twelve-tone row, with pitch organisation articulated by retrograde symmetries and piece specific RI symmetrical configurations.[139] The result of his analysis essentially establishes a transformational network that assists in surface level realisation as well as understanding the deeper structures. This study is useful in shedding light on different types of representation which better embody post-tonal harmonies. Although Webern's twelve tone practice differs to Schoenberg, he gravitates towards rows that exhibits characteristics of set class invariance and retrograde equivalence, for example Symphony Op 21, the Concerto for Nine instruments Op 24, Cantata No. 1 Op 29.[140] Lewin also investigated Schoenberg's later works, and his findings contained unique features, featuring hexachordal inversional combinatoriality.[141] Daniel Harrison's *Harmonic Function in Chromatic Music* also provides a useful perspective, which argues that scale-degree functions provides a basis for illuminating tonal associations by voice-leading connections, employing loose application of NRT concepts, where scale degree functions by disassembling the traditional harmonic unit, and breaking down the triad into its constituent elements – base, agent and associate.[142]

2.2.1 Method and Application

One alternative way to analyse neoclassical music is therefore to apply some core concepts from NRT and PC set theory. This can firstly be related to the *Tonnetz*, a tool frequently

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[138] The concept of hemitonicism reinterprets intervallic properties and renaming intervals, where the hemitonic field is the continuous filling in of semitones along vertical, horizontal and diagonal dimensions.
[139] Brian Alegant, "A Model for the Pitch Structure of Webern's Op. 23 No. 1, "Das dunkle Herz"", *Music Theory Spectrum* 13.2 (1991): 127–146. https://doi.org/10.2307/745895
[140] His Op 23 No. 1 is also unique, where it lacks symmetry, doesn't use the common disjunct hexachordal, tetrachordal or trichordal set classes, contains instead "several redundant scs" that contribute to sc saturation on a surface level. Identifying relationships within rows of set classes
[141] David Lewin, "A Study of Hexachord Levels in Schoenberg's Violin Fantasy," Perspectives of New Music 6.1 (1967): 18-32. (how he partitions the 48 rows of the row class unto 12 discrete row quartets or regions, which then consists of two I combinatorial rows and retrogrades)
[142] Daniel Harrison, *Harmonic Function in Chromatic Music: A Renewed Dualist Theory and an Account of Its Precedents* (Chicago: University of Chicago Press, 1994).

associated with neo-Riemannian theory.[143] As a graphical representation, however, this only illustrates adjacency by identifying core transformations (parallel, relative or leading-tone motion) and various other secondary operations (combinations of the core transformations). Thus, in order to account for a more diverse range of collections that do not operate or "transform" via a series of thirds or fifths, the *Tonnetz* requires modification, both to account for such motion and to observe how seemingly unrelated key areas are in fact proximate.

Adapting some aspects of Von Oettingen, Hostinsky, and Riemann's initial conception of the *Tonnetz*, an innovative way to relook this is by converting the letter names into integers,[144] the connecting lines are removed and the *Tonnetz* is realigned into a grid as opposed to a lattice diagram (see Figure 22)[145]. As such, more abstract shapes can be formed, which depict close relationships between unrelated key areas, chords and extended harmonies.

4	7	X	1	4	7
0	3	6	9	0	3
8	Y	2	5	8	Y
4	7	X	1	4	7
0	3	6	9	0	3
8	Y	2	5	8	Y

Figure 22. Modified *Tonnetz*.

For instance, when examining the transformation from G minor [7X2] into F minor [580] in Figure 23, which are the first two key areas drawn from the first movement of Hindemith's Sonata (bars 1 and 41 respectively), one can observe their numerical proximity and how they progress diagonally in their integer space. Quantifying such movement as close, or preferably, "small" movement will greatly depend on the context of the music; however, the movement of 0 (common tone), 1 (semitone) and 2 (tone) can be described as minimal/small in accordance to Neo-Riemannian principles. As transformations between two chords on the *Tonnetz* would typically share two common tones (0) and the movement comprises a semitone (1) or tone (2), these movements are therefore regarded as of a "smaller" quantity. The movement between individual voices from G to F minor self-evidently moves by 2, as

[143] A graphical tool that depicts the tonal space to visually represent harmonic relationships from Neo-Riemannian Theory. This method is used to analyse chromatic music and triadic textures, to examine the "transformations" as opposed to "relationships" within the harmonies.
[144] To avoid confusing [10] and [11] with [1] and [0] and [1] and [1] when placed in close proximity, [10] and [11] are abbreviated as [X] and [Y] respectively.
[145] Richard Cohn, "Neo-Riemannian Operations, Parsimonious Trichords, and Their "Tonnetz" Representations," *Journal of Music Theory* 41.1 (1997): 15; Milan Kidd, "An Introduction to the Practical Use of Music-Mathematics", University of Chicago, published August 2006, http://www.math.uchicago.edu/~may/VIGRE/VIGRE2006/PAPERS/Kidd.pdf.

further explained in Table 5. In this instance, the total amount of VL movement from the accumulation of the individual VL movements is therefore 6. As such, one way to quantify the movement between two chords or pitch collections (PCns) and to describe the transformation would be to measure or calculate the total amount of harmonic movement rather than using "specific labels" for the transformations (e.g. parallel, relative, leading-tone), an idea influenced by Straus's work, which attempts to generalise voice-leading systems.[146]

4	7	X	1	4	7
0	3	6	9	0	3
8	Y	2	5	8	Y
4	7	X	1	4	7
0	3	6	9	0	3
8	Y	2	5	8	Y

Figure 23. Transforming [2X7] into [580].

Table 5. Tracking the "close" movement from G to F minor.

G minor		Movement	F minor	
Notes	Pitch-class		Notes	Pitch-class
D	2	-2	0	C
Bb	X	-2	8	Ab
G	7	-2	5	F

Therefore, in the above instance, the amount of movement between the two sets of chords/PCns is 6, a value that can be perceived to be larger and can suggest more tension or a significant movement in the music. The following steps will consequently be taken to account for neoclassical music's harmonic vocabulary, and to assess how it relates to other musical parameters, following the process laid out in Figure 24.

146 Joseph Straus, "Uniformity, Balance, and Smoothness in Atonal Voice Leading," *Music Theory Spectrum* 25 (2003): 315. The term pitch collection (PCn) transcends the tonal tradition. In dealing with post-tonal repertoire, this term describes vertical sonorities derived from any given scale. This was also briefly explored by Steven Rings and Dmitri Tymoczko as well (Steven Rings, "Perspectives on Tonality and Transformations in Schubert's Impromptu in E-flat, D. 899, no. 2," *Journal of Schenkerian Studies* 2 (2007): 33; Dmitri Tymoczko, "Set-Class Similarity, Voice Leading, and the Fourier Transform," *Journal of Music Theory* 52.2 (2008): 251-272.)

Figure 24. Procedure for Harmonic Reduction

The process of rhythmic reduction parallels the Schenkerian method. It is, however, dependent on one key factor: the time signature. A hierarchy of rhythms can be established, from larger to smaller values, and relationships can then be connected to other musical parameters. Drawing upon the ideas of Cone, Cooper, Meyer and Komar, the way one musical segment is examined and identified initially relies on accentual patterns – to locate the "structural downbeats" – and its attack points.[147] Different levels of rhythmic segmentation will then emerge. The minimum number of durational units into vertical linear sonorities is therefore a variable that changes depending on the music's metre and attack points.[148] It is also vital to acknowledge that harmonic segments may not necessarily conform to any regular durational span. The following section will draw on examples from the works the previous section (first movement from Vaughan Williams' *Violin Concerto in D minor*, Copland's *Passacaglia*, and "Mouvement de Menuet" from Ravel's *Sonatine*,), to demonstrate how segmentation and harmonic analysis is performed.

<u>Example: Vaughan Williams – Violin Concerto in D minor</u>

Two sections from the first movement, bars 201–220 and bars 129–144 are selected for close examination, with its calculations shown below in Figure 25. This figure demonstrates how the chords are translated into integers and subsequently, the closest semitonal movement between the PCn were calculated. [149]The first of which, bars 201–220, is segmented in crotchets, given the clear division of each beat. As notes in the melodic line generally consist of notes from the respective chords, these are included in the PCns as well. It can be noted that the use of passing notes becomes more prominent upon the third appearance of the theme in the Viola. There are however, exceptions to this, particularly in bar 214 where the embellishment in the melody of the upper stringed instrument, D, is included in the PCn. This is reinforced by the D in the bass as well. A closer examination with a different segment, bars 129–144 subdivides by quavers, responding to the smaller division of beats, to gain a closer

[147] Edward T. Cone, "Analysis Today," *The Musical Quarterly* 46.2 (1960): 172– 88; Cooper and Meyer, *The Rhythmic Structure of Music*; Arthur Komar, *Theory of Suspensions* (Princeton: Princeton University Press, 1971).

[148] Acknowledging surface rhythm on small and large scales has been investigated by Carl Schachter. (Carl Schachter, "Rhythm and Linear Analysis: A Preliminary Study," *Music Forum* 4 (1976): 281-334; Carl Schachter, "Rhythm and Linear Analysis: Durational Reduction," *Music Forum* 5 (1980): 197-232; Carl Schachter, "Aspects of Meter," *Music Forum* 6 (1987): 1-59.)

[149] If a triad moves to a tetrachord, the movement will be calculated by using the integer closest to the voice. E.g. X36 to 8X35, X and 6 are the closest to 8, X is shared with X, same with 3, along with a movement of 1 from 6 to 5

view of each vertical
sonority.

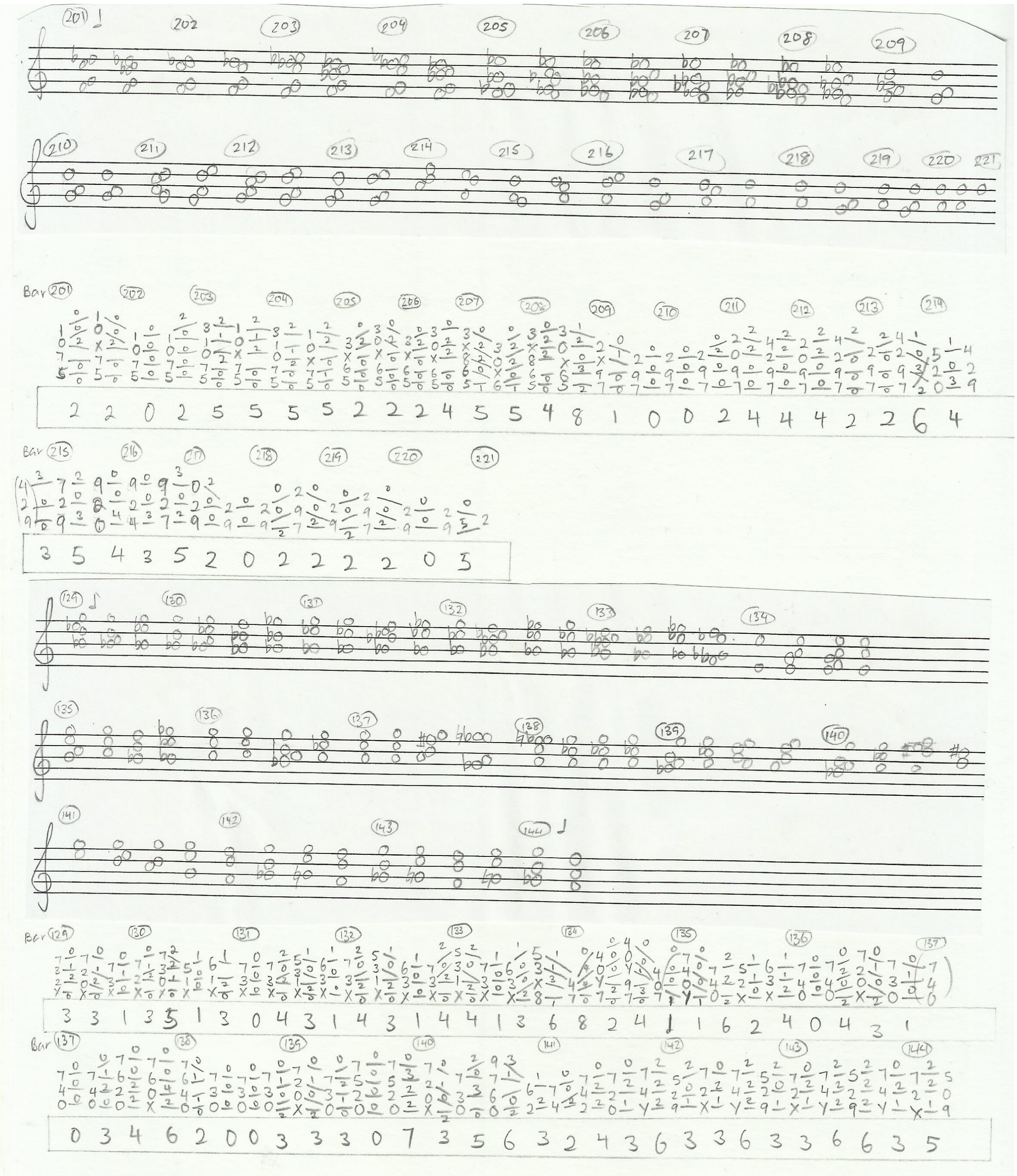

Figure 25. Segmentation and Calculation, Vaughan Williams, bars 201–220 and bars 129–144.

The numerical content from the PCns can then be aligned in three different ways:

1. Unordered VL Movement – stating the VL movement in its unordered state

2. Ordered VL Movement, also known as Basic Intervallic Pattern[150] (BIP) – arranging the numerals from smallest to largest (e.g. [001] instead of [010] or [100])[151]
3. AVL – Aggregated voice-leading movement, the total amount of movement.

Figures 26 and 27 illustrates a VL reduction integrating elements from the first section and the harmonic segmentation as well as the VL data.

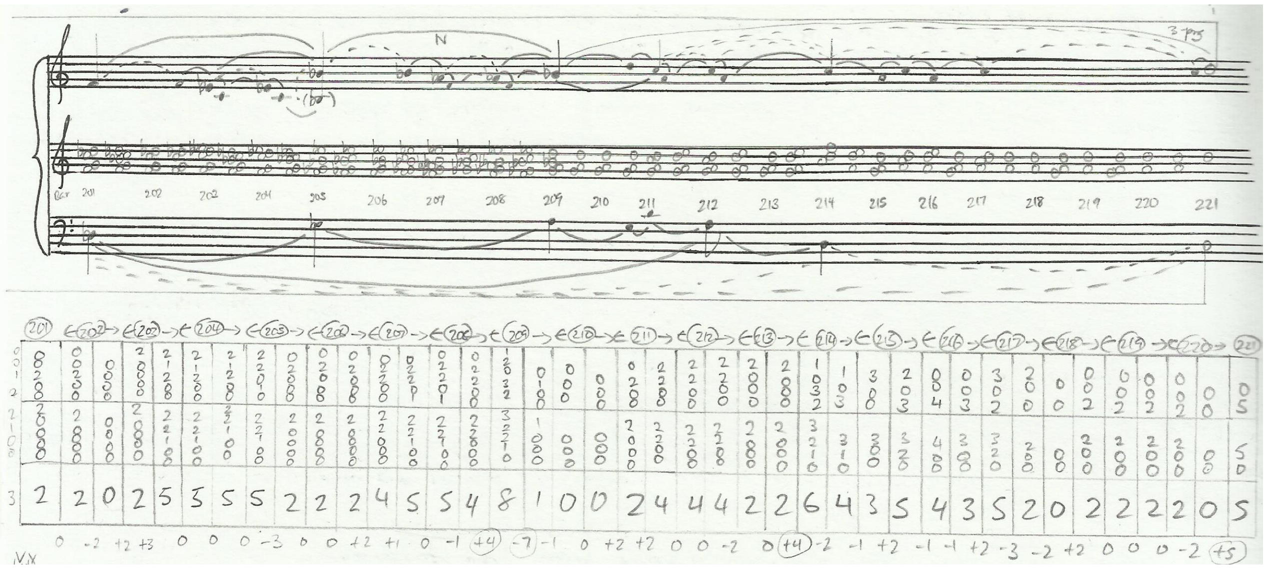

Figure 26. VL Reduction and Segmentation, Vaughan Williams, bars 201–220.

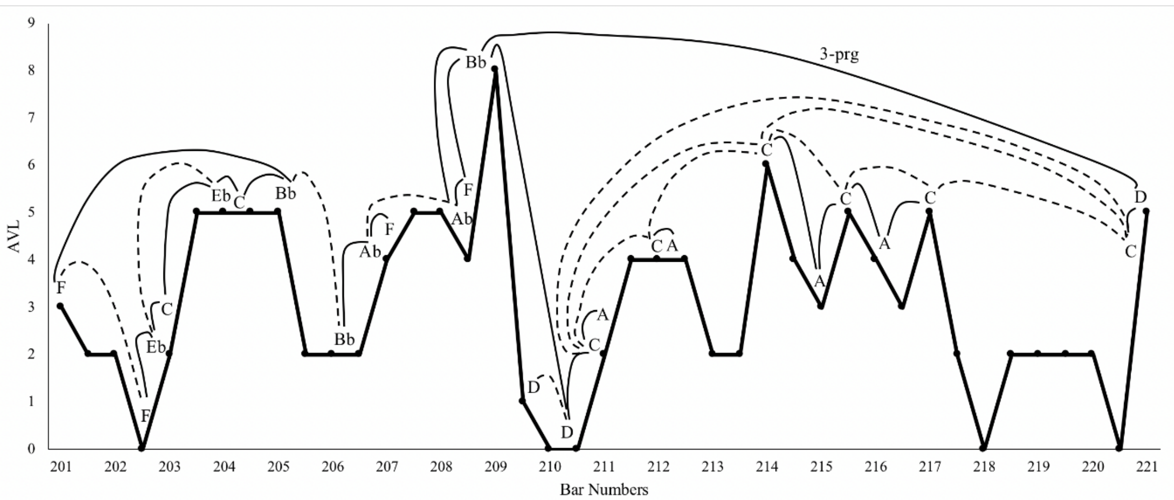

Figure 27. AVL and VL data, Vaughan Williams, Violin Concerto in D minor, Bars 201–220.

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[150] A term that has its origins in Pitch Class Set theory.

[151] This numerical representation does not cover intervallic vectors as seen in set theory.

This can additionally be plotted as a line graph, where the AVL is on the y axis and the bar numbers on the x axis. The melodic contents from the VL reduction can be plotted on these data points to further enhance the "harmonic" and "melodic" relationship within the music.

This section details the observations from bars 200–221. The "initial" prolongation of F, the shift from the lower to the upper register, is supported by a decrease in harmonic movement, which thus suggests that the peak/highest point of the phrase is established through a combination of smaller AVL. The movement from E to Eb is supported by a slight increase in AVL, suggesting that F is leading towards Eb. Eb is also the start of the consequent idea, reinforcing the notion that there is more tension in order to resolve the antecedent idea. What is even more interesting is the data point of Eb on its second appearance, as it occurs on a larger data point. This suggests that there is a renewed emphasis on its second appearance. It must be noted, however, that neither C (especially after Eb) is directly supported by a data point, as it falls on the second half of the crotchet beat. But overall, one can visually observe that the movement from the first statement of the motive in bar 201 to the second appearance has an overall increase in AVL, suggesting an increase in intensity, a phenomenon that will be explored in the last part of this chapter.

With the second statement of the M6 motive from bar 200, the shape of the graph resembles the first statement where there are decreases in both cases: the first with 3 to 0 and the second with 5 to 2 – decreasing by 3 each time. The subsequent movement to Ab is represented with an increase, much like its first appearance, suggesting more intensity upon its consequent phrase. With the Ab-F figure, unlike the first statement, both Abs are on the same data point. Through examining the VL data, this could potentially suggest the same amount of tension between the two statements.[152] Fs are not on a fixed data point either. And again, as M6 is repeated, this is situated on a higher data point. As shown in the table below (Table 6), the repetition of M6, in M6.1 and M6.2 depicts a steady increase, giving the third statement more emphasis, repeated in the violas again.

Table 6. AVL Movement in Bars 201–209.

Bar 201		Bar 205		Bar 209
M6.1		M6.2		M6.3
3	+2	5	+3	

[152] The notion of tension will be explored in the last part of the methodology chapter.

An interesting point can also be seen in this section (much like the first two appearances in this section), the highest note of the phrase is reflected by a significantly smaller number. In fact, one can observe the following decreases:

1. 3 – 0 – decrease of -3
2. 5 – 2 – decrease of -3
3. 8 – 0 – decrease of -8

Whilst there is a consistency in the first two appearances, there is a significant decrease in the AVL for the third statement. This has a significant impact on how we hear and interpret the graph, as it draws our attention to the last phrase. And much like the first two statements, the start of the consequent idea is represented by a slight increase in the data points, increasing the momentum of the phrase. Similarly, with the C-A figure, A is not on a data point as it falls on the weaker beat of the bar and due to the fact that this segment was divided into crotchet divisions. But it can be seen that there is a closer relationship between the first and third statements due to the arch of the graph.

With the prolongation of C in the last phrase, there are decreases from a large AVL to a smaller AVL (6-5-5-(0-5)), which mirrors the shape of the phrase, marking the end of the section as well. The last C is problematic as it does not fall on a specific data point. An interesting point to observe is the shape from the responding phrase in bar 211 with the identified keynote, C, there is an increase in the data point in the lead up to bar 214, which suggests a build up towards the higher sonorities.

The inner movements in the last phrase, from C to A, mirror the melodic contour, strong correlation between melodic registral movement to the harmonic tension – in the solo violin – but other parts decrease in their registers steadily. The overall 3-prg, Bb-C-C-D, represented with the AVLs 8-2-6-5, presents a decrease in the data points and this suggests that there is perhaps a sense of finality to the end of the section.

There are four instances of significant movement in these few bars, three of which have already been accounted for in bars 214, 221, and 209. The one instance that is unaccounted for can be seen on the second beat of bar 209, where there is a decrease of -7. As there is no note on this particular data point, the best candidate would be D, as this would ultimately assist in supporting the next identified D in the next bar, bar 210. On the whole, it can be seen that a crotchet segmentation has been quite effective in revealing the harmonic intensity of the section. There are, however, certain sections that would greatly benefit from a quaver segmentation.

Table 7. Statistical data, Vaughan Williams, *Violin Concerto*, Bars 201–220.

Statistical Data	
Mean	3.05
Median	2.5
Mode	2

Table 8. Individual VL Movement Data, Vaughan Williams, *Violin Concerto*, Bars 201–220.

Individual VL Movement between each PCn	
0	95
1	10
2	40
3	7
4	1
5	1

Table 9. BIP Data, Vaughan Williams, *Violin Concerto*, Bars 201–220.

BIP Collection			
0	0000	1	5
	000	2	
	00	2	
1	0001	1	1
2	00002	6	14
	0002	3	
	002	5	
3	003	2	2
4	00022	2	7
	0022	3	
	004	1	
	013	1	
5	00122	6	9
	023	2	
	05	1	
6	0123	1	1
8	01223	1	1

This line graph also yields other results as shown in Table 7, a statistical analysis of individual VL movement and frequency of BIPs. From this section, one can observe that the mean AVL is 3.05, a "smaller" AVL occurring right before the coda, the release of tension and as such, correlates with the music's structure. This is also reflected in the median and mode, where there are consecutive and frequent use of smaller VL movement. With the individual VL movement as shown in Table 8, it can firstly be noted that these are all predominantly driven by common tones, which can attribute to a sense of harmonic regularity. It is interesting to note that VL2 is used more frequently than VL1. VL2 changes the colour/quality of the chord. There is a very minimal use of larger VL movement, thus suggesting that harmonic interest can be stimulated without large VL movement.

With the BIP as shown in Table 9, several points can be made. The repeated use of certain VL movement can be seen across these few bars – AVL5 and AVL2, especially bars 204 – 205. This numerical pattern occurs from the middle of the first M6 fragment, AVL5 and proceeded immediately by AVL2. This occurs three times in a row and when examining the AVL prior to this moment, it can be highlighted that it constantly remains on VL2. This could suggest that perhaps there is a direct correlation between the closing of the phrase to a larger amount of harmonic movement. However, as this occurs within a sequence (repeated fragment), the BIP also suggests a sense of stability within the harmonies. Hence the larger number denotes instability and a drive for the phrase to propel onto its subsequent appearance. It is then interesting to note that the consecutive use of [00002] is much like the first appearance in the section, but this time, VL2 is used three times in a row as opposed to [220], and from one perspective, the use of repetition can arguably establish more of a sense of consistency. The next recurring use of consecutive BIPs appears towards the end of the section, beginning on the second beat of bar 218 and into the first beat of bar 220. The presence of repeated VL movement, particularly towards the end of the phrase, indicates that a sense of stability can perhaps be felt, giving the solo violin more prominence and emphasis. The notion of stability relating to VL movement and AVL movement will be explained in the last section of this chapter. So rather than having a series of larger harmonic movement, smaller harmonic movement was used. This can be seen where multiple instruments double up and play the same motivic idea or held note.

With [00122] in particular, although this occurs four times in a row in bars 203–205, it does occur twice in a row between bars 207–208, a reminiscent appearance of the first statement. This begins on the same beat as its first appearance, and the following harmonic movement can be seen: (1) 5-5-4-8 (2) 5-5-5-5. This suggests that the second appearance is much more significant, an increase in tension upon its reiteration. And with [00002], its remaining appearances of [00002] actually occur at the start of the section: 2-2-0-2. The appearance of VL0 breaks the pattern, coinciding with the peak/highest note of the phrase, reinforcing the notion that it is not entirely necessary for the climactic point of the phrase.

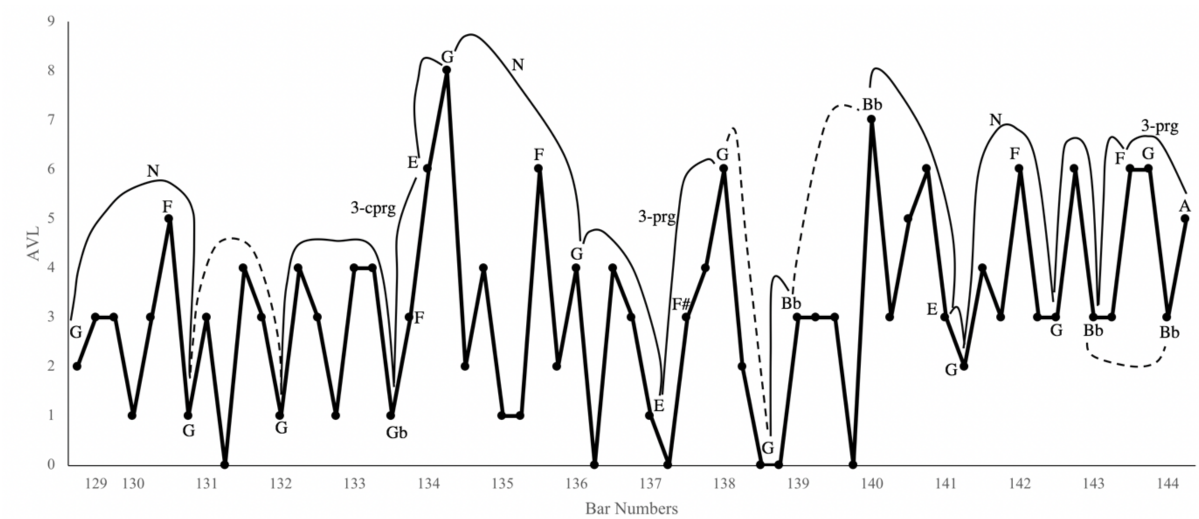

Figure 28. AVL and VL data, Vaughan Williams, Violin Concerto in D minor, Bars 129–144.

As for the segmentation of bars 129–144, which employed the minimal duration of a quaver, there are several interesting features. In bars 129–130, the first appearance of the motivic idea M2[11], played by the ritornello, indicates that there is a decrease of tension due to its small AVL contents. Although the notion of tension will be explored later in the methodology chapter, it is useful to note that the highest point occurs on the neighbouring note, suggesting that the repeated Gs preceding F aids in building the momentum to this particular point. In bars 134–135, a striking feature can be seen in the different contour of the neighbouring movement on its second appearance. This begins on a significantly higher data point and decreases upon the completion of the movement. This suggests that the second statement is more prominent, and has more significance.[153]

As for bars 141–142, the third reiteration of motive M2[11] is somewhat similar to its first appearance, due to the overall contour of the shape. The first two data points begin one notch higher than the first appearance of the motive but the last data point does not conform to this pattern. This simply means that on a larger scale, as this motive precedes the cadenza, the slightly larger data point can act as a connecting point to drive more momentum, to lead it into the cadenza. With each of the neighbouring movements, G-F-G, the following results can be discerned:

1. 2-5-1
2. 8-6-4

[153] The notion of tension is important here once more, as this begins on data point 8, a higher AVL, it suggests that there is more tension – yearning to be resolved, to phrase off – the phrase is then concluded with an overall decrease.

3. 3-6-3

A close relationship can be seen between the first and third instance as they both share the same numerical contour (+1, +1, +2). This is also a marker to denote the end of the section.

The prolongation of G in bars 131–132, containing the same data points, denotes a sense of continuity within the phrase. What is even more interesting is that the shift to Fb, denoting a temporary presence of chromatic sonorities, is represented with the same data point, a smaller AVL, which reaffirms continuity across these few bars.

Interestingly, the 3-cprg in the last three notes of the solo violin, coinciding with the last notes of the phrase, are represented on the graph as an increase from 1 to 6. This indicates that whilst we have reached the end of the phrase, on the bigger scheme of things, it is unfinished and yearns to start the next segment.

To mark the emphasis of the second statement, the consonant skip from E to G provokes an increase in the data points. Similarly, as the next consonant skip falls in the middle of the phrase, there is a decrease in order to build towards the climax of the phrase. The 3-prg across bars 137-138 also contains a steady increase, perhaps as a way to reinforce the semiquaver passage, an idea that is repeated several times in this section. The registral transfer is represented by a significant decrease from 6 to 0, perhaps as a subtle representation of continuity in the phrase. The consonant skip to Bb, one of the highest notes of the phrase, represented by a slight decrease, aligns with the melodic contour. As this bar is repeated twice, the second appearance of Bb in the subsequent bar is represented by a larger data point, which suggests more emphasis.

As one then might be able to predict, the shift from Bb to E, to the last note of the phrase is denoted by a smaller AVL, phrasing off the segment. This is then immediately followed by another smaller decrease in AVL to mark the start of the final appearance of the third figure, a closer relationship between the two phrases, with more common tones involved. The consonant skip from G to Bb contains the same data point, as these are part of the same phrase. Although it occurs towards the end, the same data point suggests continuity as it diverges to a different idea. The underlying 3-prg is represented by a slight decrease in data point, coinciding with the end of this segment. With the consonant skip from Bb to F, as this shift ultimately marks the start of a new subphrase, the increase in data points give more emphasis to F, suggesting that more attention should be given to this moment. The prolongation of Bb contains the same data point, which contains a subtle sense of continuity across the previous to the new phrase.

From this analysis, one can observe the relationships between the (AVL) data points and (VL) melodic key points as well as the relationships between the VL data to the BIP data (e.g. the appearance of repeated BIPs that can denote stability). Ultimately, the observations can be heard upon listening to the movement, establishing a close correlation between theoretical analysis and practical listening of the music.

Example: Copland – *Passacaglia*

Due to the nature of the work – set in common time – and upon examining the different rhythmic values for the selected sections for analysis, a crotchet segmentation was determined to be the best option.[154] Stepwise movements are treated as embellishments, with the assumption that thirds would be part of the PCn. Arpeggiated figures will form part of the vertical sonority, thus establishing a clear understanding of what comprises passing notes and neighbouring notes. There may also be instances where two chords will be identified per bar or simply just a deviation of a few notes for better consistency. The diagrams below present the segmentation, conversion to its numerical equivalent and calculations for bars 41 – 55 and bars 70–83.

[154] The harmonic segments in this instance do conform to a regular durational span, of crotchet beats.

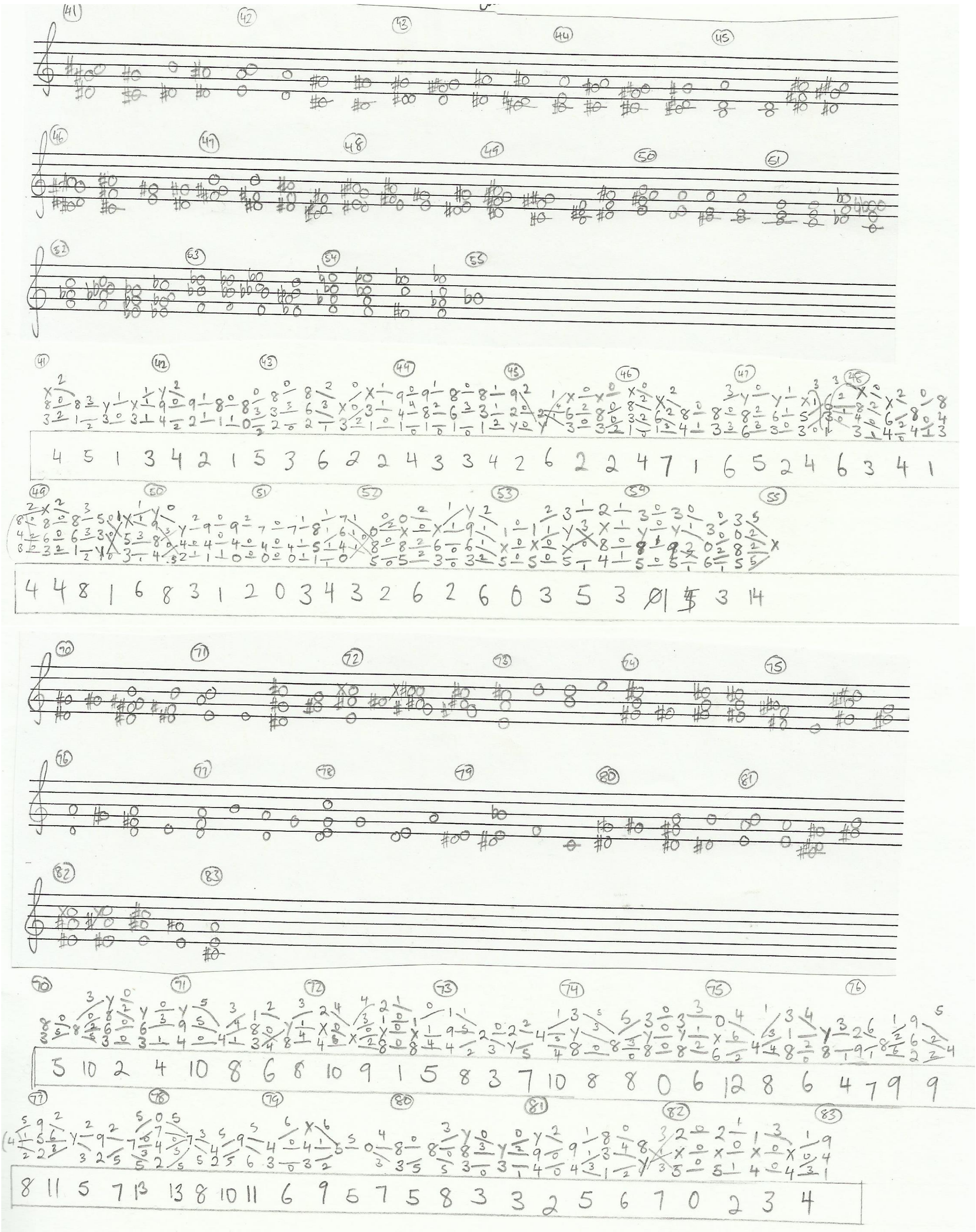

Figure 29. Segmentation and Calculation, Copland, bars 41–55 and bars 70–85.

The figures below display the VL reduction chart and its corresponding line graph for bars 41–55.

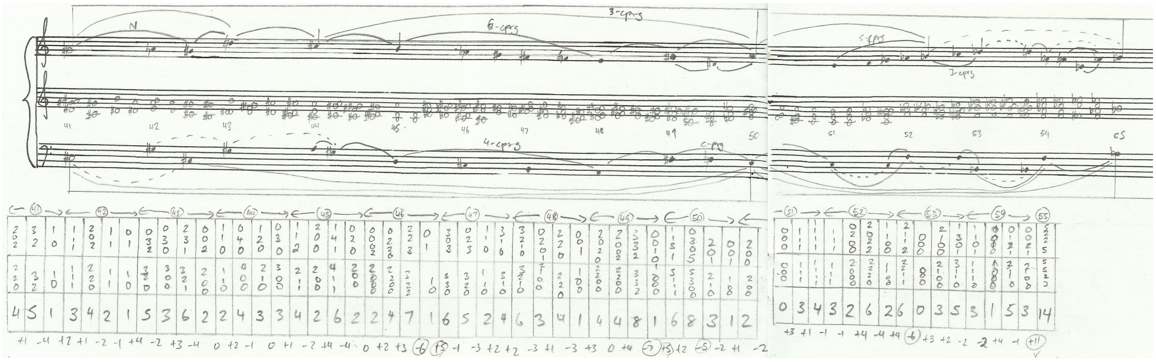

Figure 30. VL Reduction and Segmentation, Copland, bars 41–5.

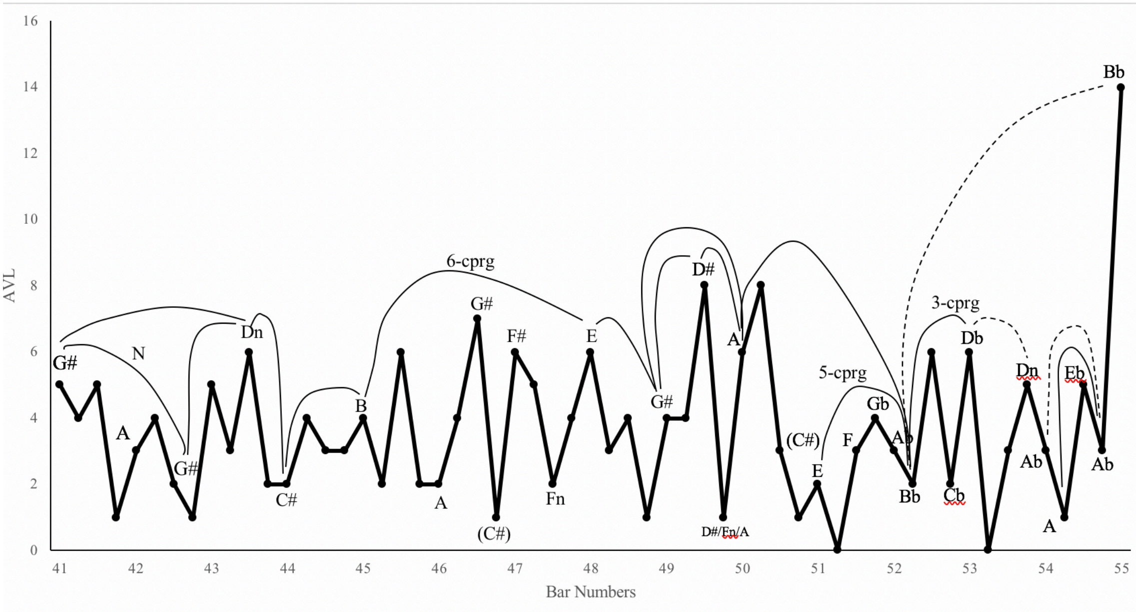

Figure 31. AVL and VL Data, Copland, bars 41–55.

Some interesting features can be seen from these bars. With the movement Gb-A-G#, presented with the data points 5-3-2, this depicts a gradual decrease in data points, which aligns with the phrase material – a "call and response" idea. A falls at the start of a new bar, a downbeat but the AVL is smaller than expected. The core note that follows is also on a smaller data point, which could perhaps explain the "closed" musical unit.[155] With the next phrase, what could perhaps be described as a contrasting idea (CI), D to C# is represented with the data points 5 – 2. What is immediately striking from this is that both subphrases begin on the same data point, 5, and its subsequent resolution to C# is also on data point 2. This also therefore means that there is an increase from the end of the first subphrase into the

[155] A "closed" musical unit can be broadly defined as a phenomena where one or more musical elements (e.g. melody, harmony, rhythm, dynamics) contribute to closure of a phrase. In this case, a smaller AVL content can denote phrase closure.

next, a "build-up" to the CI. With the 6-cprg, B-A-G#-F#-F-E, supported by the AVLs 4-2-7-6-2-6, several interesting points can be seen. For instance, the larger AVL on the notes B, G# and E suggests an emphasis on the E pitch centre. The overall decrease in AVL from B to E suggests that E is not the true "resting" point of the phrase and it is simply assisting in the build-up or increasing the momentum. The smaller DP on A despite occurring on the downbeat of the bar could be due to the fact that it might be better treated as a PN. But how might that explain the larger AVL on F#? G# is leading towards F#: a stepwise motion or sense of leaning towards the PN to E. There is also an increase from C# (the end of the last phrase) to B (start of a new phrase) – which could potentially suggest that the "consequent" phrase requires more emphasis. Much like the Vaughan Williams example, this analysis features the close relationship between harmonic data calculation and VL data to what one hears within the music, and the suggestion that a larger AVL data correlates with more tension.

The overall movement of this section, represented by the notes G# to A, suggests an overall increase in AVL, providing closure to the section. The movement from E (last note of the CI) to G# depicts a decrease, despite G# falling on the first beat of the bar, perhaps a resolution? But interestingly, before G# resolves to A, the passing D# which is represented on the chart is situated on a significantly larger data point. This suggests that D# could potentially mark the "climactic" moment of the "coda", a cadence-like moment, with a higher data point which then resolves to A, a slightly smaller data point on the next bar. With the new key area, the first interesting feature to note is the 5-cprg, E-F-Gb-Ab-Bb, supported with the AVL values of 2-3-4-3-4. There is an overall increase in data points from the first to the last note. This 5-cprg can potentially act as an initial ascent and the last note, Bb, could be perceived as the core structural note in this new key area This therefore means that the movement from A to Bb is represented by data point 6 to 2, suggesting that there might be more interconnectivity between the two different key areas. The subsequent 3-cprg Bb-Cb-Db supported by data points 2-2-6, depicts an overall increase in data points. The two smaller data points do occur on weaker beats, which may suggest equal weighting, and leaning towards the downbeat, Db. With the movement from Db to D natural, with the data points 6 to 5, it is interesting to observe that the slight chromatic shift within the very same bar itself illustrates a slight decrease in data points, suggesting possibly a sense of closure to the subphrase. The overall arch of the Bb pitch centre, spanning four bars, conveys a large increase from 2 to 14. This could potentially suggest that these four bars are a build-up to bar 55, marking the entrance of the opening materials. The materials in bars 51–54 do not occur again for the rest of the section, therefore creating a notion that these four bars are a form of introduction to the core materials. Interestingly, Ab which is “sustained” across beats 1 and 4 of the last bar, contains the same data point, so it can perhaps be argued that this bar could encompass the cadential materials in the leadup to Bb. Internally however, A and Eb contain contrasting data points: A is situated on a smaller data point and this is immediately followed by Eb on a larger data point. This could potentially imply that there is more emphasis on Eb, the third beat of the bar and also, potentially marking closure to the phrase.

There are seven instances of significant movement in this section, three of which are already accounted for and the rest occur on significant decreases. Firstly, -6 at the end of bar 46 could be supported by an additional C# from the bass. Although this then begs the question as to why it did not appear upon the first entry of the theme, it can be argued that its reappearance consists of three layers, not just two. Secondly, -7 at the end of bar 49 could have two possibilities: F natural or A. By including F natural, this would therefore mean that E will be needed on A as well and additional notes to support the soprano voice. Alternatively, D# could be used to support the D# on its previous beat, as a prolongation or repetition. A may be the better option in this instance, as this pre-empts A in the subsequent bar. Thirdly, -5 in bar 50 into the third beat, C# could be added to the data point, which does mark a change in the harmonies, and more specifically, gradually flattening of the key signature through alternating C and C#. This would then mean on a different level that there is a small arpeggiation, A-C#-E. Fourthly, with -6 on beat 2 in bar 53, there are two possibilities: Prolonging Db from the first beat or F from the chordal harmonies. Db might be the better option in this case because it reinforces the sonority. It is interesting to that it did not happen on the first time, where the original value is much lower, a larger AVL on the second time, perhaps suggesting more emphasis on the CI.

Table 10. Statistical Data, Copland, *Passacaglia*, Bars 41–53.

Statistical Data	
Mean	3.4643
Median	3
Mode	4, 3

The above information, Table 10, which presents the statistical data for this section provides further useful insights to the Copland’s use of harmonies. For instance, the movement of a tone and half is most frequently used in this section. This demonstrates how harmonic movement or progress can occur through minimal or smaller harmonic movement – this was then undoubtedly reflected in the median results as well. Interestingly, there are two values for the mode, 3 which is expected, but 4 appears to be used almost as often. Not only does this create variety in the mode but it also demonstrates that the VL movement by two tones is as crucial to the harmonic progression.

Table 11. Individual VL Movement Data, Copland, *Passacaglia*, Bars 41–53.

Individual VL Movement between each PCn	
0	71
1	52
2	39
3	17
4	2

From Table 11, it can be noted that every AVL contains a 0 or 1, reaffirming a strong harmonic progression through small and minimal movement. The use of VL2 occurred quite frequently as well, a substitution of 0 and 1 as the base number As for the other VL numbers, the use of VL3 can notably be seen in the first half of the section with only two appearances in the other half. This demonstrates the use of much smaller movement to denote harmonic movement in the next section. The use of VL4 only occurs twice in this segment but interestingly, they occur within consecutive bars, bar 44 and 45, the first half of the section. They are however supported with much smaller VL movement, 1 and 0, to establish some grounding with the large AVL. As for the use of VL5, this occurs within the larger AVL 14 and 8: twice in AVL 14 and once in AVL8 in bar 50. With AVL8, despite containing such a large VL movement, this is supported by 2 0s, retaining two common tones may attribute to a sense of stability within the large AVL, a sense of grounding despite such large VL movement.

Table 12. BIP data, Copland, *Passacaglia*, Bars 41–53.

BIP Collection			
0	000	2	2
1	0001	2	7
	001	2	
	01	3	
2	0002	2	10
	0011	1	
	002	4	
	011	2	
	11	1	
3	0012	3	11
	003	2	
	0111	1	
	012	2	

	111	3	
4	0022	3	10
	004	1	
	013	1	
	022	3	
	1111	1	
	112	1	
5	0113	2	5
	023	2	
	23	1	
6	0123	1	7
	0222	1	
	033	1	
	1113	1	
	1122	1	
	114	1	
	123	1	
7	223	1	1
8	0035	1	2
	233	1	
14	2255	1	1

As for the BIP, it can be noted from Table 12 that [002] is used the most frequently in this segment, two common tones and a tone. This mostly occurs in the first section, in beats 3–4 of bar 43 and beats 3–4 of bar 45. This also occurs on beats 1–2 of bar 45 and beat 4 to beat 1 of bar 51 It can perhaps be argued that [002] occurring 3 out of 4 cases serves as "transitional" materials. Whilst bar 45 beats 1–2 could be perceived as a syntactical continuation on a larger level. So [002] appearing on beats 1–2 might not be an anomaly as initially realised.

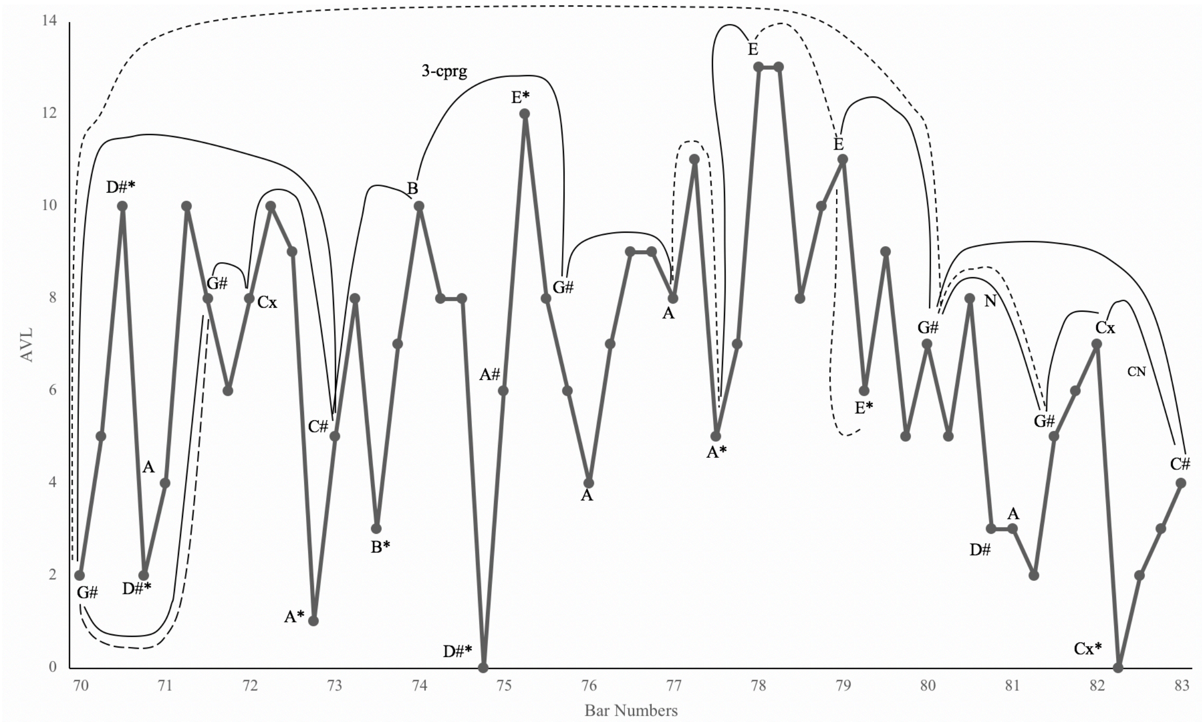

Figure 32. AVL and VL data, Copland, *Passacaglia*, Bars 70–83.

With bars 70–83, one can observe that the initial neighbouring movement at the opening suggest an overall increase in tension, 2-4-8, aligning with the phrase function – a sense of incompleteness within the basic idea (bi) figure. The reinforced presence of G# is therefore represented by an increase in data points. The data point between the first subphrase to the first note of the next subphrase is on the same data point, perhaps suggesting a subtle sense of continuity.

The movement from Cx to C#, the response to the first two bars, illustrate a decrease in data points, from 8 to 5, suggesting closure to this four-bar unit. However, this would also mean that there is an overall increase in momentum from bars 70–72, perhaps suggesting in turn that bar 72 is incomplete and this is leaning to the subsequent phrase. The subsequent 3-prg, B-A#-G#, supported by AVL10-6-8, illustrates an overall decrease in data points, significantly different to its first appearance in bars 70–71, suggesting that there is a resolution upon its second appearance. A# is on a smaller data point than its outer notes, which reinforces the notion of a passing movement. Additionally, the general movement from bars 72–73 correlates with an increase in data points, thereby suggesting that there is a renewed emphasis upon its reiteration.

The prolonged A in bars 76 and 77 is represented by an overall increase in data points, 4 to 8, then its arrival onto E is also represented by another large data point, 13, all of which simply shows that there is an increase in momentum towards the end of the section. There is however a slight decrease in bars 75–76, which denotes release on a more localised level, ending the previous section and setting up the momentum for the next phrase. E in the subsequent two bars are represented by AVL13 and 11 respectively, two large AVL numbers, which could reinforce the notion of incompleteness. Yet, the slight decrease between the two Es can replace the archetypal cadence, suggesting closure to the phrase as well. There is also an overall increase from A in bar 77 to this point which suggests a buildup to E. Subsequently, we find F#, the next data point, the start of a new phrase on a much lower data point than E, marking a resolution to the earlier section. Interestingly, unlike the opening bars to the section, we can find the G#-A-G# motive with a descending contour here instead. This evidently gives the two-bar phrase closure. The neighbouring note, A, is on a much lower data point despite falling on the downbeat of the bar. The increase then to G# reinforces the principal note. On a broader level, we can notice that the arch of the core pitch centre, G#, is represented by an overall increase in data points, suggesting that all the movement is driving towards this point. The movement from Cx to C# is depicted by a decrease, suggesting closure to the phrase. However, the movement from the end of the bi to the ci is represented with an increase in data points, an increase in momentum to the start of the ci.

Example: Ravel – "Mouvement de Menuet" from *Sonatine*

As with the second movement of Ravel's *Sonatine*, this work was segmented into quavers, mirroring the pulse and core beats of the time signature. The diagram below presents the segmentation integrated with the VL reduction as well as its numerical data.

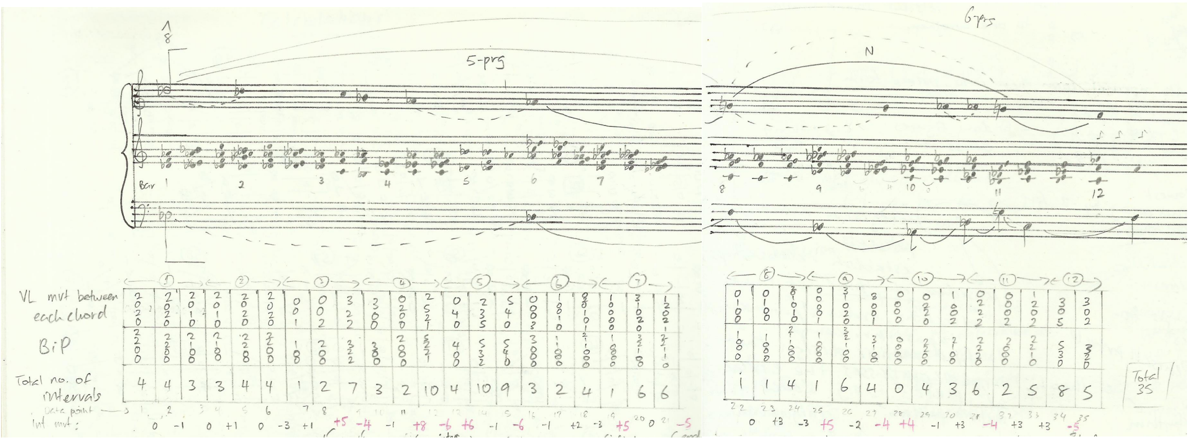

Figure 33. VL Reduction and Segmentation, Ravel, bars 1–12.

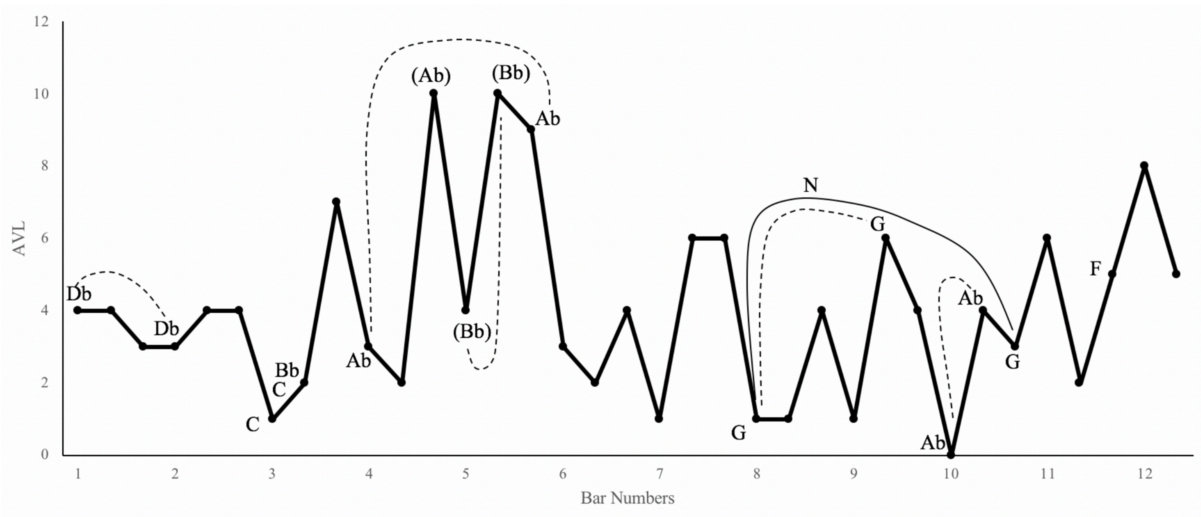

Figure 34. AVL and VL data, Ravel, Bars 1–12.

From the above figure, upon plotting the AVL to a line graph and adding the melodic content on the respective data points, the following observations can be noted. There is a 5-cprg at the very beginning, Db-C-Bb-Ab-G supported with the data points 4-1-2-3-1. The initial decrease between Db to C allows the melodic idea to expand and increase gradually over the phrase. The movement between C to Ab is presented as a slight increase from 1 to 3, a consistent increase, occurring within a short span of time, which could suggest that bar 4 is not the end of the moment and it is actually driving to its consequent phrase. The decrease then from Ab to G, depicted with AVLs 3 to 1, coincides with the approach to the end of the phrase. Overall it can be seen that the tension occurs in the middle as opposed to the end of the phrase and there is a decrease on the outer points. Additionally, it is also worth noting that the increase from G to F in bar 12, essentially creating a 6-cprg as opposed to just a 5-cprg, can suggest that the music is driving onto its development idea.

As for the prolonged Db in bars 1–2, with AVLs 4 and 3, the slight decrease can suggest that there is smaller movement to allow the music to grow, with larger AVLs as the music develops. As for Ab, despite being on the same note, this was presented with significantly different numbers, AVL3 and 9. There are several reasons for this, AVL4 coincides with the end of the first phrase whilst AVL9 occurs at the peak, the highest point of the consequent phrase, highlighting the tension and large AVL in this phrase as opposed to the first phrase. As for the chromatic neighbouring movement, G-G-Ab-Ab-G, this was represented by the data points 1-6-0-4-3. The upper neighbouring note, Ab is reflected as 0 on the graph, with more use of common tones, smaller movement and giving the key notes, G, more prominence. It is interesting to observe that G stretches from 1 to 6, contrasting the melodic contour where it descends. This strongly reinforces that the second G requires more emphasis, creating a "dissonant" chord. The important notes however, do denote an increase, suggesting a larger AVL towards the end of the first idea. The increase from 0-4 on Ab contributes to the final cadence of the phrase, driving it to its climax. In a similar manner, the tables below (Tables 13–15) present the statistical data from this section and it can be noted that AVL4 is used most frequently.

Table 13. Statistical data, Ravel, "Mouvement de Menuet", Bars 1–12.

Statistical Data[156]	
Sum	142
Mean	4.057
Median	4
Mode	4

[156] It can be noted that the statistical results for bars 1–12 are "larger" compared to bars 13–38, the next contrasting section.

Table 14. Individual VL Movement Data, Ravel, “Mouvement de Menuet”, Bars 1–12.

Individual VL Movement between each PCn	
0	72
1	21
2	33
3	9
4	2
5	4

Table 15. BIP data, Ravel, “Mouvement de Menuet”, Bars 1–12.

BIP Collection			
0	0000	1	1
1	00001	2	5
	0001	2	
	001	1	
2	00011	1	4
	0002	2	
	002	1	
3	0003	1	5
	0012	3	
	003	1	
4	000112	2	9
	0013	1	
	0022	5	
	004	1	
5	0122	1	2
	023	1	
6	00123	2	4
	01122	1	
	0222	1	
7	223	1	1
8	035	1	1
9	045	1	1
10	1225	1	2
	235	1	

2.3 “BC (Beat Class) Set Theory” and Analysis

To further enhance the VL analysis and its AVL data, it is vital to rethink how rhythm can play a larger role in this model. As Wallace Berry once stated, “rhythm is: everything”.[157] The analysis of rhythm has been investigated by numerous scholars from past to present, and although Robert Kauffman has stated that “the difficulties of dealing with rhythm are immense,”[158] scholars have attempted to analyse rhythm from various perspectives. Despite the fact that the analysis of rhythm is embedded in other analytical methods (e.g. Schenkerian method), more explicit approaches to rhythmic representations can be taken to place this crucial element on the same standing as other musical elements.

[157] Wallace Berry, “Metric and Rhythmic Articulation in Music,” *Music Theory Spectrum* 7.7 (1985): 7–33.
[158] Robert Kauffman, “African Rhythm: A Reassessment,” *Ethnomusicology* 24.3 (1980): 393–415.

For instance, theorists such as Berry, Cone, Hasty, Morgan and Yeston have attempted to analyse rhythm by creating systems of rules.[159] Berry suggests that the interaction of rhythms can be seen through various levels of hierarchy and its implications in meter, establishing a thorough understanding from the metric surface to deeper levels of meter, whilst Cone relates rhythm and meter to musical form, by developing signs to denote the different components of a musical phrase.[160] Additionally, Hasty's core argument in his widely acclaimed book – *Meter as Rhythm* – is that musical events take place "in" time, and he distinguishes all the inherent elements/qualities that "project" these events[161]. Both Morgan and Yeston's views are coloured by Schenker's methodology[162], but Yeston's system in particular explores the relation between pitch and metric significance.[163] Also with a focus on tonal music, Carl Schachter's work reinforces the rhythmic traces that can be seen in Schenkerian analyses, by viewing rhythms through the lens of durational divisions and its "tendencies" within tonal functions.[164] In contrast to those basing their rhythmic theories on Schenker and approaches which are reductive in nature, Joel Lester focuses on the different occurring rhythmic forces within a musical work and investigates the relationship between the music's rhythm and form. [165] Unlike his predecessors, who advocated an alternation of accented and unaccented beats as critical to meter in tonal music, Lester privileges the irregularities of accent and

[159] Wallace Berry, "Metric and Rhythmic Articulation in Music," *Music Theory Spectrum* 7 (1985): 7–33; Edward Cone, "Musical Form and Musical Performance 'Reconsidered'," *Music Theory Spectrum* 7 (1985): 149–158; Christopher F. Hasty, *Meter As Rhythm* (Oxford: Oxford University Press, 1997); Robert P. Morgan, "The Theory and Analysis of Tonal Rhythm," *The Music Quarterly* 64.4 (1978): 435–473; Maury Yeston, *The Stratification of Musical Rhythm* (New Haven: Yale University Press, 1976)

[160] Cone states that the "typical musical phrase consists of an initial downbeat (/), a period of motion (u), and a point of arrival marked by a cadential downbeat (\) (Edward T. Cone, *Musical Form and Musical Performance* (New York: W. W. Norton and Company, 1967), p. 27)

[161] These characteristics include introduction, beginning, continuation and anacrusis. The three categories of meter which emerge from these characteristics include equal, mediated unequal and non-mediated unequal

[162] There is a belief that certain pitch events will contain significance on multiple levels which will in turn determine important rhythmic events.

[163] Yeston's use of metre is an interchangeable term with rhythm, which poses a problem as this lacks a clear distinction between the two terms. He also employs non-pitched qualities to determine rhythmic significance. His analysis however implied that rhythm and meter are encoded in the music, which therefore meant that from his view, to understand the rhythmic structure is to decipher the rhythm. Furthermore, he derived rhythmic subpatterns from the "recurrence of pitch events of equivalent significance" (65) and his approach generally promoted that harmony is the key factor in the analysis. On the whole, he utilised meter as a conceptual idea, as an interpretation of musical events.

[164] Carl Schachter, "Rhythmic and Linear Analysis," *The Music Forum* 6 (New York: Columbia University Press, 1987): 1–60.

[165] In *The Rhythms of Tonal Music*, Lester delves into topics such as meter, hypermeter, phrase rhythm, texture and accent and he identifies various factors such as longer durations, denser texture, louder dynamics, pattern beginnings, pitch, harmony and contour changes that evoke a sense of "initiation" (Joel Lester, *The Rhythms of Tonal Music* (Carbondale and Edwardsville: Southern Illinois University Press, 1986).

celebrates metric ambiguity and metre changes.[166] Understanding and identifying metric accents particularly on higher levels are ultimately much more problematic and more subjective.

Others however, like Cohn, Cooper and Meyer[167], Lerdahl and Jackendoff, and Rothstein focus on creating a dialogue between meter and rhythm.[168] Cohn investigates the potential of graphing metric spaces as a way to "gauge proximity of states along a finely calibrated scale of measurement" whilst Cooper and Meyer emphasise the importance of grouping as a critical component in rhythmic experience. In a similar manner to Berry, Morgan and Yeston, Lerdahl and Jackendoff use different hierarchical systems incorporating rhythmic and metric features to assist in formalising the musical intuitions of listeners.[169] Rothstein introduces the concept of "phrase rhythm" as a way to demonstrate how rhythm and meter are intertwined in our understanding of phrases, periods and larger grouping structures.[170]

Interrelationships between mathematics, music and rhythm have also been investigated by several authors such as Wright, Toussaint, Lewin and Polansky.[171] Wright for instance, employs mathematics as a way to describe the rudiments of rhythm and other musical elements,[172] whilst Toussaint explores the analysis of rhythm through mathematical

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[166] Lester also developed ideas from Cone, exploring the interaction of metric levels in works from different style periods. He ultimately does not advocate a rigid model for the metric organisation of the phrase and opposes the idea of linear analysis to resolve problems for rhythmic theory. But rather, Lester attempted to create a balanced approach to understand the interplay between hypermeter against nonmetric accentual features – pointing out important compositional techniques, facets that are easily overlooked in a reductive analysis.

[167] The notion of rhythm and meter arises from the music as well as the performer.

[168] Richard Cohn, "The Autonomy of Motives in Schenkerian Accounts of Tonal Music," *Music Theory Spectrum* 14 (1992): 150–70; Richard Cohn, "Complex Hemiolas, Ski-Hill Graphs and Metric Spaces," *Music Analysis* 20.3 (2001): 295–326; Grosvenor Cooper and Leonard B. Meyer, *The Rhythmic Structure of Music* (Chicago: University of Chicago Press, 1960); Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge: MIT Press, 1983); William Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer, 1989)

[169] Both rhythm and meter are embedded in all four systems: Grouping structure (assisting with the identification of motives, phrases, periods); metrical structure (alternating between strong and weak beats, time-span reduction (the combination of metrical and grouping structures to unite the time spans at all temporal levels); and prolongational reduction (the culmination of rhythm, meter and other elements to better understand moments of tension and relaxation).

[170] Rothstein's understanding of phrase rhythm stems from Schenkerian theory, with references to eighteenth-century theorists (Joseph Riepel, Johann Kirnberger and Heinrich Koch) as well as being influenced by Lerdahl and Jackendoff's *GTTM*.

[171] David Wright, *Mathematics and Music* (Rhode Island: American Mathematical Society, 2009); David Lewin, *Generalized Musical Intervals and Transformations* (New Haven: Yale University Press, 1987); Larry Polansky, "Morphological Metrics," *Journal of New Music Research* 25.4 (1996): 289–368.

[172] Wright illustrates the close relationship between music and mathematics by discussing the following: scales and modular arithmetic, intervals and logarithms, tone and trigonometry, and timbre and harmonic analysis.

modelling – representing rhythm as symbolic form[173] – and Lewin and Polansky sought to create mathematical formalisations of musical space.[174] Similarly, Agmon explores the representation of musical duration as mathematical intervals, to re-examine the conflict between meter and grouping.[175]

An interesting discussion that arises from rhythmic theory is the treatment of accents, its nature and typology. As discussed in works by Berry, Lerdahl and Jackendoff, and Kramer, they viewed the accent as a "perceived emphasis", which arises in three distinct ways:

1. Perceived changes in pitch, duration, loudness, and more complex emphases like harmony, timbre and texture;
2. Meter as expectation of regularity;
3. Perceived function of events through structure of melodic and harmonic segments.[176]

Whilst some authors have given more weight to one facet over the other, Justin London attempts to balance rhythm, meter and temporality.[177] He connects meter to entrainment[178] – the listener's or performer's innate ability to synchronise different rhythms – and its relationship to temporal perception.[179]

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[173] Godfried Toussaint, *The Geometry of Musical Rhythm* (Florida: Taylor and Francis Group, 2013).
[174] Lewin's *GMIT* explores the concept of "interval" to the "characteristic gesture" that one hears in music and to assist in modelling other melodic, harmonic and rhythmic relationships. Polanksy employs metric equations to understand the musical and perceptual distances between pairs of shapes.
[175] Agmon suggests that the conflict between meter and grouping results when the two elements are not in sync and the metre/grouping conflict is better perceived as a metre/shadow-metre – a primary and subsidiary division. Therefore, this would mean that metrical and anti-metrical duration are *qualitatively* different. He states that "it seems theoretically possible to have a conflict between metrical and anti-metrical durations even when their attacks and releases happen to coincide" (Eytan Agmon, "Musical Durations as Mathematical Intervals: Some Implications for the Theory and Analysis of Rhythm," *Music Analysis* 16.1 (1997): 45–75, 64).
[176] Wallace Berry, *Structural Functions in Music* (Englewood Cliffs: Prentice-Hall, 1975); Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge: MIT Press, 1983); Jonathan D. Kramer, *The Time of Music: New Meanings, New Temporalities, New Listening Strategies* (New York: Schirmer, 1988).
[177] Justin London, *Hearing in Time: Psychological Aspects of Musical Meter*. Oxford: Oxford University Press, 2004. London suggests that meter serves as the foundation for the perception of rhythmic figures and meter is best represented as a cyclical representation, a metrical cycle that relates to a specific attentional state that arises in one's listening experience. He also states that meter would comprise of three or more levels: beat, subdivision, and a higher level, the "integration of several strata into a single, coherent attentional framework" (London, *Hearing in Time*, 17)
[178] A concept first introduced by Jones and Boltz (1989) (Mari R. Jones, & Marilyn Boltz, "Dynamic attending and responses to time," *Psychological Review 96.*3 (1989): 459–491) which is employed and supported by Robert Gjerdingen's 1989 work ("Meter as a Mode of Attending: A Network Simulation of Attentional Rhythmicity in Music," *Integral* 3 (1989): 67–92).
[179] London believes that "entrainment models of temporal attending are very attractive for musical meter as they provide a ready means of accounting for subdivision, durational judgements, syncopation, "accented" rests, and expectancy violations and other temporal anomalies" ("Some Examples of Complex Meters and Their Implications for Models of Metric Perception," *Music Perception: An Interdisciplinary Journal* 13.1 (1995): 59–77, 62).

Some contributions to rhythmic analysis, especially in “beat-class set theory”, can be seen in the works of John Roeder, Richard Cohn, Dan Warburton and Harold Krebs. Their use of beat-class set theory was designed as a way to better conceptualise Steve Reich’s music. Adopting Warburton’s approach[180] – representing each repeated pattern as a beat-class set to illustrate which beats are “attacked” in the pattern – Cohn tackles Reich’s music by applying the twelve-pitch-class “universe” to metric cycles, to observe how his music is shaped by recurrence of beat class sets, and he concludes that Reich’s treatment of time is actually classical. [181] Essentially, Cohn’s application of beat class set theory examines how density develops toward and away from saturation.[182] In addition, Roeder sought to develop a model, using beat class theory to unify tonality and meter, whilst incorporating other factors such as pitch, harmonic and accentual features.[183] Lastly, Harold Kreb’s explores concepts of metrical consonance and dissonance, advancing notions made by Maury Yeston. His ideas on the two types of dissonance – grouping dissonance and displacement dissonance – and its clear differentiation with tonal dissonance, is particularly useful in advancing the importance of rhythmic analysis.[184]

2.3.1 Method and Application

This study will however employ beat-class theory from a different stance. This approach does not propose a rhythmic set theory but rather, as a way forward to examine simultaneous musical elements, an attempt to place rhythm on equal footing with other frequently analysed parameters (e.g. melody, harmony, phrase structure). An abstract representation of rhythm will thus be offered as the last part of the methodology to the hybrid model. This will be shown firstly in the Enescu case study, and its integration with VL analysis will be demonstrated in the Hindemith and Martinu case study.

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[180] Dan Warburton, “A Working Terminology for Minimal Music,” *Intégral* 2 (1988): 135–159.
[181] Richard Cohn, “Transpositional Combination of Beat-Class Sets in Steve Reich’s Phase-Shifting Music,” *Perspectives of New Music* 30.2 (1992): 146–77.
[182] These metric cycles essentially consist of *n* beat classes arranged into a mod-*n* system (Cohn, “Transpositional Combination,” 149). And as stated by Roeder, this “generates the beat-class aggregate by phasing a particular beat- class set against itself” and this “is analogous to generating the pitch- class aggregate by taking the union of transpositions of a particular pitch-class set.” (Roeder, “Transpositional Combination”, 275) Noting the “formal resemblances between the structures of metric cycles and the twelve-pitch-class universe,” Cohn pursued the consequences of the idea that “much of the technology developed for atonal pitch-class analysis is transferable to the rhythmic domain.
[183] John Roeder, “Beat-Class Modulation in Steve Reich’s Music,” *Music Theory Spectrum* 25.2 (2003): 275–304.
[184] Harold Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 1999).

This approach firstly assigns a numerical value to each rhythm, symbols to denote its grouping, metrical and hypermetrical representation[185] of the rhythmic units. More simply, much like the core principles of pitch-class set theory, drawing ideas from Pearsall's work and influenced by Babbitt's use of integers to describe rhythmic systems (time-point system),[186] integers are used to address rhythm within the same hierarchy as melody and other musical parameters, to "represent durational equivalence".[187] The smallest numeral designated to a rhythmic value is a variable that changes depending on the piece's smallest rhythm. For instance, if a semiquaver is the smallest rhythmic value in a work, then the semiquaver will be the fundamental duration, which will be denoted as 1, a quaver as 2, a dotted quaver as 3 etc. and a beat-class set is defined as a group or collection of rhythms (bc).[188] In addition, rests will be represented in the analysis using numerical values. But to distinguish notes and rests, the numerical values will be supported with "{ }".

<u>Example: Enescu – Piano Sonata in F# minor No. 3</u>

Enescu's Piano Sonata in F# minor serves as a case study that instantiates some of these issues of representation. Much like the principles applied to the rhythmic segmentation, the number of bc layers will depend on the work and the number of voices that can be identified. For instance, in the case of Enescu, the music is subdivided into no more than three rhythmic layers. In bars 65–68 as shown in Figure 35, this passage consists of irregular groupings of beats, triplets being one recurrent feature, interlaced with rests and ties. Figure 36 illustrates its beat class equivalents. With no bar lines present, this passage takes the semiquaver as the base rhythmic value, 1 (quaver as 2, dotted quaver as 3 etc.). As for the representation of tied notes, rather than indicating its combined value, the individual notes are firstly illustrated with its respective numbers and with the use of square brackets. To then represent its value as an entire unit, round brackets enclose the square bracketed values. For instance, in bar 65, the tied notes in the bass are represented by [2] [2] to indicate its individual values and then with

[185] David H. Smyth, "Patterning Beyond Hypermeter," *Music Symposium* 32 (1992): 79–98; Robert P. Morgan, "The Theory and Analysis of Tonal Rhythm," *The Music Quarterly* 64.4 (1978): 435–473

[186] Milton Babbitt, "Twelve-Tone Rhythmic Structure and the Electronic Medium," *Perspectives of New Music* 1.1 (1962): 49–79.

[187] Edward Pearsall, "Interpreting Music Durationally: A Set-Theory Approach to Rhythm," *Perspectives of New Music* 35.1 (1997): 205–230 (208); See Carl Schachter, "Rhythmic and Linear Analysis: Aspects of Meter," in *Music Forum* Vol. 6 Part 1, edited by William Mitchell and Felix Salzer (New York: Columbia University Press, 1987), 1– 59; Peter Smith, "Structural Tonic or Apparent Tonic?: Parametric Conflict, Temporal Perspective, and a Continuum of Articulative Possibilities," *Journal of Music Theory* 39 (1995): 245–84.

[188] Unlike Pearsall's approach, whole numbers are used instead of fractions, and the smallest value given to the rhythm is flexible as it will ultimately depend on the smallest rhythmic value of the work.

([2] [2]) to represent the tie and grouping. To differentiate between rests and notes as shown in Table 16, rests will contain brace brackets {}. An instance of this can be seen at the rest at the start of the passage, where a quaver rest is indicated as {2}. As for the representation of irregular groupings such as triplets, a longer square bracket is placed above the respective set of numbers with the relevant number, in this case, 3 to indicate triplets. Naturally, the smallest value in any given piece of music will vary and another way to do this would be to derive the lowest common denominator; to base the calculation on the rhythmic common ground between a semiquaver and a quaver triplet. The table below illustrates the different symbols to support beat-class representation:

Table 16. Beat-Class Symbols

Symbol	**Meaning**
┌───┐	To represent irregular rhythmic grouping
[ ]	To represent a tied note
( )	To represent individual notes within a tied note
< >	To indicate multiples of a specific rhythm
{ }	To indicate rests

Figure 35. Enescu, Piano Sonata in F# minor, First Movement, bars 65–68.

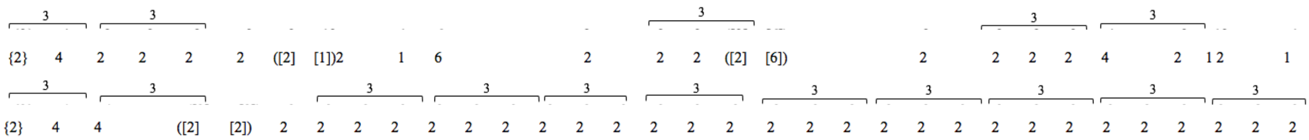


Figure 36. BC Analysis, Enescu, Piano Sonata in F# minor, First Movement, bars 65–68.

These similar issues can also be seen in bars 143–50 of the same movement as shown in Figure 37, but in this passage, the musical activity suggests that there are three different layers. The representation of each individual rhythmic layer is crucial as it will later be useful to make connections and relationships to other musical parameters from the other analytical charts – if there are any recurring patterns between the melodic or harmonic contour and the rhythmic activity.

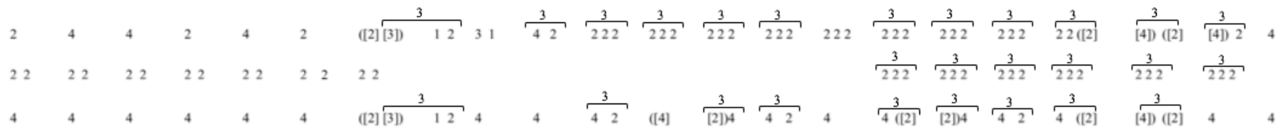


Figure 37. BC Analysis, Enescu, Piano Sonata in F# minor, First Movement, bars 143(2)–50(1).

Figure 38. Enescu, Piano Sonata in F# minor, First Movement, bars 143–50.[189]

Furthermore, once the rhythm is represented with its appropriate numerical values and symbols, these bcs can then be grouped into larger units of phrases, represented as hypermeasures (HyM). The different layers of HyM will represent its original metrical grouping (as per the time signature); phrase grouping, larger units of grouping; and in some cases, sectional groupings.

[189] Although the focus on this segment is on rhythmic representation, it is acknowledged that there are displacement dissonances in the first three bars.

Example: Hindemith - *Mathis der Mahler*

As shown in Figure 39 of Hindemith's *Mathis de Maler*, there are four HyM layers supporting the beat classes for bars 1–16. The first HyM layer represents the original metrical grouping as per the time signature.[190] The second HyM layer presents slightly larger phrase units, going beyond the time signature, to portray the direction and shape of the phrase. For instance, the first opening bars can be grouped into two units, [1½] and [2], aligning with a "call" and "response" phrase function. This is supported by various factors, one of which can be seen through the instrumentation, where the combination of the homorhythmic presentation in bars 1-2(3) (the multiple layering of instruments supporting the rhythm of the principal melodic line) and the harmonic support of its response in bars 2(4)-4(1) with some lines moving in contrary motion. Consequently, by means of representing this as a larger unit in HyM Level 3, the two aforementioned units are grouped as a unit of [3½], the combination of the "call" and "response" phrases. A HyM Level 3A is also included in the chart to represent sectional units, in this instance, the first [5½] bars are grouped as one unit to illustrate the bigger phrase structure, the notion that the opening 5½ bars are an antecedent to its consequent in the subsequent phrase. Although it can be argued that the unit of [3½] is not truly hypermetrical in relation to its notated metre, with regards to its conventional definition (3.5 cannot be subdivided using the notated metre as a divider), hypermetre in this context encompasses an understanding of larger phrase spans as well as rhythmic elements.[191] Individualising the rhythm and labelling its larger phrase structures is integral to the analytical process and to the theoretical model as rhythm will now be better represented, on par with other musical parameters.

[190] In this application, meter remains intact at the first hypermetric level, as it can be argued that understanding the metric context is vital to understand the rhythm. This can be defined as hierarchy of accent patterns, considered to be more regular than rhythm (Seymour Chatman, *A Theory of Meter* (The Hague: Mouton and Co., 1965)

[191] Harold Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 1999), 22.

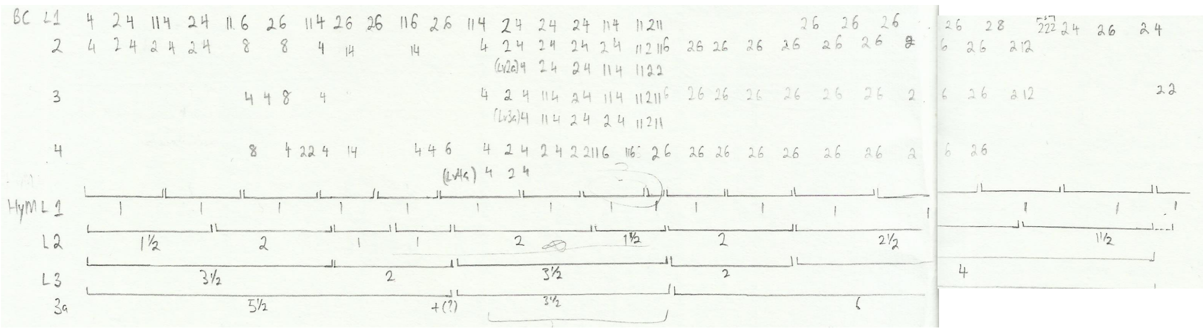


Figure 39. BC Analysis, Hindemith, *Mathis der Maler*, Second Movement, bars 1–16.

Upon establishing these HyM levels, relationships and observations can be made between rhythmic features (either grouped as an individual or a set of beat class units) and the phrase structures, which shed an insight to any recurring rhythmic patterns in specific phrases units. This information will then be amalgamated with the data gathered with the earlier charts from the VL reduction charts, in order to examine the inter-relationships with other musical parameters. Synthesised with the AVL and VL features, the data is presented as a "hierarchical chart," a bc x VL chart – comprising the beat classes (bc) and hypermeasures (HyM); VL calculations in its relevant segmentations (AVL); and the identified notes from the melodic and bass reductions and their corresponding data points previously highlighted in the line graphs (Key DP), along with its melodic features. This will provide a visual representation of all the aforementioned analysis into one comprehensive analytical chart, but one will be able to make observations correlating rhythmic, melodic and harmonic elements and identify recurring patterns and interesting features.[192]

For instance, with the same 16 bars of the Hindemith as shown in Figure 40, we can observe that the HyM levels correlate with the key notes identified in the melodic and bass reductions, particularly across HyM Levels 2, 3 and 3a.[193] More specifically, in the second section of HyM Level 3A, this correlates with a series of AVL values that are within a range of 3 to 6, with an increase or decrease no larger than 2 between each PCn. The identified key notes in the melodic reduction at this particular moment consist of an ascent: C, D and E. It is also interesting to note that the AVL value at the start and end of this passage is 3, thereby suggesting that there is a sense of integration, a relationship between the presence of extra rhythmic layers (as shown through the additional bc levels 2A and 3A) and the identified

[192] It is hoped that by examining the rhythm from a representational and mathematical approach will provide objective depictions as opposed to subjective ones to better corroborate with other musical parameters.
[193] Full score for bars 1–16 can be found in Volume 2: Appendix 3, Figure 85.

melodic key notes, that this particular moment or for a better word, phrase are bound by the same tension and momentum.

An interesting point can be seen in the next unit [6], where bc[62] in the lower bc levels (2-4) encases bc[26] and this is supported by the same AVL values. However, when the encased bc[26] becomes bc[28], there is a significant increase (of 5) in the AVL values from 4 to 9. *This thereby suggests that there is a relationship between the pitch relations via AVL movement and rhythmic movement, where a slight change of rhythmic value to a longer one has resulted in a larger AVL value*. The notion that bc[62] evokes a sense of stability (via a series of repeated AVL values) is ultimately reinforced by its presence across bc levels 3 and 4, where the AVL movement associated with each bc[62] contains values that do not fluctuate significantly and are within a small range. Another interesting feature can be seen towards the end of the section, through the presence of an irregular grouping, a triplet (bc[222]). This is supported by a larger AVL value but upon the shift back to a regular rhythmic grouping coincides with smaller AVL values, perhaps suggesting that the triplet in this context has significance from the perspective of both rhythmic and VL movement/progression. The application of bc[1] is also quite varied. Depending on the context, the use of bc[1] across the opening bars can suggest a decrease in tension. However, in the one instance where there is an increase, this coincides with the use of a larger rhythmic value in lines 2 and 4. But in other instances, as the movement of bc[1] has a tendency to be associated with smaller AVL values as well as a decrease. It can also be suggested from this chart that a shift from a shorter to a longer rhythmic value correlates with stability.[194] The notion of stability to its musical contents will be further explained in the next chapter.

Additionally, the entry of another rhythmic layer towards the end of the section correlates with an increase in AVL values, thereby suggesting that this particular moment is unfinished, yearning to be resolved. In the bigger picture, one can observe that with the two different hypermetric units as denoted in HyM Level 3A, the first of which can be described to be more stable, (setting up the expectations) whilst the significant increase in the AVL values in the second unit aligns with more tension. It is also interesting to highlight that the repeated use of AVL 4 aligns with a specific rhythmic motive, coinciding with the first entry of

[194] Stability in this instance, refers to its application in both performative and analytical contexts, a combination of several musical elements such as harmony, rhythm, melody and register.

bc[26], which could suggest that its initial appearance is more harmonically stable. Furthermore, in moments where all rhythmic parts are in unison (e.g. towards the middle of Figure 39), this aligns with a decrease in the AVL values, also suggesting the notion of stability at this particular point in the music.

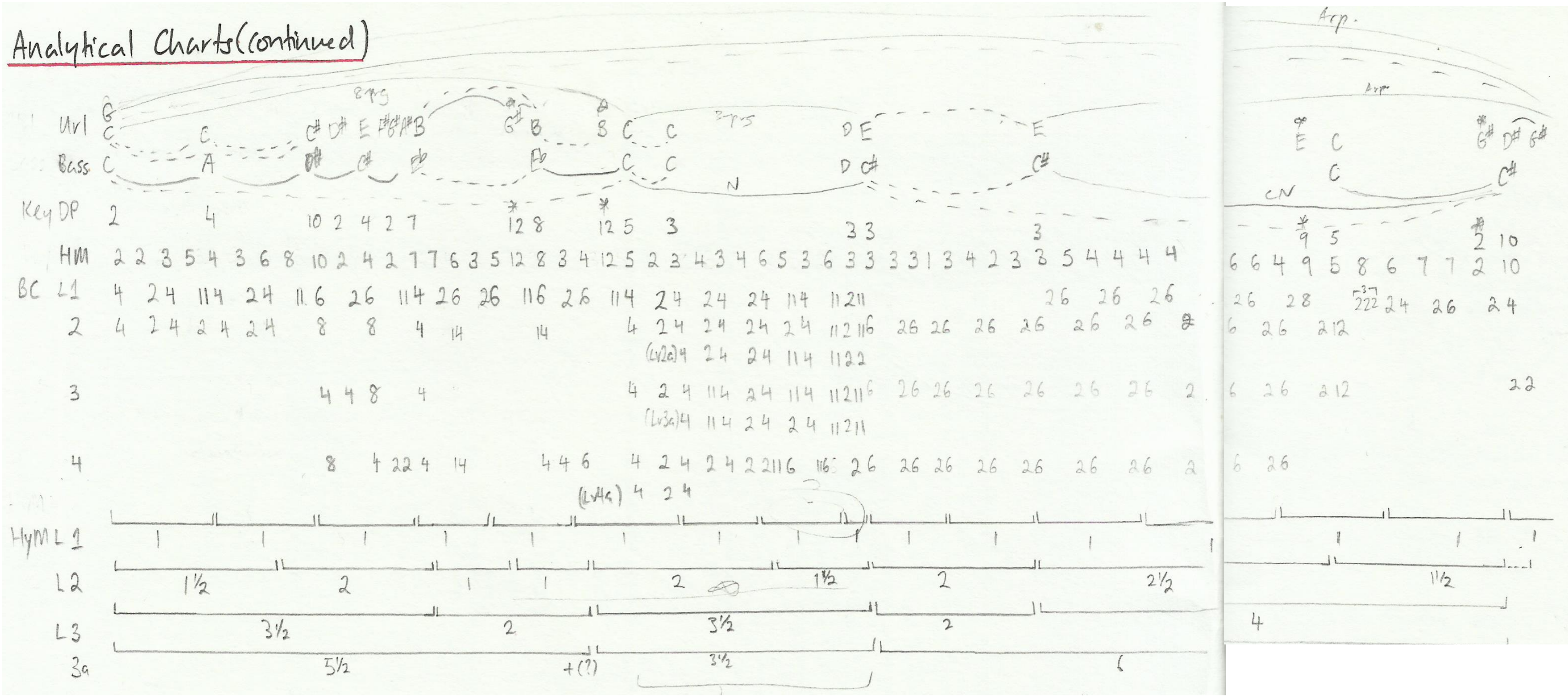
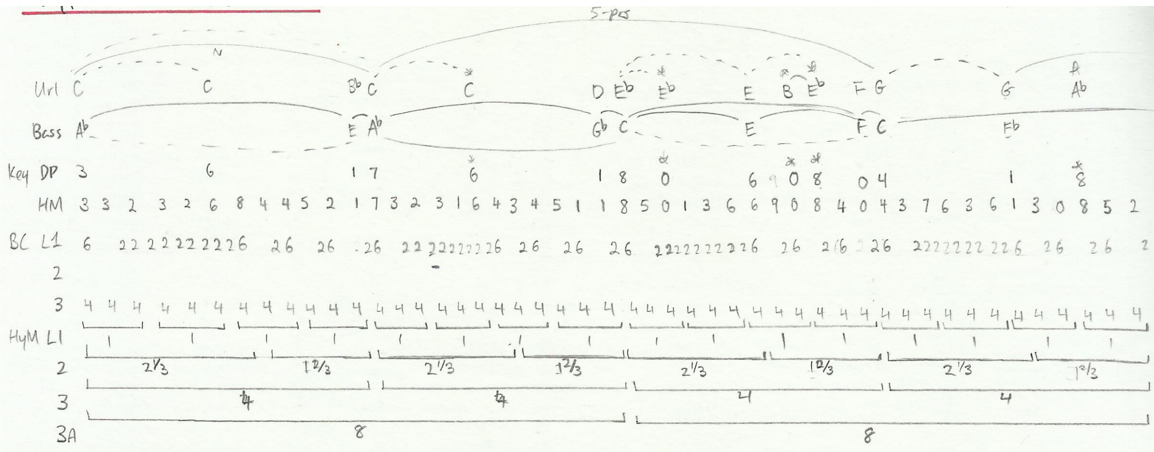


Figure 40. BCxVL Chart, Hindemith, *Mathis der Maler*, Second Movement, bars 1–16.

Example: Martinu – "Tanec Loutek" from *Puppets*

Similarly, interesting findings can be gleaned from Martinu's "Puppets" as shown in Figure 41. In the example of the return of the opening materials and the coda, in the higher hypermetric level, level 3A), what is immediately striking about this level is that section A, the opening thematic materials, comprise of "regular" grouping of phrases. The A section is made of two large units of eight bars, which can then be subdivided into four by four bars and four groups of 2 1/3 and 1 2/3 bars. In contrast, the coda section, labelled B in this context, consists of irregular groupings, 6 1/3 + 5 +3 1/3. Therefore, in addition to the clear melodic differences between the two sections, this hypermetric perspective reinforces the segments as well, where one is more regular than the other. The grouping of phrases into larger units involving thirds, have been quite effective, as this shows how the notes can be seen on larger scales too. As the rhythmic analysis already reveals that the rhythm of the first four bars essentially repeated four times, rather than isolating specific bc units, when perceiving the four bars as an individual unit, it is interesting to observe that the AVL movement in the groups of 4 (HyM L3) as in all four statements, there is a decrease in the AVL. Within the largest level of segmentation, it is interesting to note that the opening section and coda align with the notes identified in the soprano line. Similarly, this is reflected in levels 3 and 3A as well, where one can see the clear segments and larger melodic features and prolongations embedded within these larger units. However, the same cannot be said about HyM L2, as the phrases in most instances "cut" into the following bars. Nonetheless, the HyM and soprano line are congruent in the higher levels and new additions to the soprano line appear to be quite prominent in HyM L2. It can also be highlighted that bc[444] can be notably seen as a rhythmic feature in section A and bc[44] as the feature in the B section, due to its recurrence.



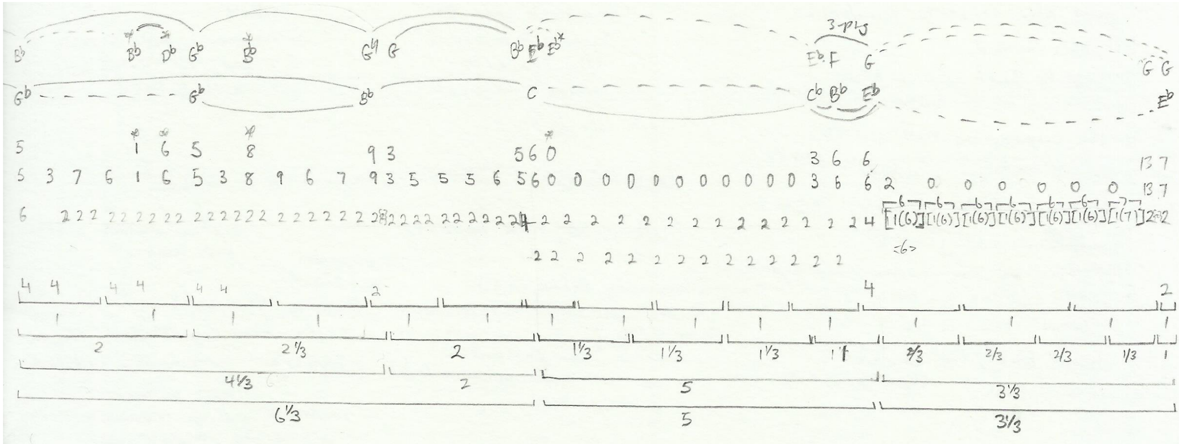


Figure 41. BCxVL Chart, Martinu, *Puppets*, “Tanec Loutek”, bars 1–20 and 64–74.

At points of unison, for instance towards the end where L1 and 3 are on bc4, this is supported by notes in the soprano and bass line and a larger AVL. The same can also be said for the last beat of the piece where there is a subtle increase from AVL6 to 7 in the coda. This simply reinforces a higher sense of tension towards the end of the piece.

Table 17. Relationships between AVLs and Motifs, Martinu, bars 1–16.

Bars	Material	AVL	Motif[195]
1 – 4	1st statement	3 – 1 -2	A
5 – 8	2nd statement	7 – 1 -6	A1
9 – 12	3rd statement	6 – 0 -6	B
13 – 16	4th statement	4 – 2 -2	B1

As shown in Table 17, each of the four statements from bars 1– 6 contain the same rhythm and it can be seen the AVL movement between bars 1–8 and 9–16 are a mirror image: [2-6] and [6-2], revealing a decrease over the span of the phrase. Furthermore, if bars 9–16 can be perceived as a consequent idea to the antecedent in bars 1–8, you can see that the decrease occurs over this idea. However, more can still be stated about each of the data points. Bars 1–4 and 5–8 are similar but it can be seen that the latter begins on a much higher data point. This suggests that there is a renewed emphasis upon its repetition. A similar amount of harmonic movement can be seen in the third statement as opposed to a smaller AVL. Why is this so? A different idea is stated at the point, despite the presence of the same rhythmic figure. These four bars act as a form of transition for the fourth statement. And naturally, its

[195] The different labelling of the “motif” is determined primarily by melodic and harmonic factors.

final statement begins on a smaller AVL as there is a sense of stability, reaching a new key region. All of these points simply reinforce the notion that other surrounding musical parameters are absolutely crucial to get a full scope of the phrase structure.

In the B section, bc[44] appears right at the start, only a small segment, but this particular region deviates from the first half, rather than bc[444], we get bc[44] instead. In each of the three appearances, we can observe the following:

1. 5 – 3 (decrease of 2)
2. 6 – 1 (decrease of 5)
3. 5 – 3 (decrease of 2)

In the first and third instance, these fragments contain exactly the same notes but on different octaves, with the same AVL. The larger decrease in the second instance contains the same chord but in different inversion. This could therefore suggest that in this particular instance, a chord in its second inversion as opposed to its root form could contain more musicaltension.

With HyM L2, [2 1/3] [1 2/3] appears four times, with one increase and three decreases within [2 1/3] and all decreases in [1 2/3].

Table 18. BCxVL data to Antecedent-Consequent ideas, Martinu, bars 1–16.

[2 1/3]	[1 2/3]
3 – 8 +5	4 – 1 -3
7 – 4 -3	3 – 1 -2
8 – 6 -2	9 – 0 -9
4 – 1 -3	3 – 2 -1
Ant.	Conse.

From Table 18 within the [2 1/3] column, it can firstly be noted that this consists of mostly decreases with one increase of 5. Although this could be initially perceived as a slight anomaly, this could in fact suggest that it is setting up the context, the expectations of the work. Within the [1 2/3] column, all the decreases between each AVL suggest a release of tension. This is more apparent on the third appearance as we move to a new key area. The other three decreases within the “consequent” column can be seen to be more consistent, suggesting a brief release of tension. Another view of the first 16 bars as shown in Table 19 suggests that the Antecedent-Consequent idea is better represented as a compound basic idea (CBI) followed by a continuation and a consequent phrase.

Table 19. BCxVL data to CBI, continuation and consequent ideas, Martinu, bars 1–16.

ant.							
cbi				cont.		conse.	
bi	ci (HC)	bi	ci (HC)	bi	ci	bi	ci
3-8	4-1	7-4	3-1	8-6	9-0	4-1	3-2

Whilst the "A" section produced "consistent" results, the larger arcs of the B phrase presents a series of very different AVL:

1. Bars 17 – 66: 1st statement 6 – 5 (decrease by 1)
2. Bars 66 – 71: 2nd statement 6 – 6 (no increase/decrease)
3. Bars 71 – 74: 3rd statement 2 – 7 (increase by 5)

It is interesting to note particularly with the third statement, that there is an overall increase in AVL in the shortest grouping in HyM L3A. It is from this larger arc that one can see the impact of [1(6)] and [1(7)] has on the phrase itself – the use of faster rhythm as a factor in stimulating tension. This is a better representation or description of the movement towards the end, when describing harmonic parameters do not suffice. The decrease in the first statement perhaps has a structural significance, given the fact that we have reached the end of the thematic idea, rounding off the section and concluding the theme. The same AVL for the second statement can be perceived as a subtle sense of continuity between the first and second statement. Commencing on a smaller AVL for the last phrase is also interesting to note, as this demonstrates continuity/connection from the previous idea, a false sense of stability before propelling to the final chord at the end.

Methodology – Part Two

2.4 Measuring Harmonic Tension in Post-Tonal Repertoire

Despite the large body of research that has examined tonal and atonal harmonies to our perception of tension, there is no work that describes or explores the perception of post-tonal chords, but more specifically, chords that contain both tonal and post-tonal features. This section of the methodology highlights the background and findings of an empirical study, applying the concept of calculating the total amount of voice-leading movement, to examine its relationship to our perception of tension and release. To do this, three neoclassical pieces - *Sonatine* (Ravel), *Piano Sonata No. 2* (Hindemith), and *Concerto for Piano and Wind Instruments* (Stravinsky) – are selected to analyse the relationship between theoretical to perceived tension. The findings suggest that in addition to calculating the horizontal motion between harmonies, physical and acoustical factors play a critical role in relating theoretical to perceived tension. This approach is adaptable to other neoclassical works and in addition, this study could have implications in other musical fields such as performance practices and analysing formal functions in post-tonal repertoire.

2.4.1 Background

Understanding how one perceives musical tension can vary significantly depending on the readers' lens, a music-theoretical or psychological perspective. On the one hand, Bigand, Parncutt and Lerdahl state that musical tension from a purely theoretical perspective can be generally explained by a few variables, such as the function of chords within a tonal context[196], acoustical or sensory consonance[197] and its melodic organisation[198]. On the other hand, a psychological perspective of musical tension investigates other factors such as cognitive approaches that justify the importance and role of tonal contexts (how chords have specific functions in tonal contexts)[199], and theories in musical perception that reveal the

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[196] Hugo Riemann, *Vereinfachte harmonierlehre* (Harmony Simplified), trans. H. Bewerunge (London: Augener, 1893); Heinrich Schenker, *Free composition*, trans. Ernst Oster (New York: Longman, 1979).

[197] Jean-Philippe Rameau, *Traité d'harmonie* (Treatise of Harmony), trans. P. Gosset. (New York: Dover, 1971).

[198] Emmanuel Bigand, Richard Parncutt and Fred Lerdahl, "Perception of musical tension in short chord sequences: The influence of harmonic function, sensory dissonance, horizontal motion, and musical training," *Perception and Psychophysics 58*.1 (1996): 125–141.

[199] Jamshed Bharucha, "Anchoring effects in music: The resolution of dissonance," *Cognitive Psychology* 16.4 (1984): 485–518; Emmanuel Bigand, "Abstraction of two forms of underlying structure in a tonal melody," *Psychology of Music* 18.1 (1990): 45–60; Fred Lerdahl, "Tonal Pitch Space," *Music Perception* 5.3 (1988): 315–349; Fred Lerdahl, *Tonal pitch space* (Oxford: Oxford University Press, 2001.)

chords' psychoacoustical features.[200] This psychological approach can also be extended to the study of perceptual aspects of auditory perception and its impact in music perception such as dynamics and timbral elements such as pitch register, roughness, brightness and density.[201]

One common trait between these perspectives is the emphasis of establishing a stable tonal centre to derive sentiments of musical tension. These studies and observations have undoubtedly stemmed from the analysis of tonal repertoire and although some work has been extended to atonal repertoire[202], understanding musical tension in repertoire that embodies both tonal and atonal elements, such as neoclassical repertoire, is an area of research that remains to be explored.

Tonal and Atonal Tension

The notion of tension and release is a fundamental concept to tonal music, a core component in the analyses of Western repertoire and this has been thoroughly explored through theoretical ideologies, music perception and empirical findings. As seen in Schenker's ideologies[203], his principles of identifying the hierarchical levels within the music, resulting in deriving the fundamental *Ursatz*[204] can be seen as similar to the notion of tension and release. This schema has been explored from a cognitive psychological perspective, in the renowned text, *Generative Theory of Tonal Music* (GTTM), by Lerdahl and Jackendoff[205], to

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200 Richard Parncutt, *Harmony: A psychoacoustical approach* (Berlin: Springer-Verlag, 1989); Linda Roberts and Marilyn Shaw, "Perceived structure of triads," *Music Perception* 2.1 (1984): 95–124.

201 Vernon Burnsed and James Sochinski, "The relationship between dynamics and tension in Haydn's symphony 104: A developmental study," *Psychomusicology* 17.1-2 (1998-2001): 19-35; Roni Granot and Zohar Eitan, "Musical tension and the interaction of dynamic auditory parameters," *Music Perception* 28.3 (2011): 219-246; William Hutchinson and Leon Knopoff, "The acoustical component of western consonance," *Interface* 7.1 (1978): 1-29, ; Gabriela Ilie and William Thompson, "A comparison of acoustic cues in music and speech for three dimensions of affect," *Music Perception* 23.4 (2006): 319–329, ; Carol Krumhansl, "A perceptual analysis of Mozart's piano sonata k. 282: Segmentation, tension and musical ideas," *Music Perception* 13.3 (1996): 401–432; Dale Misenhelter, "An investigation of music and nonmusic majors' responses to musical tension and dynamics in Beethoven's Symphony No. 7," *Missouri Journal of Research in Music Education* 38 (2001): 56-67; Daniel Pressnitzer, Stephen McAdams, Suzanne Winsberg and Josh Fineberg. "Perception of musical tension for nontonal orchestral timbres and its relation to psychoacoustic roughness," *Perception and Psychophysics* 62.1 (2000): 66–80; Reiner Plomp and Willem Levelt, "Tonal consonance and critical bandwidth," *Journal of the Acoustical Society of America* 38 (1965): 548-560.

202 Nicola Dibben, "The cognitive reality of hierarchic structure in tonal and atonal music," *Music Perception* 12.1 (1994): 1–25; Fred Lerdahl, "Atonal prolongational structure," *Contemporary Music Review* 4.1 (1989): 65–87.

203 Schenker, *Free Composition*, 1979.

204 The *Ursatz*, comprising the fundamental descent (typically from either 3, 5, 8) and the bass arpeggiation (typically I-V-I), illustrates the fundamental structure of a tonal piece, a simple progression from which the piece is theoretically generated (Tom Pankhurst, *SchenkerGUIDE: A brief handbook and website for Schenkerian analysis* (New York: Routledge, 2008).

205 Fred Lerdahl and Ray Jackendoff, *A generative theory of tonal music* (Cambridge: MIT Press, 1983).

understand the musical events. Supporting Schenker's ideas, their work revealed hierarchical organization as the driving factor, understanding the relationship between pitches, keys of tonal hierarchy and rhythmic structure as a way to understand tonal music's structure and processes. The claims made from *GTTM* are supported by empirical studies, all of which emphasizes the importance of tonal hierarchies, the close relationship between metric-rhythmic and pitch structure, and the combination of structure and hierarchical relationships to represent stability.[206] These findings have also revealed the close relationship between such hierarchies to the notion of tension and release.[207] For instance, in a Mozart case study, Krumhansl suggests that there is a high correlation between completeness and judgements of tension, where tension increases upon approaching the end of a section approached, and a decrease of tension at the end of the piece.[208] And in subsequent studies, Lerdahl explored the prolongational component from the *GTTM* and developed a methodological approach to quantify sequential and hierarchical harmonic tension as well as an algorithm that accounts for stability, proximity and directed motion.[209]

However, extending these theories to atonal music may not yield the same outcomes. The notion of tension and release in atonal music has been developed by Lerdahl[210], who proposes an atonal prolongational theory as a way to comprehend twentieth-century music, using Schoenberg as case studies. He proposes that the perception of atonal music relies more on salience conditions (such as register and parallelism[211]) and creating an atonal pitch space

[206] Jamshed Bharucha and Carol Krumhansl, "The representation of harmonic structure in music: Hierarchies of stability as a function of context," *Cognition* 13.1 (1983): 63-102; Emmanuel Bigand, "Abstraction of two forms of underlying structure in a tonal melody," 45–60; Nicola Dibben, "The cognitive reality of hierarchic structure in tonal and atonal music," 1–25; Carol Krumhansl, "The psychological representation of musical pitch in a tonal context," *Cognitive Psychology* 11.3 (1979): 346-374; Carol Krumhansl and Edward Kessler, "Tracing the dynamic changes in perceived tonal organisation in a spatial representation of musical keys," *Psychological Review* 89.4 (1982): 334-368; Caroline Palmer and Carol Krumhansl., "Pitch and temporal contributions to musical phrase perception: Effects of harmony, performance timing, and familiarity," *Perception & Psychophysics* 41.6 (1987): 505–518; Christopher White, "Relationships between tonal stability and metrical accent in monophonic contexts," *Empirical Musicology Review* 12.1-2 (2017): 19–37.
[207] Emmanuel Bigand, "The influence of implicit harmony, rhythm and musical training on the abstraction of 'tension-relaxation schemas' in tonal musical phrases," *Contemporary Music Review* 9.1-2 (1993): 123-137; Emmanuel Bigand, Richard Parncutt and Fred Lerdahl, "Perception of musical tension in short chord sequences," 125–141.
[208] Carol Krumhansl, "A perceptual analysis of Mozart's piano sonata k. 282,"401–432.
[209] Fred Lerdahl and Carol Krumhansl, "Modelling tonal tension," *Music Perception: An Interdisciplinary Journal* 24.4 (2007): 329-366; Fred Lerdahl, "Calculating tonal tension," *Music Perception* 13.3 (1996): 319-363.
[210] Fred Lerdahl, "Atonal prolongational structure," 65–87.
[211] Lerdahl's use of "parallelism" suggests a musical event that may have motivic and rhythmic significance, which occurs elsewhere in the analysis.

than stability conditions (as established in *GTTM*). Additionally, a reductional hierarchy of atonal music is more dependent on time span reduction, particularly in its metrical and grouping structure. And whilst Lerdahl emphasises a strong level of congruence between rhythmic structure and hierarchical events, a study by Krumhansl, Sandel and Sargeant focusses on using pitch sets and serial structure rather than hierarchy to investigate the perception of atonal music by listeners.[212] Using Schoenberg's Wind Quintet and String Quartet No. 4 as case studies, they uncovered that listeners have the ability to internalize serial compositional techniques such as mirror transformations, octave transpositions of tones and variations of rhythm and phrasing, and they are able to listen to the music without reference to tonal structures.[213] A more recent study by Esteve-Faubel, Francés-Luna and others investigates the cognition of stability of atonal music in non-musicians.[214] Their findings revealed that listeners were able to perceive atonal music through the structural stability and metrical contents of the music's events, which thus reinforces the works carried out by Dibben and Lerdahl, aligning the predictions of atonal prolongational theory with the results from experienced listeners of atonal music.[215]

Harmony, Roughness and Tension

Nonetheless, a unifying theme to understand musical tension amongst both tonal and atonal music is the influence of harmony, as one of the primary means to create a coherent progression in musical events.[216] In tonal music, it has been argued that some chords[217] suggests stronger or lesser tension.[218] This claim is further supported by Schenker's theory, where tonal centric pieces can be analysed as "elaborations of a fundamental tensing-relaxing relation defined by tonic-dominant-tonic chords"[219] all of which relates back to a theoretical

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[212] Carol Krumhansl, Gregory Sandel and Desmond Sargeant, "The perception of tone hierarchies and mirror forms in twelve-tone serial music," *Music Perception* 5.1 (1987): 31–77.
[213] Carol Krumhansl, Gregory Sandel and Desmond Sargeant, "The perception of tone hierarchies and mirror forms in twelve-tone serial music," 31–77.
[214] José Esteve-Faubel, Benjamin Francés-Luna, Jonathan Stephens and Lee Bartel, "Cognition of stability in atonal music in teenagers with no musical experience," *Psychomusicology: Music, Mind, and Brain* 26.1 (2016): 43–55.
[215] Nicola Dibben, "The perception of structural stability in atonal music: The influence of salience, stability, horizontal motion, pitch commonality, and dissonance," *Music Perception* 16.3 (1999): 265–294; Fred Lerdahl, "Spatial and psychoacoustic factors in atonal prolongation," *Current Musicology* 63 (1997): 7–26.
[216] Fred Lerdahl and Ray Jackendoff, *A generative theory of tonal music*, 1983; Leonard Meyer, *Emotion and meaning in music* (Chicago: University of Chicago Press, 1956); Heinrich Schenker, *Free composition*, 1979.
[217] In this context, echoing the words of Bigand, Parncutt and Lerdahl, a chord "designates the simultaneous sounding of three or more notes" (Bigand, Parncutt and Lerdahl, 1996, 125).
[218] Fred Lerdahl and Ray Jackendoff, *A generative theory of tonal music*, 1983; Leonard Meyer, *Explaining music: Essays and explorations* (Chicago: University of Chicago Press, 1973).
[219] Emmanuel Bigand, Richard Parncutt and Fred Lerdahl, "Perception of musical tension in short chord sequences," 125–141.

understanding on how we perceive stability in musical events. Additionally, the notion of musical expectancy also comes into play when investigating musical tension. As stated by Bigand, Parncutt and Lerdahl, "musical tension and relaxation, created by chords, appears to be linked to the musical expectancies governed by harmonic structures."[220]

Exploring musical tension with a focus in harmonies has been examined by several authors. Although it is known that meter and duration will undoubtedly influence listeners' perceptions, the following works however, localises specific musical elements, some of which focus on manipulating certain musical factors (e.g. pitch, rhythm, timbre), exploring the concept of horizontal motion, the impacts of intervallic distance, dissonance and roughness. A study by Paraskeva and McAdams investigates the influence of musical factors such as timbre, the absence of tonal hierarchy on the perception of musical tension and relaxation.[221] With a focus on pitch, rhythm and timbre, the stimuli set was created using a computer and synthesizer to avoid the intervention of parameters to represent the same rhythmical structure, intensity, tempo and duration.[222] Their study concluded that timbre has a direct implication, and understanding the musical context influences listeners in determining tension and relaxation.

Another element that could influence one's perception of tension and release is through horizontal motion. The concept of horizontal motion as a perceptual phenomenon can be traced back to Huron[223] but its influence on the perception of stability has been discussed by Schoenberg where he encourages an understanding on the perceptual independence of voices.[224] Furthermore, this has been explored in two case studies by Dibben. Dibben's study in 1994 which sought to locate structural stability in nontonal contexts, highlights salience,

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[220] Musical expectancies include factors such as melodic interval size, melodic contour, rhythmic features and tonal and harmonic structures and "harmonic structures" consist of a framework that establishes its relationship to its relevant key.
[221] Stella Paraskeva and Stephen McAdams, "Influence of timbre, presence/absence of tonal hierarchy and musical training on the perception of musical tension and relaxation schemas," *Proceedings of the 1997 International Computer Music Conference* (1997): 438-441.
[222] Although two contrasting pieces of work were used as the stimuli (Baroque and Twentieth-century), the results revealed that unlike tonal works, there are different levels of stability (stable, middle stability, less stability, strong instability) in atonal works and its structural importance are attributed to two main factors: the presence of a hierarchically important chord or the sense of expectation of the arrival of an essential chord or an important note.
[223] David Huron, "Tone and voice: A derivation of the rules of voice-leading from perceptual principles," *Music Perception: An Interdisciplinary Journal* 19.1 (2001): 1–64.
[224] Arnold Schoenberg, *Theory of harmony*, trans. R.E Carter (London: Faber and Faber, 1911).

voice-leading and dissonance as important factors to locate structural importance.[225] Whilst her results correlate with Lerdahl's atonal prolongational theory, it is interesting to point out that her results also reveal that horizontal (or voice-leading) motion and dissonance influences participants when rhythmic, timbral, dynamic and metric information is absent. Her work also uncovered that larger intervals between events correlate with less stability, especially for outer voices, demonstrating perceptual significance of horizontal motion in music. Dibben also observed that the occurrence of certain intervals, ones where listeners will have a preconceived notion as being 'dissonant', predicts listeners' judgements of stability (e.g. leaning quality of certain intervals such as minor 2nds and tritones). This therefore suggests the importance of examining horizontal motion between voices in chord sequences and the influence of dissonance in non-tonal music. Another study by Dibben in 1999 also suggests that voice-leading could be a more important factor in perceiving tension in atonal music (marking a change in the traditional balance of harmonic and contrapuntal considerations), and this could potentially help to explain the instability of particular melodic intervals and preference for types of linear movement within voices.[226] Additionally, her study also revealed that chords containing high roughness values were perceived to be more unstable than its context in tonal music.

Additionally, Bigand, Parncutt and Lerdahl's studies revealed the effects of interval size between successive chords on the perception of tension, where interval size is particularly significant for the movement within outer voices – where the larger the interval was in each voice, the greater the perceived tension.[227] This is however context-dependent, as their hypothesis states that an event, which is preceded by a large interval is perceived as less stable than an event which is preceded by a smaller interval.[228] Their studies[229] also focus on the internal and external influences (by utilizing short and long chord sequences as the stimuli set) to better account for perceived tension through a cognitive approach (echoing the works of Lerdahl and Krumhansl) and applying a sensory model, examining the roughness

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[225] Nicola Dibben, "The cognitive reality of hierarchic structure in tonal and atonal music," 1–25.
[226] Nicola Dibben, "The perception of structural stability in atonal music: The influence of salience, stability, horizontal motion, pitch commonality, and dissonance," 265–294.
[227] Emmanuel Bigand, Richard Parncutt and Fred Lerdahl, "Perception of musical tension in short chord sequences,"125–141.
[228] Their initial prediction suggests that musical tension will be higher if the second chord of the sequence is non-diatonic, which is negatively correlated with the perceived harmonic hierarchies created by Krumhansl.
[229] Emmanuel Bigand, Richard Parncutt and Fred Lerdahl, "Perception of musical tension in short chord sequences,"125–141; Emmanuel Bigand and Richard Parncutt, "Perceiving musical tension in long chord sequences," *Psychological Research* 62 (1999): 237–254.

and dissonance of individual chords.[230] Their results reported that the examination of horizontal tension and its roughness will better account for musical tension and chords that contain high roughness values are perceived to be more tense.[231] However, one limitation from these two studies is the emphasis on analysing chords within a strictly tonal context. As such, this could be further developed into a study that examines tension in harmonies that do not have to be related back to a specific tonality and the tension of these chords will be assessed at face value.

Other studies have explored roughness as a key factor to assist with determining tension in nontonal music. Roughness, as a concept, can vary depending on the context and its application in research. First introduced by Hermann von Helmholtz in 1885, a high level of roughness for instance was associated with pitch instability, amplitude fluctuations and high ratio partials. In more recent studies, there are varying approaches to defining and calculating roughness. Lartillot and Toiviainen, for instance, portray roughness as 'sensory dissonance' and this was calculated by "adding the beating provoked by each couple of energy peaks in the spectrum."[232] Arnal, Flinker, Kleinschmidt, Giraud, and Poeppel describe roughness in a different manner, measuring this phenomenon through the Modulation Power Spectrum (MPS) – a two-dimensional fast Fourier transform of a spectrogram – and focussing on rough sounds that "correspond to amplitude modulations ranging from 30 to 150 Hz [in the MPS] and typically induce unpleasant, rough auditory percepts."[233]

One such study by Pressnitzer and others focuses on treating roughness as a "dimension of timbre," to open a new avenue of perceiving tension nontonal harmonies.[234] The results suggest that although roughness participates in intrinsic consonance in tonal context, it does also extend to nontonal contexts and ultimately, the results demonstrate that rough

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[230] Such factors include the influence of harmonic function, sensory dissonance, horizontal motion and the impact of musical training.

[231] The authors concluded that non-musicians were more influenced by the melodic arrangements between the chords whilst musicians paid more attention to the chords' harmonic function and its roughness.

[232] Olivier Lartillot and Petri Toiviainen. "A Matlab toolbox for musical feature extraction from audio", in S. Marchand (Ed.), *Proceedings of the 10th International Conference on Digital Audio Effects (DAFx-07)* (pp. 237–244). Bordeaux, France: Université Bordeaux, 2007, p. 238.

[233] Arnal, Luc, Adeen Flinker, Andreas Kleinschmidt, Anne-Lise Giraud, and David Poeppel. "Human screams occupy a privileged niche in the communication soundscape." *Current Biology* 25.15 (2015): 2051–2056.

[234] Daniel Pressnitzer, Stephen McAdams, Suzanne Winsberg and Josh Fineberg, "Perception of musical tension for nontonal orchestral timbres and its relation to psychoacoustic roughness," 66–80.

instrumental sounds evoke tension in listeners.[235] Other studies also revealed that the analysis of timbre, combined specifically with the examination of roughness, does have an impact on how we perceive tension in both tonal and nontonal music, as a means to support the harmonic changes.[236] Although theories of nontonal tension are less numerous, it has been suggested that composers have proposed theories of nontonal tension that are however, only related to their own musical styles, like a "codification or personal practices".[237]

More recent studies in musical tension have sought to formalise musical tension, the application to other musical disciplines (e.g. performance) and the development of a more inclusive model to account for musical tension. One such study incorporates the examination of the predictability of musical structure and expressive timing in performance to perceived musical tension.[238] Based on a tonal-centric work, Gingras et al's findings suggest that there is a close interconnection between the dimensions of pitch (melodic structure) and time (expressive timing) in music when the notated meters and durations are removed.[239] A similar study by Farbood and Upham investigates how performances can be interpreted through listeners' judgements of musical tension.[240] Additionally, another study by Farbood proposed a quantitative model of musical tension, one that accounts for the dynamic and temporal

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[235] In the first part of the study, participants were required to make a forced judgement on how tense the chord was and the second part required participants to use a slider to rate the changes in quality, to determine roughness. Different factors were accounted for: tonal references and surface characteristics from performance variables.

[236] Stephen McAdams and Daniel Pressnitzer, "Psychoacoustic factors to musical tension in western nontonal music," *International Journal of Psychology* 31.3-4 (1996): 148; Stella Paraskeva and Stephen McAdams, "Influence of timbre, presence/absence of tonal hierarchy and musical training on the perception of musical tension and relaxation schemas," *Proceedings of the 1997 International Computer Music Conference* (1997): 438-441.

[237] Daniel Pressnitzer, Stephen McAdams, Suzanne Winsberg and Josh Fineberg, "Perception of musical tension for nontonal orchestral timbres and its relation to psychoacoustic roughness," *Perception and Psychophysics* 62.1 (2000): 66–80.

[238] Bruno Gingras, Marcus T. Pearce, Meghan Goodchild, Roger T. Dean, Geraint Wiggins, and Stephen McAdams, Stephen, "Linking melodic expectation to expressive performance timing and perceived musical tension," *Journal of Experimental Psychology: Human Perception and Performance 42*.4 (2016): 594–609.

[239] This study utilised recorded performances of an unmeasured prelude, *Prélude non mesuré No. 7*, by Louis Couperin as the stimuli and participants were asked to rate the perceived tension via continuous ratings.

[240] Farbood and Upham's study explores two aspects of musical tension that has not been thoroughly investigated – the individual timescales to assess how the different parameters attribute to tension and a close examination of participants' ratings to excerpts – to assess if musical features that require higher levels of cognitive processing (e.g. harmony) do contribute to tension over longer time periods than "low-level" auditory features (e.g. loudness) (Mowaread Farbood and Finn Upham, "Interpreting expressive performance through listener judgements of musical tension," *Frontiers in Psychology 4* (2013): 1-15.

aspects of listening.[241] Their findings revealed that two parameters in particular have a significant impact on listeners' perception of tension, dynamics and pitch height.[242]

Despite the large body of research that has delved the various different aspects of music that attribute to our perception of tension, there is no work that describes or explores the perception of post-tonal chords, but more specifically, how these chords will be perceived without reference to a tonal centre. The appraised literature therefore points out two key points: one, a lack of research into understanding and measuring post-tonal tension, a series of chords that encompass atonal and tonal elements and two, the importance of using psychoacoustical factors such as roughness to support empirical analyses into chordal tension. This empirical experiment therefore seeks to explore a different way to measure musical tension in post-tonal repertoire, by taking the approach of calculating the total amount of voice-leading movement between chords[243] – and extending Lerdahl's model (Tonal Pitch Space) of calculating tonal tension.[244] The aim of the experiment is to establish if the values from the model approach have a direct relationship to how we perceive tension and release specifically in post-tonal repertoire. It is predicted that listeners' tension ratings are closely related to its musical context, and to the composers' harmonic idioms. Furthermore, without reference to a tonal context however, listeners may be more likely give higher tension ratings based on the movement between the first and last "pitch collections" (PCns)[245], as well as accounting for preconceived notions of consonance/dissonance and other parameters such as register, and voice-leading movement. It is predicted from the model approach that a larger value denotes tension and a smaller value correlates with relaxation.

[241]Mowaread Farbood, "A parametric, temporal model of musical tension," *Music Perception: An Interdisciplinary Journal* 29.4 (2012): 387–428.
[242] The experiment was carried out in two parts. The first part required participants make judgements of tension for short stimuli through graphical shapes. The stimuli set was created so that each feature was isolated in some excerpts and combined with other parameters in order to uncover which specific parameter has direct impacts to tension. The second study required participants to make continuous, real-time judgements of tension – some stimuli came from Experiment 1 whilst some other excerpts were taken from the "Classical" repertoire – Bach, Vivaldi, Schoenberg, Beethoven and Brahms.
[243] Refer to Section 2.2 for an explanation of the VL movement
[244] Fred Lerdahl and Carol Krumhansl, "Modelling tonal tension," *Music Perception: An Interdisciplinary Journal* 24.4 (2007): 329-366; Fred Lerdahl, "Tonal Pitch Space," *Music Perception* 5.3 (1988): 315–349; Fred Lerdahl. "Calculating tonal tension." *Music Perception* 13.3 (1996): 319-363.
[245] The term pitch collection is given to chords that transcend the norm of the Classical tradition, sonorities that can contain more than one pitch.

2.4.2 Method

<u>Design</u>

The design of this experiment derives from one component from a "hybrid" theoretical model.[246] Rather than applying the conventional Roman numeral labelling, calculating the total amount of minimal movement between each voice in the chords or more loosely, pitch collections (PCns) will provide a different and concise representation of the harmonies, known as the Aggregated Voice-Leading (AVL) movement.[247] This aspect of the model suggests that there are potentially correlations between tension and release to the AVL movement. In order to test this empirically, a number of extracts – taken from the model's application – are tested for listeners to rate the amount of tension through the use of a tension rating scale, from 1 to 5.

In addition, several commonly used descriptors of music associated with measuring tension were extracted to provide an alternative or broader account of the tension within the music. Tonal stability[248], roughness[249], and several variables denoting other characteristics of the pitch collections such as mean pitch[250], median range[251], and the number of notes in a PCn[252]. Tonal stability and roughness[253] were extracted from the last pitch collection of the clip using

[246] As stated in earlier sections, this model encompasses elements from three different theories – Schenkerian method, neo-Riemannian theory and pitch-class set theory. This model has been created to address the harmonic issues posed by post-tonal repertoire, more specifically neoclassical works, as these works contains vestiges of tonality as well as post-tonal elements.As yet, no one theoretical model fully accounts for such neoclassical practices: a Schenkerian analysis will struggle to describe extended harmonies and post-tonal progressions; a Neo-Riemannian perspective does not fully acknowledge extended harmonies within chordal transformations, particularly on localized levels; and the application of pitch-class set theory struggles to describe meaningful tonal relationships between melody and harmony in this repertoire.

[247] As mentioned in 2.2, the AVL differs to voice-leading movement as AVL is the sum of all the voice-leading movement whilst voice-leading movement denotes the individual movements.

[248] Tonal stability is a tool derived from the MIDI toolbox that examines the "maximal correlation of the pitch-class distribution with the 24 K & K (Krumhansl and Kessler) profiles," assessing the PCn's tonal stability and clarity.

[249] For more information, see Bigand, Parncutt, & Lerdahl, 1996; Bigand & Parncutt, 1999.

[250] The mean pitch is obtained from the analysis of the midi sounds of each individual note in the PCn.

[251] The median range comprises the analysis of the midi sounds, the different between the highest and lowest pitch in each PCn.

[252] Chord Size simply comprises the examination into the number of notes within each PCn.

[253] Examining roughness originates from Vassilakis's doctoral dissertation (Pantelis Vassilakis, *Perceptual and Physical Properties of Amplitude Fluctuation and their Musical Significance* (Doctoral Dissertation), University of California, Los Angeles, America, 2001.)

MIR Toolbox.[254] The other calculations of the other properties of the pitch collections was carried out with MIDI toolbox.[255]

Stimuli

Although the three case studies – Hindemith's *Piano Sonata* No. 2, Ravel's *Sonatine* and Stravinsky's *Concerto for Piano and Wind Instruments* – have been analysed from a music theoretical perspective (refer to Chapters 2.1– 2.3, 3 and 4), assessing "real-life" responses by participants could potentially shed more light on the correlation or interaction between music theory and music perception.

These pitch collections (or "vertical sonorities" or "chords") in the stimuli set were generated by Sibelius and played with piano sounds produced by Sibelius at a tempo of 100 crotchet beats per minute. Tempo and dynamics (set to *forte*) are a constant factor across all sound clips, providing listeners with the same rate of change between pitch collections and its decay rate of sound. There are no rests or silences between successions of pitch collections. Three excerpts of varying lengths from each of the three works are selected and they are segmented into smaller fragments/clips (see Appendix A for the scores and the model's results):

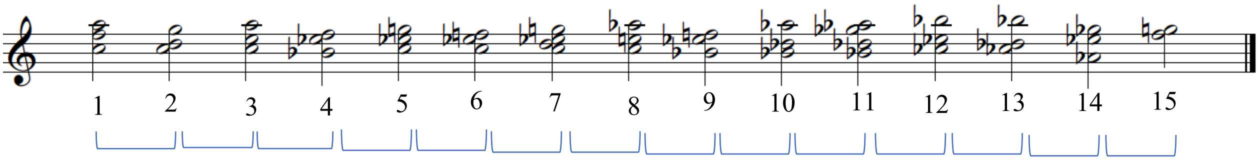
1. Hindemith
    1. Bars 12–17 (10 clips)
    2. Bars 22–27 (9 clips)
    3. Bars 56–63 (14 clips)
2. Ravel
    1. Bars 3–5 (8 clips)
    2. Bars 24–27 (9 clips)
    3. Bars 39–42 (10 clips)
3. Stravinsky
    1. Bars 1–4 (7 clips)
    2. Bars 39–43 (10 clips)
    3. Bars 64–69 (12 clips)

[254] Olivier Lartillot, and Petri Toiviainen. A Matlab toolbox for musical feature extraction from audio. In S. Marchand (Ed.), *Proceedings of the 10th International Conference on Digital Audio Effects (DAFx-07)* (pp. 237–244). Bordeaux, France: Université Bordeaux, 2007.

[255] Tuomas Eerola and Petri Toiviainen, *MIDI Toolbox: MATLAB Tools for Music Research.* (Kopijyvä, Jyväskylä, Finland: University of Jyväskylä, 2004).

Figures 42, containing the third Hindemith excerpt, exemplifies how meaningful segmentation[256] occurs and Figure 43 lays out these segments as pitch collections into a separate stave for voice-leading analysis. The numbered segments in Figure 42 correspond with the PCns in Figure 43 and the brackets under the PCns in Figure 43 denote the smaller segments, the sound clips.

(A)



(B)

[256] Drawing upon the ideas of Cone, Cooper, Meyer and Komar, a one musical segment initially relies on accentual patterns – to locate the "structural downbeats" – and its attack points (Edward Cone, "Analysis today," *The Musical Quarterly* 46.2 (1960): 172– 88; Grosvenor Cooper and Leonard Meyer, *The Rhythmic Structure of Music* (Chicago: University of Chicago Press, 1960; Arthur Komar, *Theory of Suspensions* (Princeton: Princeton University Press, 1971)). Different levels of rhythmic segmentation will no doubt emerge, and the minimum number of durational units into vertical linear sonorities is a variable that changes depending on the music's meter and attack points. Viewed in this way, the first movement of Hindemith's Second Piano Sonata can be constructively segmented into two different levels, in minims (which correspond to its meter) and in crotchets (the next fastest meaningful rate of harmonic change). Further divisions and segmentations can occur depending on the rhythm used in the music. This study will focus on its smaller form of segmentation: crotchets. As the Piano Sonata is in simple-duple time, one PCn, is obtained for the minim level of segmentation. At times, some of the segmentation results in vertical sets of sounds that only contain one or two notes as the notes are taken at "face" value and no notes are added to conform to the "archetypal" triad (a collection of notes that are a third apart). In this particular work, the PCns can be easily identified, because the bass line generally contains the harmonic tones; and in passages where it is less obvious, the PCns can be "implied" from identifying the melodic embellishments. On a crotchet level of segmentation, the notes are taken at a face value, without any alterations, and passing notes are excluded from the PCn.

Figure 42. Hindemith Excerpt – Bars 56–63: (A) Segmentation; (B) PCns.

Task and Procedure

This online experiment was conducted via Qualtrics and distributed through a mixture of different media: University mailing lists; social media; and word of mouth. Data quality was based on three factors: completion of the survey; rate of speed; and consistency of results. For instance, in scenarios where participants left the survey incomplete or completed it in a very short amount of time (e.g. 5 minutes) given the number of questions, their results were eliminated.

Set in the form of an online survey, the study firstly required participants to answer a series of general questions, adapted from the Ollen Musical Sophistication Index (OMSI) such as age, gender, country of origin and residence, musical expertise. The first part of the experiment then consists of a practice trial for the participants to familiarise with the format. This comprises 3 sound clips that do not reoccur in the study, and participants are asked to assess how tense the *second* sound is: using a 5-point scale, ranging from 1 (*weak*) to 5 (*strong*). No answer or feedback was given. In the second part of the experiment, each participant was instructed to firstly, listen to the musical excerpt (comprising a longer series of PCns); and secondly, in a randomised order, participants were to listen to a musical clip drawn from the excerpt – two sets of "sounds" or for a better term, PCns – and rate the tension of the second sound. Figure 43 illustrates an example, the first clip from Hindemith, and a brief explanation of the clip labels. This was repeated for every musical clip within the musical excerpt and the entire process is repeated for all nine musical excerpts (three excerpts each from Hindemith, Ravel, and Stravinsky). For each participant, the presentation of the musical clips within the larger musical extracts were presented in a randomised order. Participants were allowed to replay the extract if necessary. The experiment took 15 to 20 minutes to complete.

Figure 43. H-1-1.

H	-	1	-	1
Name of Composer		Excerpt Number		Clip Number

Participants

Participants greatly varied in age range, countries, gender and musical backgrounds. Of the 121 recorded responses, only 63 responses were valid[257]. The participants in the experiment included 16 non-musicians, 41 music-loving musicians, 18 amateur musicians, 10 serious amateur musicians, 13 semi-professional musicians, 16 professional musicians, with more female (63%) than male (37%) participants.

2.4.3 Results

A preliminary examination of the frequency distribution of the tension ratings (use of the rating scale) in each of the case studies highlights that in accordance with Cronbach's alpha,[258] the internal consistency of the ratings was high, producing a reliability coefficient of 0.725, based on accounting for other variables (Tonal stability, roughness, mean pitch, range, and chord size). The mean and standard deviation across all three excerpts are 2.60 and 0.71 respectively.

The main results from the experiment are presented through various modes of graphical representation in two components: "Aggregated Voice-Leading (AVL) and Mean Tension Rating (MTR)" and "Roughness and Mean Tension." Volume 2: Appendix 4 provides the respective scores that the segmentation is based upon, as well as the pitch collections and data.

[257] Some participants did not complete the study and some participants did not complete the study properly (e.g. inputting the same option repeatedly).

[258] Lee Cronbach, "Coefficient alpha and the internal structure of tests," *Psychometrika* 16.3 (1951): 297–334.

Aggregated Voice-Leading (AVL) and Mean Tension Rating (MTR)

The following diagram represents the results from the model (AVL) against the mean ratings (MTR) of participants' responses.

EXCERPT 1: HINDEMITH, PIANO SONATA NO. 2

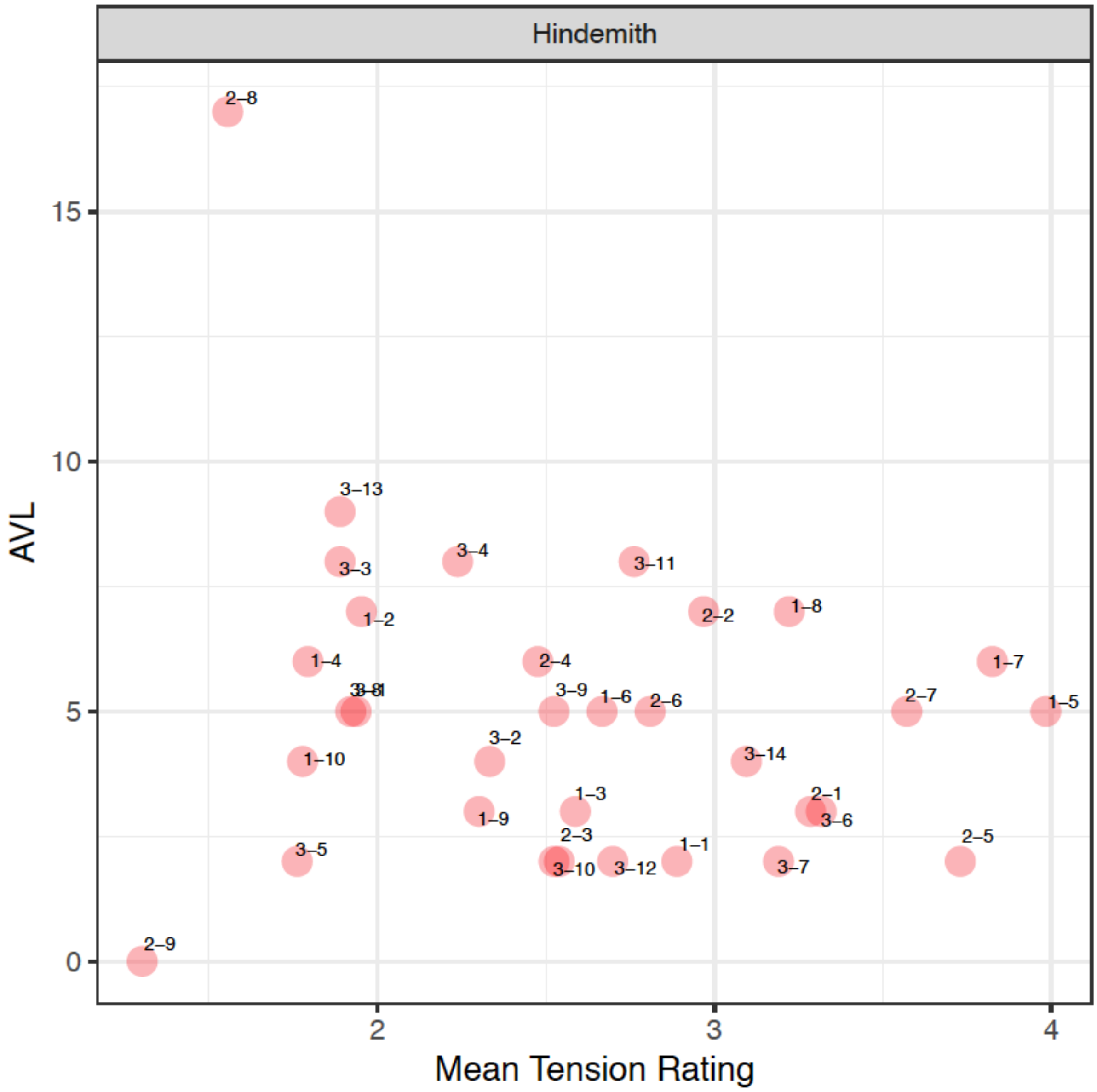
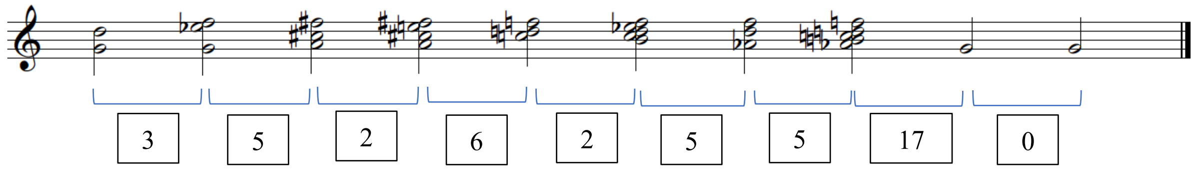


Figure 44. Model VS Mean Tension – Hindemith.

In the Hindemith extracts, an initial observation reveals that participants rated the extracts as containing lower tension rather than a higher one. This can firstly be attributed to the registral placement of the sound clips. As the PCns are organized and presented in a manner that moves by small (or "smooth") voice-leading movement, this may be challenging for participants to identify points of tension. This can be seen in 20 out of 33 clips, where the soprano voice – the outer voice that most listeners tend to associate with – moves by a semitone (1) or a tone (2) or retains its note (0).

When comparing the mean tension rating (MTR) to the aggregated voice-leading values (AVL) in the Hindemith excerpts, the results firstly reveals that larger values from the model do not necessarily mean more tension, (as there is no correlation between the ratings and the model, *r*[31]= -0.227, *p*=0.2028), but it does act as a prompt to invite the analyst to re-examine the particular moment in the music. For example, sound clips H-2-8 and H-2-9 have been identified by participants as a small MTR, between 1 and 2. The model indicates that H-2-8 is supported with AVL17, so despite the large value, the smaller tension rating in fact coincides with a movement from a "cluster" chord to a unison note. And whilst H-2-9 is supported with AVL0 from the model, correlating closely with the results from the study, it actually represents the movement between two identical notes – a unison – which suggests that listeners associate movement by unison with a small tension rating.

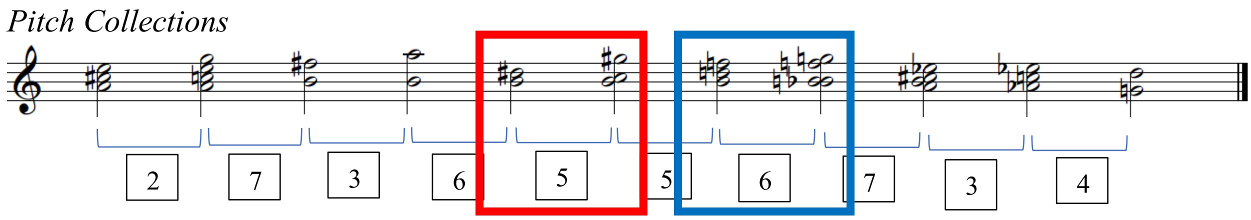
Pitch Collections



Clip	H-2-1	H-2-2	H-2-3	H-2-4	H-2-5	H-2-6	H-2-7	H-2-8	H-2-9
AVL	3	5	2	6	2	5	5	17	0
MTR	3.29	2.97	2.54	2.48	3.73	2.81	3.57	1.55	1.30

Figure 45. Model Results and Pitch Collections – Hindemith, Excerpt 2.

The two largest tension ratings identified in all three Hindemith sound clips, H-1-5 and H-1-7, coincide with a shift from a consonant interval to a more dissonant pitch collection, which comprises more than one layer of consecutive semitonal movement (e.g. H-1-7 contains a movement of Bb to B and F to G). An interesting point that arises from this observation is that when putting this back in context with the music, the results align with the climactic moment of the phrase (bars 15–16), where there is a driving quaver pattern in the LH against the descending melody of the RH, played *forte*. This reinforces the relationship between the musical contour (examining the melody, dynamics and rhythm) and the harmonic contents.



Clip	H-1-1	H-1-2	H-1-3	H-1-4	H-1-5	H-1-6	H-1-7	H-1-8	H-1-9	H-1-10
AVL	2	7	3	6	5	5	6	7	3	4
MTR	1.95	2.89	2.59	1.79	3.98	2.67	3.82	3.22	2.30	1.78

Figure 46. Model Results and Pitch Collections – Hindemith, Excerpt 1.

Figure 47. Hindemith, bars 9–16.

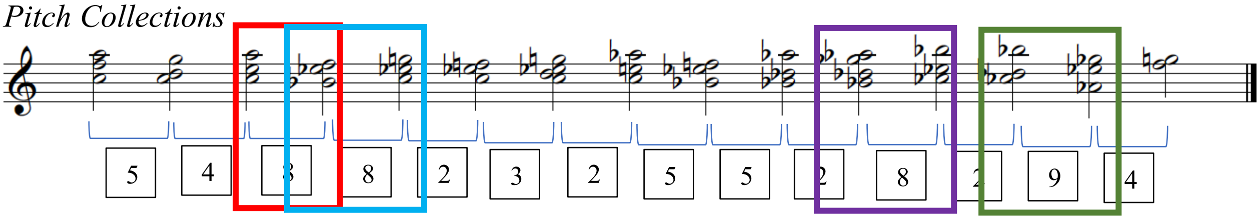
With H3, although the MTR value identified from participants are around the 2.4 range, the model indicates much larger values on certain clips, such as H-3-3, H-3-4, H-3-11, and H-3-13. In all four instances, the following observations can be noted:

Table 20. Hindemith Excerpt 3 – MTR, Contour and Intervallic Observations.

Sound Clip	AVL	MTR	Contour	Movement – Soprano Voice
H-3-3	8	1.88	Descending	M3
H-3-4	8	2.23	Ascending	M2
H-3-11	8	2.76	Ascending	M2
H-3-13	9	1.88	Descending	m3

It is interesting to observe the contour or direction from the first to the second PCn in each of these four instances as this may have had an impact on listeners' perceptions. For instance, in H-3-3 and H-3-13, despite the large value from the model, the descending contour and intervallic movement of a 3rd may have attributed to the smaller tension rating. H-3-3 in particular challenges the earlier statement that a consonant triad to a less consonant sonority may contain a higher tension rating. This therefore suggests that the direction of the notes plays a part in how listeners would determine more or less tension. With H-3-4 and H-3-11, despite their large model value, this is represented with MTR values that are larger than H-3-3 and H-3-13. This can perhaps be attributed to its ascending contour as there is a slight ascent in the soprano voice between the first to the second PCn. On the whole, it can be seen that through these examples that large values calculated from the model does not necessarily have to correlate with a higher perceived tension rating and there are other musical factors that will have an influence on listeners.

Pitch Collections



Clip	H-3-1	H-3-2	H-3-3	H-3-4	H-3-5	H-3-6	H-3-7	H-3-8
AVL	5	4	8	8	2	3	2	5
MTR	1.94	2.33	1.89	2.24	1.76	3.32	3.19	1.92

Clip	H-3-9	H-3-10	H-3-11	H-3-12	H-3-13	H-3-14
AVL	5	2	8	2	9	4
MTR	2.52	2.52	2.76	2.70	1.89	3.09

Figure 48. Model Results and Pitch Collections – Hindemith, Excerpt 3.

Figure 49. Hindemith, bars 55–67.

EXCERPT 2: RAVEL, MOUVEMENT DE MENUET FROM SONATINE

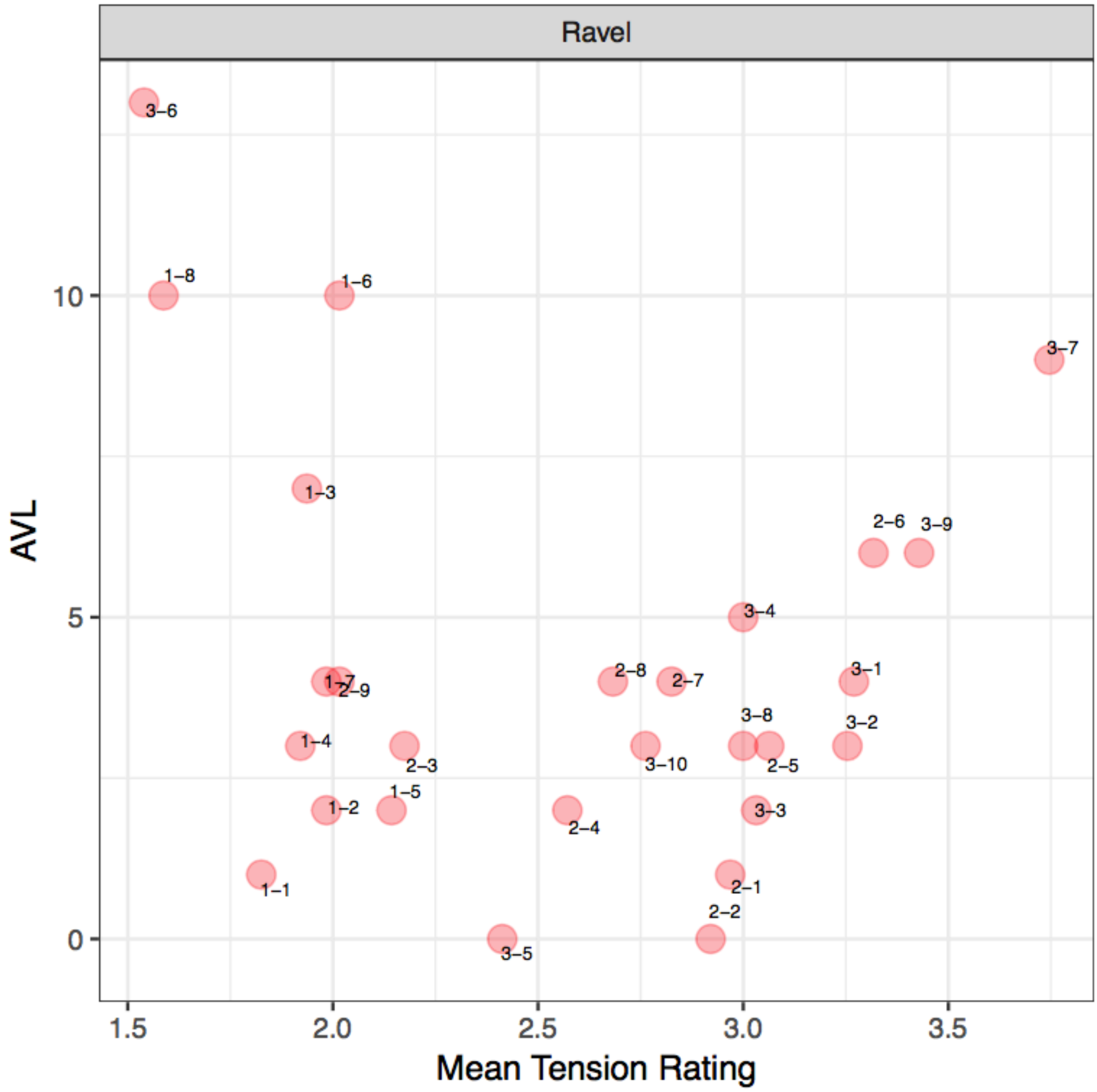


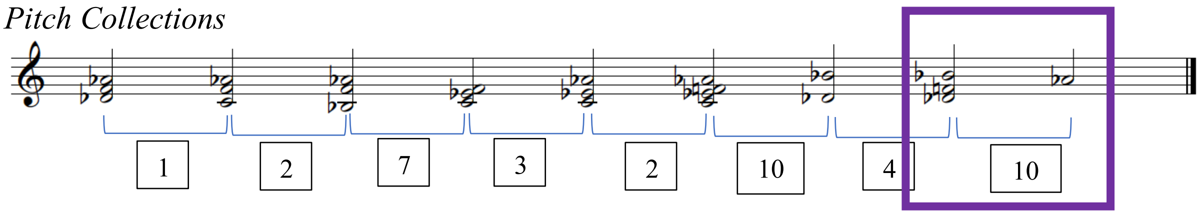
Figure 50. Model VS Mean Tension – Ravel.

With Ravel, participants have generally rated the excerpts between a medium to low tension rating as opposed to a higher tension rating. Given that Ravel's harmonic idiom can be described to be more consonant than the other two composers, it is interesting to analyse why it might be the case that listeners have used smaller tension rating values. Out of the 27 clips, the soprano voice in 21 of these clips move via "minimal" movement, thereby suggesting the importance of the positioning of the PCn, whether it sits in a "root position" or in its various inversions. The remaining 6 clips move via slightly larger movements such as a major 3rd (M3). In instances where larger tension rating values have been identified (such as R-3-9), as stated earlier, register plays an important role in listeners' perception as the larger tension rating value could be attributed to the slight ascent in the notes from the first to the second PCn, as well as the consecutive use of stacked seconds within the PCns.

The AVL and MTR results from the Ravel excerpts reveal that there is no clear linear correlation between the AVL model and mean tension ratings ($r[25]= -0.199$, $p= 0.3187$). However, this does not mean that the pattern could not be interpreted and there might in fact be a curvilinear relationship. Firstly, R-1-8 and R-3-6 have been perceived by participants with a lower tension rating but the model indicates a large AVL value. When examining the notes in R-1-8, the large AVL movement (AVL10) identified by the model marks a shift from a PCn containing 3 notes to a single note. The direction of the first PCn to the second is also of a descent. It can also be noted that a reduced number of notes in the second PCn may have had an impact on listeners' perception as it may appear less tense. When correlating this finding back to the music, this particular moment coincides with a tied Ab across the bar, with an absence of a bass note. Therefore, despite the large AVL value from the model contrasting the small tension rating, it simply indicates that a large AVL movement does not necessarily have to represent more tension but it marks a significant change in the harmonic contents, drawing our attention to that particular moment. In this instance, the large AVL value indicates a release of tension. Thus, whilst the model's calculation represents the physicality of the PCn's movement, its external qualities, it can be argued that the mean tension represents the culmination of other parameters, such as contour.

Figure 51. Ravel, bars 1–12.

Pitch Collections



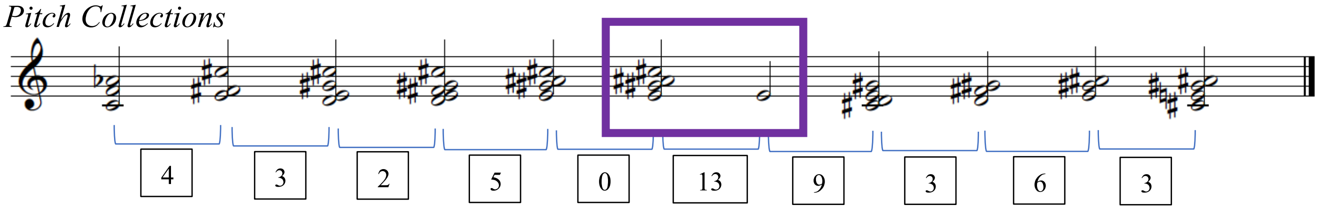
Clip	R-1-1	R-1-2	R-1-3	R-1-4	R-1-5	R-1-6	R-1-7	R-1-8
AVL	1	2	7	3	2	10	4	10
MTR	1.82	1.98	1.94	1.92	2.14	2.01	1.98	1.59

Figure 52. Model Results and Pitch Collections – Ravel, Excerpt 1.

Similarly, with R-3-6, which also contains a small tension rating value, this is supported by a large value from the model, AVL 13, and this also marks a shift from a PCn containing four notes in a chord to a single note. At this point in the music, R-3-6 coincides with the end of the two-bar figure, where both treble and bass arrive on E. This highlights the importance of the slur marking in bar 40, to phrase off that particular moment. In this instance, the lower tension rating value perceived by listeners can be accounted for in conjunction with other surrounding musical parameters.[259]

Figure 53. Ravel, bars 39–42.

Pitch Collections



Clip	R-3-1	R-3-2	R-3-3	R-3-4	R-3-5	R-3-6	R-3-7	R-3-8	R-3-9	R-3-10
AVL	4	3	2	5	0	13	9	3	6	3
MTR	3.27	3.25	3.03	3	2.41	1.54	3.75	3	3.43	2.76

Figure 54. Model Results and Pitch Collections – Ravel, Excerpt 3.

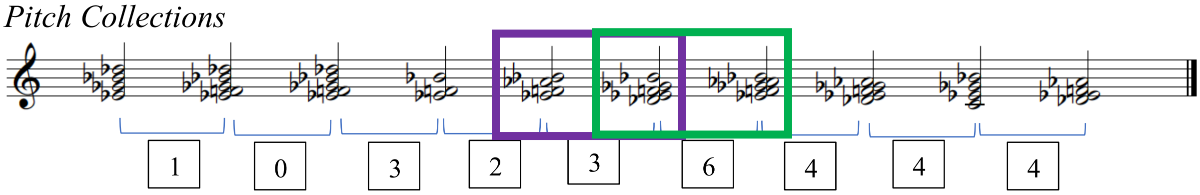
[259] It can perhaps be stated that when relating this finding to more practical purposes (such as performance practice), we may tend to perceive and value the importance of localized phrasing, to round off the two-bar phrase. Alternatively, another way to look at this is that these few bars are part of a sequence, that the smaller MTR gives listeners a false sense of resolution and it is ultimately driving towards the end of its second repetition in bar 42.

Whilst two instances of competing results have been identified in the Ravel excerpts, R-3-7 reveals a large tension rating value alongside a large AVL value from the model calculations. R-3-7 contains a shift from a single pitched sonority to a four-note PCn, but this raises the issue of whether listeners are giving this sound clip a higher tension rating value due to a presence of more notes or simply because the contents of second PCn is perceived to be more tense.[260] In the third excerpt (R-3-1 to R-3-10), participants identified a high tension rating value (3-4) in R-3-1 to R-3-4, and it is interesting to highlight that the tension rating decreases each time: 3.27, 3.25, 3.03 and 3. The decrease in the tension rating initially correlates with the model tension's decrease (up till R-3-3) but it is peculiar that what is perceived to be a "large" amount of tension is actually reflected in the model as a slightly smaller movement.[261] This is evident particularly in R-3-3 where listeners rated the clip as MTR3.03, but this may have been attributed to the additional presence of F sharp in the second PCn. Through these four examples, it can be seen perhaps that a higher MTR can be attributed to the groups of seconds within the PCn. However, this contradicts the statement made earlier on how successive PCns with small movement in the soprano line tend to correlate with a lower tension rating value, therefore reinforcing the notion that other parameters need to be considered as well. In the second excerpt, there is a higher tension rating value on R-2-5 and R-2-6. The mean tension rating value for R-2-6 correlates with the model's larger numerical value, whilst the model tension for R-2-5 denotes a smaller value. It could perhaps be argued that listeners may have rated R-2-5 with a higher tension rating value due to the consecutive stacks of 2nds clustered together within the PCn, reinforcing the close relationship to the tonal system.

[260] This moment coincides with the start of the next subphrase, a repetition of the previous melodic figure stated in bar 39.
[261] A VL movement larger than 4 in this instance can be described as a large movement.

Figure 55. Ravel, Bars 24–27.

Pitch Collections



Clip	R-2-1	R-2-2	R-2-3	R-2-4	R-2-5	R-2-6	R-2-7	R-2-8	R-2-9
AVL	1	0	3	2	3	6	4	4	4
MTR	2.97	2.92	2.17	2.57	3.06	3.32	2.82	2.68	2.01

Figure 56. Model Results and Pitch Collections – Ravel, Excerpt 2.

Another interesting point can be seen in the second Ravel excerpt, where there is a larger tension rating value in R-2-1 and R-2-2 despite the small value from the model. The first clip, R-2-1, comprises a movement of a semitone (1) whilst the second clip, R-2-2, retains the same pitches. The MTR values are 2.97 and 2.92 respectively. This then suggests that even if outer voice movement (especially in the soprano line) is not the primary factor in determining tension, the density of the chords plays a role in determining post-tonal tension. The presence of more pitches as well as intervallic movements of a second within the PCn could attribute to how one perceives tension. The same observation is also extended to the third excerpt in R-3-5, where the model tension value is 0 whilst the MTR is 2.41.

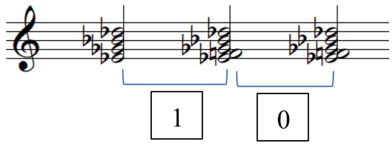


Figure 57. Model Results and Pitch Collections – Ravel, Excerpt 2, R-2-1 and R-2-2.

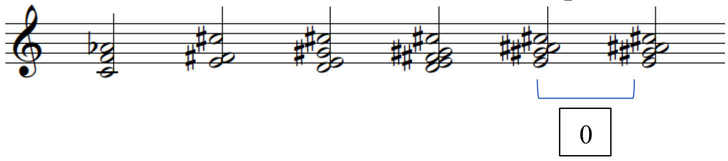


Figure 58. Model Results and Pitch Collections – Ravel, Excerpt 3, R-3-5.

EXCERPT 3: STRAVINSKY, CONCERTO FOR PIANO AND WIND INSTRUMENTS

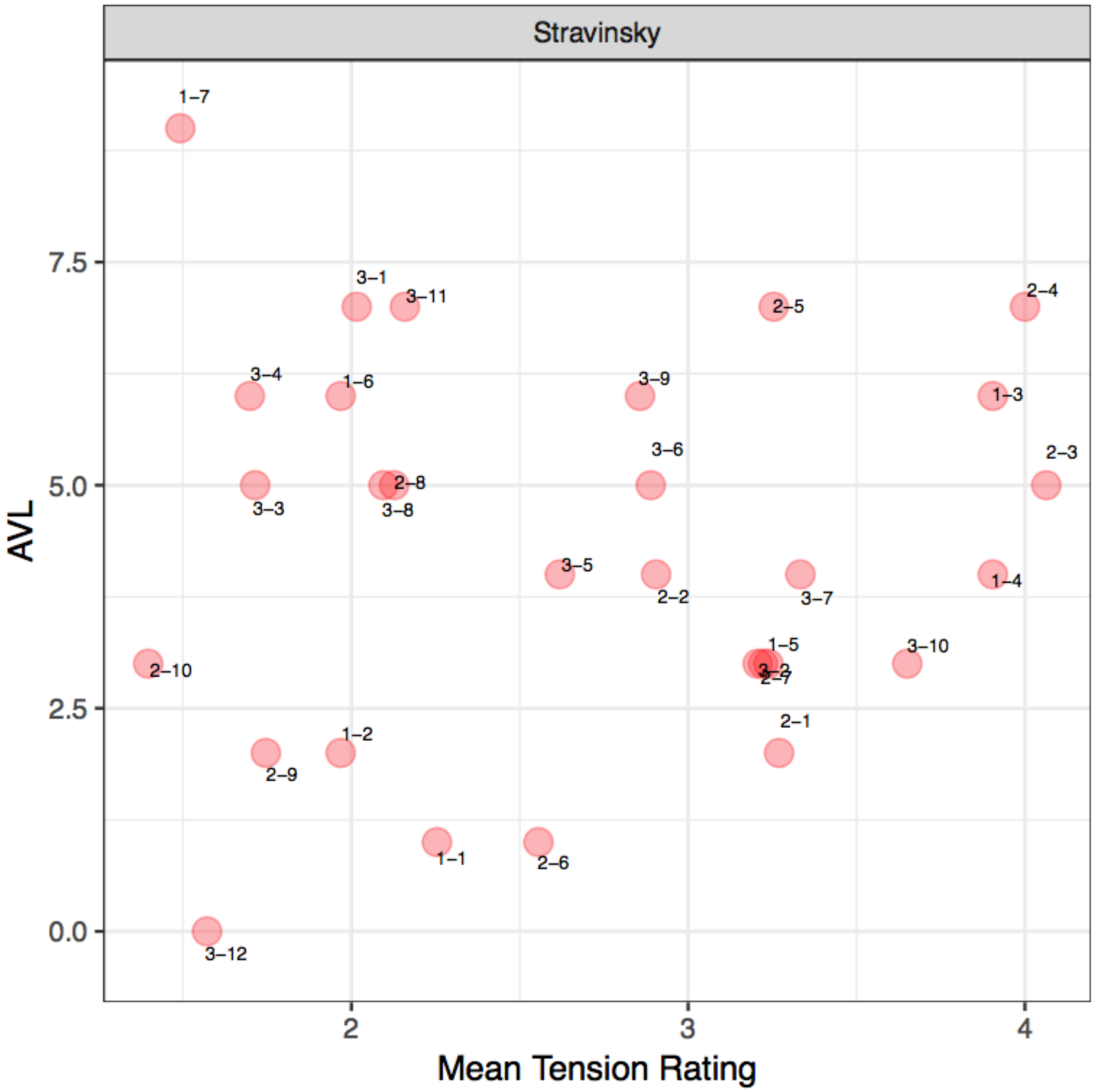


Figure 59. Model VS Mean Tension – Stravinsky.

From Figure 59, we can firstly identify that there are higher tension rating values in the Stravinsky excerpts than Hindemith and Ravel. This can especially be seen where listeners used the higher end of the spectrum for Stravinsky as opposed to the other two composers. Interestingly, this aligns with the composers' harmonic idioms as Stravinsky employs more chromaticised and "extended" harmonies than Ravel and Hindemith whose harmonic idioms are more tonally based. Furthermore, as these PCns are unaltered and derived at face value, listeners will naturally tend to pick up more dissonance in Stravinsky and dissonance is known to contain more tension than consonant triads.[262] On the whole, participants have generally rated the excerpts with a low to medium tension ratings more frequently. It is also interesting to highlight that with this Stravinsky, the use of tension rating 5 is used more than

[262] Roger Kamien, *Music: an appreciation* (Boston: McGraw-Hill Higher Education, 2008); V.L. Kliewer, "Melody: linear aspects of twentieth-century music", in *Aspects of Twentieth-Century Music*, edited by Gary Wittlich, 270–321. New Jersey, US: Prentice-Hall, 1975; Richard Parncutt and Graham Hair, "Consonance and dissonance in music theory and psychology: Disentangling dissonant dichotomies," *Journal of Interdisciplinary Music Studies* 5.2 (2011): 119-66.

the previous excerpts. One possible reason may be due to the increased number of stacked seconds within the PCn as well as a denser PCn. For instance, in the third excerpt, R-3-7 and R-3-10 contain a large tension rating and both clips contain a stacked second alongside the archetypal stacks of thirds within the second PCn.[263]

Pitch Collections

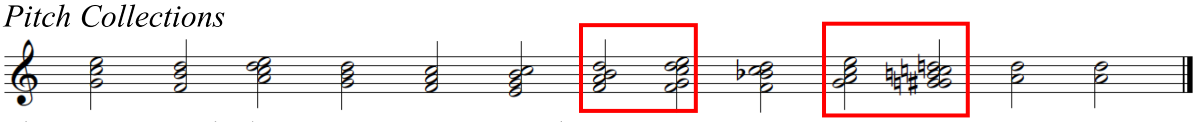


Figure 60. Stravinsky, Excerpt 3, R-3-7 and R-3-10.

From the MTR of the Stravinsky excerpt, it can firstly be seen that S-2-10, S-3-12 and S-1-7 contain the lowest ratings from participants, implying a low amount of tension. Again, no clear pattern between AVL and mean tension ratings emerge ($r[27]=0.043$, $p = 0.823$). With the first clip, S-2-10, this is also supported by a low AVL movement from the model, AVL3. When relating this particular moment to the music, this moment coincides with the end of a phrase as well as the end of the musical idea. However, the low-tension rating could also be attributed to the shift from a PCn to a single note. With R-3-12, this is supported by AVL0 from the model and it can be seen that there is a direct correlation between the model and mean tension there is no movement between the pitch collections. Interestingly, this also coincides with the start of a new phrase, which suggests that the phrase begins on a low amount of tension. And as for S-1-7, this is supported by a large value from the model, AVL9. This may be attributed to the shift from a 3-note PCn to a single note. This again exemplifies how a large AVL value from the model does not necessarily have to evoke more tension, but it could represent the opposite, simply marking a pivotal moment in the music. Incidentally, when relating this back to the music, this also coincides with the start of a new phrase as well.

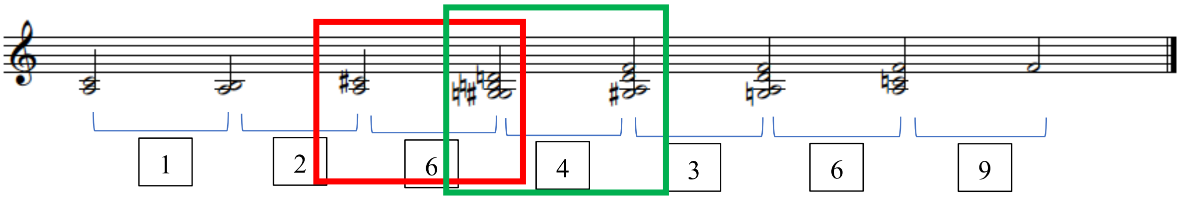
In this excerpt, four clips have been identified by participants as containing a higher tension rating value: S-2-4, S-2-3, S-1-3 and S-1-4. With the first excerpt, S-1-3 and S-1-4 are supported by AVL6 and 4 respectively from the model. Within its individual movements, S-1-3 contains a shift from a sound that can be described as containing “consonant” qualities to a more dissonant sound, where there is a “clash” between G# and G. S-1-4 contains a movement of two consecutive dissonant sonorities. With the second excerpt, S-2-3 and S-2-4 are supported by AVL 5 and 7 respectively from the model. Both sound clips contain PCns that can be described as dissonant due to the presence of stacked second intervals. These two

[263] R-3-7 in particular contains three pairs of M2nd intervals within the second PCn.

sound clips also demonstrate that despite the small movement in the soprano voice, listeners can hear the dissonance in the inner voices, which resulted in the high-tension rating. This could therefore suggest that register and small voice-leading movement in the soprano voice may not be a primary factor in determining post-tonal tension.

Figure 61. Stravinsky, Bars 1–5.

Pitch Collections



Clip	S-1-1	S-1-2	S-1-3	S-1-4	S-1-5	S-1-6	S-1-7
AVL	1	2	6	4	3	6	9
MTR	2.254	1.9683	3.9048	3.9048	3.2381	1.9683	1.4921

Figure 62. Model Results and Pitch Collections – Stravinsky, Excerpt 1.

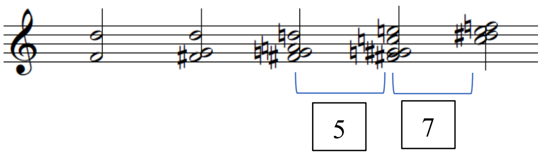
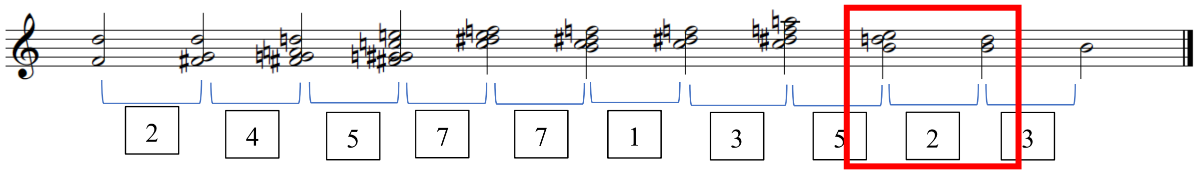


Figure 63. Model Results and Pitch Collections – Stravinsky, Excerpt 2, S-2-3 and S-2-4.

Additionally, it can be pointed out that S-2-9 contains an MTR of 1.7, correlating with the model tension, AVL2. When relating this back to the music, this PCn occurs at the end of the phrase, there are fewer notes in the second PCn and it can be described as more "consonant" as well.

Figure 64. Stravinsky, Bars 43–44.

Pitch Collections

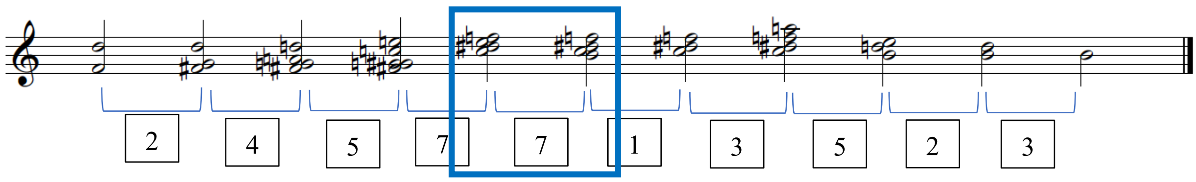


Clip	S-2-1	S-2-2	S-2-3	S-2-4	S-2-5	S-2-6	S-2-7	S-2-8	S-2-9	S-2-10
AVL	2	4	5	7	7	1	3	5	2	3
MTR	3.2698	2.9048	4.0635	4	3.254	2.5556	3.2222	2.127	1.746	1.3968

Figure 65. Model Results and Pitch Collections – Stravinsky, Excerpt 2.

There are also some instances where the model tension does not correlate with the perceived tension. Firstly, with S-2-5 and S-3-11, the model tension produces a large value but perceived tension indicates a smaller value. With S-2-5, containing an MTR of 3.25, whilst the smaller perceived rating coincides with the end of the subphrase, listeners may have associated the movement between the two PCns a lot lower due to the presence of repeated pitches. And with S-3-11, which contains an MTR of 2.15, contains a shift from a larger to smaller PCn (5 to 2 notes), a “consonant” P4 interval. This again reinforces the earlier observation that listeners may tend to associate consonant sounds and a shift from larger to smaller PCn as less tense.

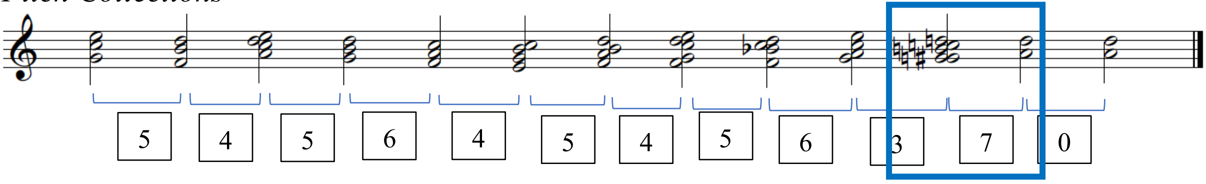
Pitch Collections



Clip	S-2-1	S-2-2	S-2-3	S-2-4	S-2-5	S-2-6	S-2-7	S-2-8	S-2-9	S-2-10
AVL	2	4	5	7	7	1	3	5	2	3
MTR	3.2698	2.9048	4.0635	4	3.254	2.5556	3.2222	2.127	1.746	1.3968

Figure 66. Model Results and Pitch Collections – Stravinsky, Excerpt 2.

Pitch Collections



Clip	S-3-1	S-3-2	S-3-3	S-3-4	S-3-5	S-3-6	S-3-7	S-3-8	S-3-9	S-3-10	S-3-11	S-3-12
AVL	5	4	5	6	4	5	4	5	6	3	7	0
MTR	2.0159	3.2063	1.7143	1.6984	2.619	2.8889	3.3333	2.0952	2.8571	3.6508	2.1587	1.5714

Figure 67. Model Results and Pitch Collections – Stravinsky, Excerpt 3.

Secondly, there are instances where the model tension produces a smaller value (up to AVL2) and perceived tension indicates a larger value. With S-2-1, which contains an MTR of 2.9, we can see that the two PCns are similar. What differs between the two is that the second PCn contains an F sharp (instead of an F in the first PCn) with an additional G. As such, the additional note to the second PCn and the chromatic shift may have influenced listeners' tension rating responses. With S-2-6, which contains an MTR of 2.5, the rating may have been a result from the absence of B in the second PCn, which brings out the augmented 2nd interval, therefore resulting in a higher tension rating value.

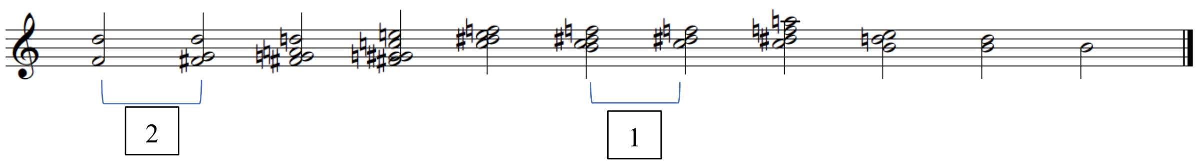


Figure 68. Model Results and Pitch Collections – Stravinsky, Excerpt 2, S-2-1 and S-2-6.

Furthermore, when there are instances where there is no movement or just a semitonal movement between PCns, it is interesting to observe how this is reflected in the tension rating values. With S-1-1 which contains a semitonal shift in the soprano voice, this correlates with an MTR of 2.25. Whilst this coincides with the development of the phrase in the music, the higher tension rating contrasts the model results, suggesting that the quality of the PCn plays a role in how one perceives tension in the PCn movement. This is also reflected in S-1-2, where a small model result is correlated with a small tension rating as well. It is also interesting to examine S-3-1 and S-3-4 as both contain small tension rating with PCns that would be typically characterised as consonant – e.g. G to F major chords in S-3-4.[264]

[264] This could potentially reinforce already established preconceived notions of consonance in conventional triads, and "chord clusters" or a larger set of PCn with dissonance.

2.4.4 Roughness and Mean Tension

As roughness has been reported to be one of the key factors to influence listeners' perception[265], a series of charts depicting roughness of the last chord of each pitch collection were produced.

EXCERPT 1: HINDEMITH, PIANO SONATA NO. 2.

Figure 69. Roughness and Mean Tension – Hindemith.

[265] For more studies carried out into roughness, see McAdams & Pressnitzer, 1996; Paraskeva & McAdams, 1997; Pressnitzer, McAdams, Winsberg & Fineberg, 2000.

EXCERPT 2: RAVEL, MOUVEMENT DE MENUET FROM “SONATINE”

Figure 70. Roughness and Mean Tension – Ravel.

EXCERPT 3: STRAVINSKY, CONCERTO FOR PIANO AND WIND INSTRUMENTS

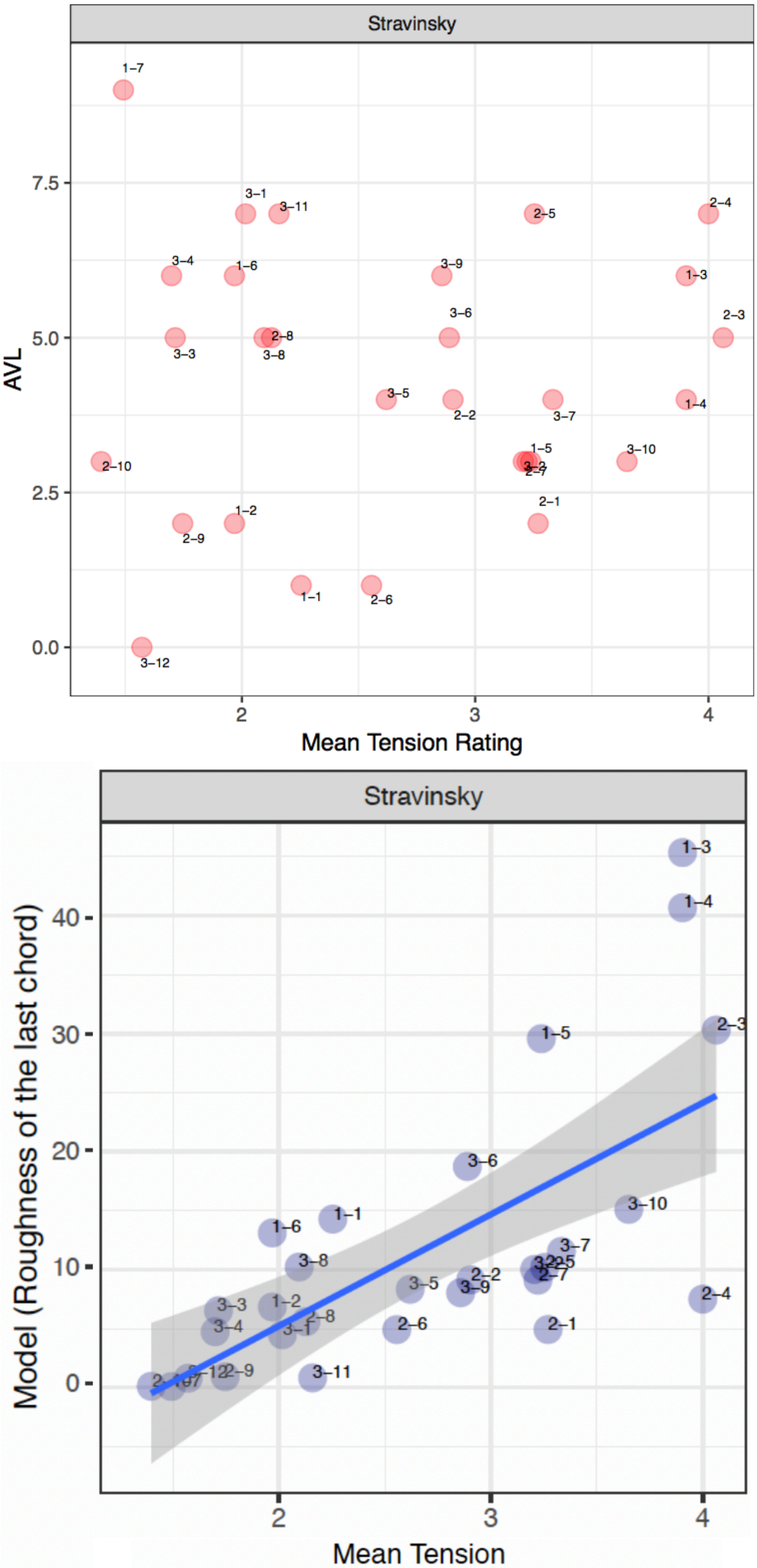


Figure 71. Roughness and Mean Tension – Stravinsky.

In the Stravinsky excerpts, accounting for roughness yielded results that both corroborate and contrast with the model and mean tension. The close link between a larger amount of roughness and dissonance[266] can be seen in sound clips S-1-3, S-1-4 and S-2-3. The larger amount of roughness in the last PCns of these sound clips directly correlate to common perceptions of dissonance. This could indicate that listeners have a preconceived notion of consonant and dissonant sounds and are able to distinguish the two apart. The same can be stated with S-1-5, however, this does not correlate with the model tension, as it is situated on a smaller AVL value, 3.

On the other side of the spectrum, it can be observed that a smaller amount of roughness correlates with a shift from "dissonant" to "consonant" PCn. As shown through the MTR and roughness value of S-3-11 (which doesn't correlate with the model), the movement between the first and second PCn supports coincides with a shift from a large PCn to two notes, which also forms a P4. This could indicate that there are two factors which may possibly account for its smaller roughness content, its consonant and dissonant quality as well as a reduced number of notes, depicting a P4.

Despite the close interrelationship that can be seen between the amount of roughness to consonance and dissonance, there were some anomalies. As shown in Figure 31, S-2-4 contains a large MTR but coincides with low roughness content. The first PCn of S-2-4 can arguably be described as dissonant, due to the presence two stacked intervals of a 2nd, where one of which is an augmented 2nd and the other is a minor 2nd. This is then resolved by an unconventional "triad" – B-D sharp-F – with an added second, C. This could potentially disprove the notion that dissonance is directly correlated with high roughness. It may be the case that the second chord is perceived to be more stable due to the stacked thirds, as well as the slight descent in the melodic contour in the inner voices. The same can be applied to sound clip S-3-10, where the larger roughness content correlated with an MTR of 3.65, reinforcing the idea that dissonance is not the only factor in a larger roughness content and melodic contour could be a factor (a descent in the inner voices). In all, it can be seen that in most cases, roughness correlates with the MTR results but not all the time with the model

[266] The close link between roughness and dissonance have been investigated in short and long sequences (Bigand, Parncutt, & Lerdahl, 1996; Bigand & Parncutt, 1999).

tension, highlighting some discrepancies between my theoretically derived notions of tension and perceived tension.

Figure 72. S-2-4.

In the Hindemith excerpts, again we can find instances where the roughness of the last chord correlates with the mean and model tension. Firstly, H-2-7 presents a higher roughness rating against an AVL5 and MTR of 3.57. The correlation of all three factors especially when placed back to its musical context, we can observe that this coincides in the middle of a subphrase, the climactic point of the section. The presence of additional notes in the second PCn, multiple stacks of 2nds of varying quality (major, minor, augmented) can be attributed to its higher roughness value. The soprano voice, F, remains the same, yet it can inevitably be argued that the higher roughness value is attributed to the presence of more inner voices.

Figure 73. H-2-7.

There are however, instances where the roughness values do not correlate with mean and/or model values. For example, H-1-3 contains a higher roughness value, but this is supported by MTR 2.58 and AVL 3. H-1-3 comprises PCns that contain two notes, the first of which is a P5 and the second, a m7. It can perhaps be argued in this case, there is a correlation between a minor 7th interval and notions of dissonance and larger roughness values. Within its musical framework, the higher roughness value does however demonstrate the importance of A (part of the second chord), the change of one note between the two PCns.

Figure 74. H-1-3.

Similarly, in H-3-14, this contains a smaller roughness value but this is supported by an above average MTR of 3.09 and an AVL of 4. It is interesting to firstly point out that there are fewer notes in the second PCn, two notes comprising a major 2nd, and the first PCn comprises three notes, Ab-Eb-Gb. It might be the case that a lower roughness value in this context coincides with fewer notes as well as a "more consonant" interval – as major 2nd can arguably be perceived as more consonant than a minor 2nd interval. Therefore, in this instance, we have a correlation between mean and model value but the roughness value can be perceived as an anomaly.

Figure 75. H-3-14.

Again, H-1-5 presents another example of an anomaly as this clip contains a lower roughness value against a high MTR of 3.98 and an AVL of 5. Like the H-3-14 and H-1-3, it might be the case that the lower roughness value can be attributed to the consonance of the interval. The second PCn comprises, B-C-G#, and its lowest and highest notes form a major 6th. It may be possible to state that roughness does not have a direct correlation to how one perceives tension of these PCns, although it is one of the key factors, as shown through examples that demonstrate a close interrelationship between the three factors, the model value might be a better tool to reinforce perceptions of tension. Register movement in H-1-5, an ascent in the register, could be one of the primary factors as to its higher MTR value, as well as the minor 2nd interval.

As for Ravel, the same types of observations can be made, where there are instances of similarities amongst all three parameters (R-3-7) as well as discrepancies (R-2-7, R-2-8 and R-3-10). Firstly, we can observe that R-3-7 is supported by a high roughness value as well as a large AVL of 9 and a higher MTR of 3.76. There are two distinct sets of PCns in this clip, the first of which is simply one note, E, which then progresses to a four-note collection, which can loosely be described as a C# minor chord with an added 2nd. Here we have an example where we have congruence amongst the three different factors used to account for tension. The same can be said for R-2-3, where a low roughness rating correlates with an MTR of 2.17 and an AVL of 3. This again coincides with tied notes as well as longer rhythmic values in the treble stave.

Figure 76. R-3-7.

Figure 77. R-2-3.

On the other side of the spectrum, there are some discrepancies between the roughness values and the MTR/AVL values. In the case of R-3-10, the higher roughness value correlates with an MTR of 2.76 and an AVL of 3, two values that bear no correlation to the roughness value. The higher amount of roughness in this instance can be attributed to its density, more notes in the last PCn rather than its consonant/dissonant quality as described in earlier examples. The lowest and highest of this PCn forms a major 6th, a consonant sonority, yet it contains a higher roughness value. However, when relating R-3-10 to its musical context, the higher roughness value is particularly useful in highlighting the emphasis of the PCn, the first beat of the new bar. The smaller values from the MTR and AVL of this clip can be attributed to the tied notes in the lower stave, meaning that there will be smaller in this set. Similarly, R-2-7 and R-2-8 contain higher roughness values whilst its MTR and AVL suggests otherwise. Both clips contain an AVL of 4 with MTR of 2.82 and 2.68 respectively. The lower MTR, supported by its AVL could be argued to be more suited in perceiving tension in this context when relating back to the music, but its higher roughness value does suggest a correlation with chord density to roughness.

Figure 78. R-3-10.

Figure 79. R-2-7 and R-2-8.

Some further discrepancies can be seen particularly in R-1-8, where a lower roughness value as well as a low MTR (1.58) is represented by a large AVL, 10. This lower roughness and MTR value can be attributed to two factors: the reduced number of notes in the second PCn (from three notes to one), the descending contour of Bb to Ab. The same can be stated for R-3-6 where the low roughness value and MTR of 1.54 correlates with a large AVL, 13 and its factors simply comprises the movement to a smaller PCn and a descending contour.

Figure 80. R-1-8.

Figure 81. R-3-6.

2.4.5 Summary

Some general comments can be made on the relationship between MTR and AVL values. Firstly, there are instances where the model calculations (AVL) depict a higher amount of tension whilst the perceived tension (MTR) is much lower. This simply demonstrates that this process – VL calculations and examining the PCns – is not sufficient in determining real-time tension and release in music. Secondly, the arrangement of the PCns could also play a factor in participants' ratings. For example, in H3, the minimal movement in the progression of the individual voices within each PCn from one to the next may have impacted listeners' perception. Additionally, the number of notes within the PCn may have had an effect on how listeners perceived tension. A movement from a PCn with more notes to fewer notes may result in a lower MTR but the AVL might project the opposite result. Thirdly, echoing Lerdahl's TPS, there may also be a correlation between listeners' preconceived notions of consonance and dissonance to release and tension. This can be seen especially in S-1-2 and S-3-4 from the Stravinsky excerpts, and R-2-1, R-2-2 from the Ravel excerpts. With the Ravel excerpts, these consist of what can be generally described as dissonant sonorities, represented with a small AVL value to a larger MTR. As for Stravinsky, S-1-2 consists of a dissonant to consonant sonority, supported with a low MTR and low AVL whilst S-3-1 and S-3-4, consisting of archetypal triads, thereby suggesting consonance, was supported with a low AVL. This could therefore suggest the importance of the PCn's contents rather than its movement, as its unique quality may hold the key in influencing listeners' perception rating. For instance, there are cases of PCns that contain no voice-leading changes yet they are represented with a higher MTR.

On the whole, this experiment has shown that listeners' perception of tension is dependent on a few factors, ones that go beyond the mere use of AVL calculations. External factors include register (e.g. shift from higher to lower registers may result with a small MTR), number of notes (e.g. shift from a larger to smaller number of pitches in a PCn) and its pitch organisation (e.g. root position triads tend to hold less tension whilst its inversions tend to be more tense).

Other variables that may better account for post-tonal tension can include chord size, range of the PCns, mean pitch and applying Krumhansl and Kessler's key profiling system.[267] A comparative analysis between these variables (as well as MTR, AVL and roughness) illustrating the means, standard deviations and correlations with confidence intervals is presented in Table 21. From this correlation table, we can firstly observe that the roughness has a high correlation with the size of chords, thereby suggesting that the varying number of notes has an impact on listeners' perception. Secondly, there is a strong correlation between roughness and chord size to mean tension ratings, which then reinforces the importance of physical factors in perception of post-tonal harmonies. Thirdly, other physical variables such as the registral range and the tonal stability of the chords, also have a strong correlation to tension ratings as well. The tonal stability of the chords is based on the correlation with the Krumhansl-Schmuckler key profiles, which is an index frequently used to estimate the tonal stability of a section of music. This tool however, is designed to measure single tones to tonal key areas and the results will no doubt be rooted in tonal traditions. Applying such a tool for this study is not entirely inappropriate, given that these PCns embody both tonal and post-tonal elements. Perhaps post-tonal features could be described from analysing other physical factors such as roughness, chord size and range. Based on the analysis of these additional variables, there is a stronger correlation between these physical factors to perception than simply using the AVL and roughness.

One step that can be taken further with these additional variables is to perform a regression analysis[268], using tension as the criterion and all available variable as predictors, as shown in Table 22. The regression analysis suggests that an adequate model can be created to account about 72% of the variance in the tension ratings. Furthermore, the sr^2 column[269] suggests that the two factors that are most crucial in accounting for the tension ratings are the **chord size** and **tonal stability**. The signs of the beta coefficients suggest that tension is negatively linked

[267] Carol Krumhansl and Edward Kessler, "Tracing the dynamic changes in perceived tonal organisation in a spatial representation of musical keys," *Psychological Review* 89.4 (1982): 334-368.
[268] A regression analysis is a statistical method that is designed to locate trends in the data, to understand the relationship between the results and variables.
[269] This column explains how much the specific variable contributes independently to the equation when isolated from other features.

to tonal stability whereas higher chord size, roughness, mean pitch seem to contribute to higher tension ratings. Despite the overall success of the regression model with these variables for this material, it is important to realize that the model would require more data in order to form generalized statements, for different contexts. Although the AVL loses out in the process, what this ultimately demonstrates is that unlike tonal tension, other physical and psychoacoustical factors must be analysed and accounted for to understand the treatment of post-tonal tension, to create a better measurement.

The following two chapters will consist of two detailed case studies, applying the hybrid theoretical method set forth in this chapter to the first movement from Hindemith's Piano Sonata No. 2, and the first movement and Stravinsky's *Concerto for Piano and Wind Instruments*.

Table 21. Correlation table between tension and external variables.

Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	Tension	AVL	Roughness	Tonal stability	Range	Mean Pitch
Tension	2.60	0.71						
AVL	4.51	2.85	-.13 [-.33, .08]					
Roughness	10.26	9.17	.55** [.38, .68]	-.18 [-.37, .03]				
Tonal stability	0.66	0.15	-.45** [-.60, -.27]	-.12 [-.32, .10]	-.11 [-.31, .10]			
Range	7.22	2.80	.46** [.28, .61]	-.30** [-.48, -.09]	.39** [.20, .55]	.05 [-.16, .26]		
Mean Pitch	69.57	4.94	.04 [-.17, .25]	.02 [-.19, .23]	-.57** [-.69, -.41]	.01 [-.20, .22]	.08 [-.13, .28]	
Chord Size	3.29	1.06	.69** [.56, .78]	-.32** [-.50, -.13]	.62** [.47, .73]	.01 [-.20, .22]	.66** [.53, .76]	-.05 [-.25, .16]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Table 22. Regression Analysis

Regression results using Tension as the criterion

Predictor	b	b 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	2.60**	[2.52, 2.68]				
AVL	0.03	[-0.05, 0.10]	.00	[.00, .01]	-.13	
Roughness	0.25**	[0.08, 0.37]	.04	[.00, .09]	.55**	
Tonal stability	-0.29**	[-0.41, -0.20]	.16	[.07, .28]	-.45**	
Range	0.00	[-0.11, 0.11]	.00	[.00, .02]	.46**	
Mean Pitch	0.19**	[0.07, 0.30]	.03	[.00, .08]	.04	
Chord Size	0.36**	[0.24, 0.47]	.09	[.03, .16]	.69**	
						R^2 = .725** 95% CI[.64,.82]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
* indicates $p < .05$. ** indicates $p < .01$.

Chapter 3

Case Study 1
Hindemith, Piano Sonata No. 2, First Movement

The analytical findings of the first case study – the first movement of Hindemith's Piano Sonata No. 2 – are presented in this chapter. The presentation of these analytical charts, graphs and the following discussion are segmented into smaller phrases and key sections according to its formal sonata structure. The rhythmic segmentations for this movement have been carried out in minims and in crotchets, which correlates with the natural downbeats of the music. The segmentation and calculation process can be seen in Volume 2: Appendix 1, Figures 1–3. The first movement's overall formal scheme can be broadly described in the following manner:

Table 23. Formal Structure for the First Movement of Hindemith's Piano Sonata No. 2.

	Exposition					Development				Recapitulation					Coda
	A					B				A^1					
	Theme 1	Theme 1a	Transition	Theme 2	Theme 2a	4 subphrases				Theme 1	Theme 3	Theme 2	Theme 2a	Transition	
Bars	1–16	17–26	27–40	41–55	56–63	63–73	74–81	82–89	90–94	95–106	107–116	117–129	130–136	137– 144	145–156
No. of bars	16	10	14	15	8	11	8	8	5	12	10	13	7	8	12
	63					31				49					11

As such, the data will be presented through the following segments:

1. Bars 1 to 16
2. Bars 17 to 26
3. Bars 27 to 40
4. Bars 41 to 55
5. Bars 56 to 73
6. Bars 74 to 89
7. Bars 90 to 106
8. Bars 107 to 116
9. Bars 117 to 129
10. Bars 130 to 144
11. Bars 145 to 156

This will be carried out under the following categories: VL reduction to AVL data; Statistical analysis – Mean, median, mode, and Voice-leading (VL) movement; and BCxVL data. The BIP local and global observations will then be presented to conclude this chapter. This chapter should be read in conjunction with Volume 2: Appendix 1, where it provides the relevant analytical charts.

Bars 1 to 16

<u>VL Reduction to AVL Data </u>(Refer to Volume 2: Appendix 1, Figure 4)

Minim Segmentation

Even though the first data point connects the first to the second bar, AVL6 is implied from the set-up of the movement. It can firstly be noted that Bb in the initial arpeggio is not accounted for on the graph as this note was located on the "weaker" beat, not part of the core chord. This same issue also occurs with the passing note, Ab, at bar 16 as this note is unaccounted for – the note falls on a weaker beat and has no position in the soprano line. The decrease in the data points in the first phrase, AVL 6 to 4, coincides with the end of the phrase as the phrase concludes with a smaller harmonic movement. The next data point, marked in bar 7, is significantly smaller, on AVL1, and suggests that the music has reached a point of stability and it is setting up the momentum for the next phrase.

Crotchet Segmentation

The three notes of the arpeggio are represented on the graph as AVL3-2-5, and it can be suggested that these numbers coincide with how one should shape the phrase. The decrease from 3 to 2 coincides with the descent in the melodic contour and the subsequent increase to coincide with the downbeat and the final note of the first subphrase. This therefore suggests that from a performance perspective, more emphasis is required on the final note of the subphrase. Interestingly, unlike the minim graph, the movement from D to A is on the same data point (thereby abbreviated as DP), which suggests that there is a connection between the initial melodic idea and its developmental material. Perhaps they could even be perceived as one larger unit – bars 1 to 10 as a larger phrase. Furthermore, unlike the minim graph, the prolonged As depict a decrease in the DPs (5-3-5) and it can be suggested that this decrease correlates strongly with the dynamics in those bars. This is supported with the *piano* marking with less subtle movement, smaller harmonic movement and in turn, this creates more stability before the climactic moment at bar 13. And hence, the subsequent increase (3 to 5) builds the momentum towards the climax.

The overall movement from G to B indicates an increase in DPs from 3 to 7, reinforcing the climactic moment in the opening bars. Although this contrasts the results gathered from the minim graph, this suggests that a closer inspection of the harmonic movement (thereby abbreviated as HM) will reveal the contour and musical action at a deeper level whilst the decrease depicted by the minim level has a role to play in the bigger picture – in providing an overall view of the movement. The 3-prg is represented by the data points, 7-3-4, illustrating an initial decrease from B to Ab, coinciding with the registral decrease and *decrescendo* and the end of the opening materials. The slight increase to G then coincides with the downbeat and the reprise of the initial materials. Furthermore, it is worth noting that this is one DP higher than the first DP. So much like the results gathered from the minim graph, this indicates that there is an "overall" increase in the momentum leading from the initial materials from bars 1 to 16 into its repetition at bar 17. The increase from 2 to 7 between A and B at bars 11 and 13 coincides with the climactic moment of the opening material yet it contrasts the results gathered from the minim segmentation graph (which depicted a static movement) – this reaffirms the notion that the minim segmentation has more of an impact on our understanding of the overall picture. Two of the three instances of significant movement are already accounted for with corresponding notes on the data points. -5 at bar 6 could be supported by G and this would then connect the first G at the start of the movement to that particular moment and in turn, this reinforces the tonal centre of the movement. This will subsequently establish a stepwise movement to A in the next bar. Another interesting point can be seen in bars 4 – 6 where the increase in DPs coincides and supports the way one would shape the phrases – the increase suggests that the music is driving towards the new materials in bar 7.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis of a minim segmentation reveals that the mean of the introduction contains a "moderately"-sized harmonic movement, and the result is the same when examining the mode and median – 4. However, it is interesting to observe the contrasting results to the crotchet segmentation. Even though the mean is similar to the results yielded in the minim segmentation, it is slightly smaller. Furthermore, the mean and mode are different: 3 and 2 compared to 4. An initial statement can be made that a crotchet segmentation reveals a deeper insight to the harmonic movement.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)
It can be observed that there is more variety of VL numerical values in the crotchet than the minim segmentations. In both cases, 0 is the most frequently used VL movement, which reinforces the importance of minimal movement. Consequently, 1 and 2 are the next most exhibited numbers – which represents semitonal and tonal movement. The more frequent use of VL2 than 1 in the crotchet segmentation can imply that its effect aligns with the additional variety of chords and chord colours. The use of a larger VL number, such as ones that are larger than 3 are only used once in these bars, across both minim and crotchet segmentations. It can also be noted that the use of a larger VL number is always supported by a smaller number such as 0 and 1. At this stage, the crotchet segmentation so far has revealed more information between each set of sounds.

<u>BIP Observations</u>
Local Observations (Refer to Volume 2: Appendix 1, Figures 4 and 19–23)
When comparing the results between the minim and crotchet segmentations, it can be noted that there are some similarities – there are some shared BIPs. Out of the five identified BIPs, only two appear in the same bar whilst the others occur in different bars.Within the minim segmentation, it is interesting to note that the smallest identified AVL, 1, occurs at the close of a phrase, in bar 6, and at the beginning of a crescendo (which also coincides with the increase of tension in bar 11). This therefore suggests that in this movement so far, a smaller movement plays a structural role in the melodic contour of the music. With the two largest AVLs, it is worth noting that whilst it is a significant number, the AVL is created through the combination of several "smaller" numbers – 0, 1, 2 and 3. It can also be highlighted that these larger numbers appear at specific structural moments – AVL6 at bar 1, AVL6 at bar 7 – the beginning of a new melodic idea, or perhaps better stated, the reprise of the opening materials (which some alterations). Therefore, this suggests that the larger movement may need to be emphasised. With the most commonly used BIP, the first two appear at the end of a phrase in the first idea whilst the others occur in the build-up of a phrase.

With the crotchet segmentation, the use of 0 and 1 only appear once in the opening bars – perhaps this is less preferred in the statement of the opening materials. And much like the result from the minim segmentation, the largest AVL, AVL7, appears only once – used very sparingly and plays a structural role in the music. Interestingly though, there is more use of "larger" movements, AVL5 and 6 – where AVL5 is used seven times and AVL6 appears three times. From an overall view, the use of 5 predominantly appears on the downbeat, the strong beat of the bar, with the exception in bar 14 where it occurs on the second beat. The appearance of such a "large" number plays a role in establishing the harmonic character of the piece – unexpected sonorities – but each of occurrences consist of a combination of smaller numbers. The most commonly used AVL, AVL2 is also particularly useful in setting up the piece, as stability is commonly associated with smaller movement. The BIP [0002] is used six times:

Table 24. Bars 1–16, BIP [0002] and its function.

BIP [0002]	
Bar 3	anacrusis
Bar 6	anacrusis
Bar 7	Anacrusis (part of a larger phrase)
Bar 8	anacrusis
Bar 9	Anacrusis (part of a larger phrase unit)
Bar 10	anacrusis

There is a recurring theme whenever [0002] appears – it always appears on a weaker beat and supports an anacrusis. In four out of the six occurrences, it appears at the start of a new phrase whilst the other two act as an anacrusis to a melodic figure as opposed to a larger unit.

Bars 17 to 26

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 5)

Minim Segmentation

The opening arpeggiated figure depicts a decrease from AVL7 to 5 – one set of DPs higher than the opening bars. Once again, Bb isn't supported by a specific data point as it falls on the second beat of the bar. Again, this decrease coincides with the end of the phrase – which suggests that the moment of intensity occurs right at the start of the phrase and there is perhaps a sense of closure in bar 19. This arpeggio, unlike the beginning, finishes on the tonic, with a lower DP. The overall ascending arch of this arpeggio is the opposite to the descending DPs – which suggests the notion that the harmonic movement does not necessarily have to correlate to the melodic contour.

The prolongation of G is supported by an increase in AVLs from 4 to 6, which contrasts the dynamics, a *decrescendo* and the descending melodic contour that is nested with each identified G. Even though they are on the same note, the different DPs suggest that the second one would be more intense and significant – as the musical idea is developing the intensifying towards bar 26. The next B in the descending arpeggio is not supported by any DP as the note falls on the second beat of the bar. The subsequent prolongation, of D, is supported by a decrease from 10 to 5, which coincides with the *decrescendo* and the movement towards the end of the phrase. Despite the repeated melodic figure, there are two very different DPs – which suggests that the first is more significant and its repetition is much less of a "surprise" and in turn, this could potentially explain the presence of smaller numbers.

However, the final note of the phrase in bar 26 is supported by AVL13. This falls on the unison note and evidently, this indicates a large change in the harmonic density and it also suggests that the end of the phrase also plays a role in creating the momentum in the subsequent idea. This also coincidentally coincides with the softer dynamics, marking a sharp change in the texture as well. The overall arch from G to G in bars 22 to 26 is supported by an increase in DP, which suggests a build-up in intensity, perhaps in preparation for the development section. The same can also be stated for the overall arch of bars 17–26, where there is an overall increase in the data points and momentum). The subsequent movement, 3-prg and several prolongations in bar 26 are not accounted for as they do not fall on the main pulse of the bar – they can only be speculated at this stage but a crotchet segmentation will most definitely reveal more information.

Crotchet Segmentation

Much like the opening bars, the arpeggiated figure, G-Bb-D, is supported by AVLs4-2-5 (opening bars: 3-2-5) and again, this suggests that D is significant harmonically and metrically as it falls on the first beat. Interestingly though, as this arpeggio resolves on its tonic, the DP is on the same number as bar 17, suggesting a relationship between the two notes and perhaps on a deeper level, the ascent could be perceived as one musical unit. With the prolongation of G, it is interesting to note that once again, it is on the same DP, suggesting that these few bars, from bars 17–22, will contain the same amount of musical tension. Perhaps this is to aid with the following bars, where there is more HM and contrasting ideas – establishing a sense of stability before the climactic moment. Much like the results from the minim graph, the prolongation of D is supported by a slight decrease in the DP, whilst a sharp decrease occurs in the minim segmentation. This correlates with the decrease in dynamics as well as the conclusion of the musical idea. Interestingly, the next note, B, is on the same data point and this suggests that there is the same amount of tension in that bar.

The final note G is on AVL17, a large shift in HM to reach this point. The large number contains some structural significance as it marks the end of the first section before leading into the development. As discussed in the minim segmentation, the dense harmonies have suddenly changed to a mere unison note, which attributes to the presence of such a large number. The overall movement from bars 17–26 (and even bars 22–26) indicates an increase in AVL – perhaps as a way to intensify the music, in preparation for the development. The sharp change/movement to 0, supported by G, clearly indicates that there is no change in the note or chord which is interesting. The use of 0 immediately after bar 17 can suggest that there is almost a sense of stability, before the music propels to the next section. Subsequently, B is on AVL4, a number that is bigger than its preceding numbers and is not supported by "smaller" VL movement. This contains some structural significance – three consecutive instances of sharp movement between chords – which relates to the quaver movement as it is then progressing towards a transitional idea. The movement between G to B, a 3-prg, is not accounted for in this graph and requires further segmentation, perhaps a quaver one.

There are three instances of significant movement that are unaccounted for in this graph. In bar 21, B can be added for inclusion in the MG chart, acting as a CS within the prolonged G and on a larger scale, it can be connected to Bb, marking a sharp tonal change in the music. In bar 23, two As can be added to account for +4 and -5 and these notes will create a CS to D. This A is also prolonged – a strong dominant chord can be seen in that bar, D major (F# and A) in the soprano reduction, which is supported by a descending chromatic figure in the bass reduction

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

The statistical analysis of both minim and crotchet segmentation reveals that the HM is much higher than the opening materials. This is particularly evident in the minim segmentation, where both median and mode are of a larger number – 5.5 and 6,5. This could indicate a sense of harmonic variety, where there are different notes and new ideas being introduced, as a way to lead into the subsequent section. Interestingly, both minim and crotchet segmentations share the same mode, 5 – which creates a correlation between the results from the minim and crotchet segmentation. However, it is worth highlighting that the presence of some of these larger numbers in the minim segmentation can be explained by a lack of a segmentation by smaller note values, as there are evidently sections and moments that necessitate a crotchet segmentation. It can therefore be suggested that the results from the crotchet segmentation may provide a more accurate insight to the movement between each set of sounds.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)
In the minim segmentation, 0 or 1s are used in every bar but it is interesting to note that there is more use of 1 than 0. The use of VL1 indicates the change of a semitone, which reaffirms the notion that more harmonic movement is occurring overall in these bars. The use of larger AVL such as 4 and 5 are supported by smaller VL movement and interestingly, these occur consecutively towards the end of the section which thus suggests that the musical materials in bars 24–26 are driving towards a new section, which in turn suggests an increase in tension, a more intense moment of the section. Unlike the minim segmentation, 0, common tone movement, is used more frequently than 1 in the crotchet segmentation and the use of larger VL movement are scattered somewhat evenly across the section. Almost every transformation between chords are supported by 0 or 1 – and again, this reinforces the importance of minimal movement. The transition to singular notes, clearly marked by the large decrease in the AVL initially starts off with 0, a common tone movement, before increasing significantly.

<u>BIP Local Observations </u>(Refer to Volume 2: Appendix 1, Figures 5 and 19–23)
When comparing the minim and crotchet segmentations, it can be noted that larger AVL is a main highlight in the minim segmentation, which significantly contrasts the variety of HM collected from the crotchet segmentation. No number below HM4 was collected but it is interesting to note that these large movements are always supported by smaller VL movement such as 0, 1, 2. There are two instances of BIP/AVL that are shared across the two segmentations. [0112] occurs at the same spot in the two segmentations but [0113] does not align between the two segmentations.

When comparing the results of the minim segmentation to the opening bars, it is apparent that larger AVL is employed and this suggests the idea that there is more development of the musical materials and more tension in the reprise. AVL5 and 6 are used more frequently than others and the sharp AVL occurs towards the end of the section. [0123], which appears twice, coincides with the peak/highest point of the phrase – bar 18 (of bars 17 to 19) and bar 21 (of bars 20 to 23). The first of the two is within a small phrase whilst the second occurs within a larger metric unit. Notably, the smallest AVL occurs at the end of the section, indicating that this particular moment marks the end of the musical idea. With the exception of bar 27, the other bars are supported with smaller VL movement.

In the crotchet segmentation and when comparing this data to the first 16 bars, it can be noted that there is a large AVL, 17, that occurs towards the end of the section. As mentioned before, this is structurally significant and marks the end of the section. AVL5 is used the most frequently in this section and it is interesting to note that most of its occurrences are in pairs, bars 17 to 18, bars 20 to 21 and bars 25 to 26. When correlating these movements to the music, it becomes immediately apparent that these pairs play a role in creating a sense of stability in the music.

Table 25. Bars 17–26, BIP content for AVL5.

AVL5		
Bars 17 and 18	Bars 20 and 21	Bars 25 and 26
[0023]	[0014]	[00122]
[0113]	[0113]	[00023]

Although AVL5 is arguably a larger number, the presence of smaller VL numbers such as 0 and 1 creates a sense of coherence and stability. It can be implied that smaller VL numbers suggest stability whilst larger numbers suggest instability. But the combination of smaller and larger numbers will give the BIP a dual function and its role will ultimately depend on other musical parameters – the melodic contour etc. [0113] occurs three times and it appears on the first beat in bars 18, 19 and 21. It can be argued that as most of the appearances of AVL5 occurs earlier on, [0113] plays a large role in maintaining the momentum of the music before approaching the climax.

Bars 27 to 40

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 6)

Minim Segmentation

The ascent from B to D is supported by an increase in the data points from 4 to 6, aligning with the use of the higher register. However, it must be noted that the small prolongation of B is not accounted for in this graph as the second B coincides with a weaker beat. Interestingly, the movement from D to A is supported by the same data points – suggesting that bars 29 and 30 contain the same amount of harmonic tension despite the increase in dynamics and "unison" musical figure. Although it is marked *forte*, this is not the highest point in the movement and suggests that the climactic point is located further on in the section. The 3-prg, A-B-C#, is not supported completely by the DP as they fall on weaker beats (a crotchet segmentation will no doubt reveal more information). The decrease on C# subsequently is interesting as it aligns with the decrease in the dynamics and the use of a single melodic line – bearing some structural significance as well, as it occurs at the start of a new phrase. E the final note of the arpeggio cannot be placed on the graph as it is situated on a weak beat. However, its prolongation to E# is supported by AVL7, the highest DP identified in this section and this coincides with the use of more dynamics, chromatic notes and a more active bass line. On a broader scale, bar 27 onwards is driving towards this particular moment in the music – the climactic point.

The overall movement from E# to A is supported by a decrease in HM, reinforcing the empirical study, suggesting that dynamics may not directly play a role in the increase in harmonic tension. The presence of more common tones (CTs) and smaller movement suggests that it is preparing for a more intense moment in the subsequent bars as opposed to bar 35. Within A, F can also be charted at this point – D and E are not supported by a DP though as they fall on a weaker beat. Despite the ascending figure, D is supported by a low AVL value and this is due to the movement of both treble and bass lines of the VL reduction moving in unison. The subsequent movement from D to F, with the prolonged Ds are not supported clearly on the graph. This is the same with the PN, E, as well. There is therefore a strong need for further segmentation to account for these notes as they play a vital role in the transition to the second idea – which actually accounts for one of the significant movements in this graph. The overall arch for this graph depicts an increase in the HM from 4 to 6, correlating with the formal structure of the movement, the transition to the second idea, with more harmonic tension. One significant movement is accounted for in the MG chart – bar 34. E can be considered to be included in the MG chart as this can resolve the E-E# line and the note can also act as a consonant skip to G#.

Crotchet Segmentation

The prolongation of B at the start of this section is supported by a significant increase from 4 to 11. B has two roles in this context – the first marks the end of the section whilst the second marks the beginning of the section, which consist of a larger HM. Interestingly, the consonant skip from B to D is supported by a decrease in HM, suggesting the notion that D is not the highest point of the phrase and it is leading or preparing for the "true" climactic moment. Unlike the minim graph, the movement from D to A is supported by an increase in DP, coinciding with the start of the bar and the "loudest" point of the subphrase. B from the 3-prg from A to C# is not supported by a DP as it falls on the second half of the crotchet beat – perhaps further segmentation can be done in this bar?

The prolongation of C# is depicted on the graph as a sharp increase as it contains unfamiliar harmonies, it occurs at the start of a new section and defies the dynamic marking – all of these therefore suggest that this particular moment is structurally significant. Bars 30 to 32 contain an arpeggio, A-C#-E, with the data points, 5-11-5. The significant movement between these notes can suggest that A and E are a point of relaxation and C# holds the most amount of tension. But more importantly, A and E coincides with the end of the subphrase. The movement of E to E# is represented by a slight decrease in data points and this could be interpreted as a form of preparation for the climactic moment of the section. It is interesting to observe that with the subsequent 3-prg, E#-G#-A, even though the notes do not fall within the soprano voice, they are structurally significant. A is on AVL12, marking the climactic moment of the section. However, within this, there is another 3-prg in the soprano voice, D to F. E is not supported as it falls on the second half of the crotchet beat. The movement from D to F is supported by an increase in the DP – reinforcing the highest point of the section.

There is another 3-prg and prolongation immediately after the climactic point. The first D is not supported by any DP due to its metrical placement. The prolongation to the next D is supported by a significant decrease in DP, from 12 to 5, coinciding with the decrease in register and dynamics. The movement from D to E, also supported by a decrease in DP, reinforces the idea of closure, end of the phrase, section coinciding with the decrease in dynamics. The subsequent increase to F, from 2 to 4, coincides with the start of a new section and key. The significant movement in bar 34 is unaccounted for and the most appropriate addition would be E. This unmarked point was also identified on the minim chart and clearly suggests that E should be included as it provides structural weight on both broader and deeper levels. The movement of -10 is unaccounted for and is situated on a dotted crotchet. F can be considered for inclusion as it ties in with the first beat and the decrease on the whole coincides with the longer rhythmic value. With the movement of +5, C can be added not A as this will then create a leading note (LN) movement to Ds and it partially creates a stepwise motion. A consonant skip (CS) can be created with the unaccounted DP as it emphasises the median of the key area. With the movement of +4, C can be added as this will create a deeper relationship to the first identified C and creates a long linear progression.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

The statistical analysis of both the minim and crotchet segmentation reveals that there is a sharp difference in the mean between the two, as the result from the crotchet segmentation is much larger than the minim segmentation. This reinforces the idea that a closer inspection and further segmentation of the PCn will reveal a deeper insight to the harmonic movement. Interestingly, the mean from the minim segmentation is similar to the result gathered in the opening bars, suggesting the notion that there is a correlation between the first and second thematic ideas. Three different modes were identified as well and in turn, this suggests that there is more variety of AVL than previous sections. However, two of these identified numbers can be considered as "large," indicating the use of larger AVL in these bars. 5 is reflected in the modes of both minim and crotchet segmentations. It is interesting to point out that with the crotchet segmentation that the overall calculations for mean, median and mode have increased from the previous sections, indicating an increase in harmonic intensity, which reinforces the statements made in Chapter 2: the correlation between harmonic movement to one's perception of tension/release.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)

In the minim segmentation, 0 supports almost every single harmonic movement and this reinforces the importance of maintaining a common tone – it is also used alongside larger VL numbers – so therefore a combination of smaller and larger numbers creates more harmonic interest. There is more frequent use of 2 as opposed to 1 which suggests more harmonic variety than its previous section – coinciding with the second idea of the movement. The largest VL movement, 5, appears right at the start of the section, coinciding with the beginning of the section. 2 is used the most frequently, which again reinforces the change of the tone.

In the crotchet segmentation, 0 is the most frequently used, much like the other sections. 7 is also used here, number than did not appear in previous sections. Larger VL movement are also used sparingly – 6 and 7 are only used once but in conjunction with smaller numbers. In fact, the presence of these two numbers appear consecutively, coinciding with the climactic moment of the section. Once again, they are supported with smaller VL numbers such as 0 and 1. Much like the results gathered from the minim segmentation, 2 is used more frequently than 1 – as it can be argued that 2 changes the chord colour more than 1 (a semitone) does.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 6 and 19–23)
When comparing the minim and crotchet segmentations, there are two instances where the BIP in the minim segmentation is situated on the same spot as the crotchet one – bars 34 and 38, whilst the rest yielded different BIPs. It is interesting that there is more variety in the crotchet segmentation as opposed to the minim segmentation, reinforcing the idea that a closer examination of the chords will reveal more information than a minim segmentation will. But the minim segmentation contains smaller VL numbers than a crotchet segmentation. This indicates that a broader overview of the section is bound by the use of VL movement. The larger VL movement in the crotchet segmentation is supported by a deeper examination of the AVL.

Each BIP is only used once in the minim segmentation, even the occurrence of two consecutive HM is represented by different BIPs. The first set of HM that appears twice, 6, in bars 29 and 30 both share 0 and 2 and the other numbers are not as larger either. Its appearance in those bars coincide with the climactic section, maintaining the high amount of tension. The second set of HM, 3s, coincide with the stepwise scalic motion – in unison, smaller than the first, it is essentially a sequence, with repetition and less of a surprise. The third set, bars 38 to 39, coincides with the appearance of a repeated semiquaver figure. Although bar 37 is not accounted for, it is supported by 4, a number similar to 5, suggesting that these semiquaver figures may contain a similar amount of tension and similar VL movement. The use of 2 is interesting too, they are structurally placed at points in the section that are crucial in building the tension in its subsequent bars.

A larger variety of BIP content also feature in the crotchet segmentation. The largest BIP number is this section is however, smaller than the one identified in bars 17 to 26, which may suggest that there is more momentum in the previous section. Consecutive BIP [023] can be identified in bar 38 and this is particularly effective in maintaining the amount of tension needed to build up to the next bar. Retaining one CT and moving by 2 and 3 also indicates that tension can be built by smaller VL movement. Consecutive HM can be seen prior to this too - where bars 36 and 37 contain different BIPs: [0025] and [25]. As 7 is considered to be a large HM, having two CT aids in bridging the 2 PCns but the second BIP can be felt to be much bigger due to the lack of CTs. AVL11 coincides with the start of each subphrase – bars 27, 31 and 35. The first two share the same BIP but the last one contains a VL6 – it can be perceived that the last one is more significant and larger due to this. AVL12, consisting of the BIP [237], coincides with the climactic moment of the section and it is made up of mostly smaller numbers, 2 and 3 and a larger one, 7.

Bars 41 to 55

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 7)

Minim Segmentation

It can immediately be seen that there are a few DPs that cannot be plotted on the minim graph – due to its metrical placement – occurring on the weak beat of the bar or on an offbeat. Furthermore, some of these DPs contain notes that have been moved forward by a beat as it can be argued that metrical placement occurs in that particular phrase – bars 44 to 48. A crotchet graph will be far more insightful than a minim graph in this section – the minim graph will therefore present an overall scope of the section

The arpeggio with the 7th is depicted on the graph as an overall decrease from 6 to 0 – despite the fact that it is immediately obvious that the DPs are not a *true* reflection of the HM. This can perhaps be a visual aid to illustrate how the previous section, that is filled with harmonic intensity, reaches a point of stability – the start of a new thematic idea – a series of repeated F minor chords in the bass. Within the 5-prg, 4 out of the identified points are not the "true" notes on the graph – they have been pushed forward by a beat as the phrase started a beat later. The overall shape depicts an increase in the HM, coinciding with the musical idea, the consequent phrase, as it drives to reach bar 48. This is reinforced by the walking bass line and additional motifs in the inner voices. The approach to bar 47 is represented by a slight decrease in DP – suggesting some structural significance – marks the end of a subphrase.

Several observations can be made in regards to the consonant skip from Bb to Gb. Gb is not supported but it is implied by the graph that there is an increase in the harmonic tension to its arrival on F – suggesting the notion that F is not the true conclusion of the section and it is in fact leading onto the next phrase. G, the first note of the prolongation is not clearly supported (a crotchet segmentation would assist here). Its connection to G in bar 53 is depicted by a decrease in DP – which does not directly correlate with the other musical characteristics in the phrase where a sense of urgency and build up can be felt towards the arrival of bar 53. On the whole, the movement from G to Gb is represented by an increase in DP – building up to the climax of the phrase. Above the prolongation from G to Gb contains an arpeggio with the seventh, the first three notes are supported by an increase in the DP – coinciding with the climactic moment of the phrase, the sharp decrease at the end coincides with the first note starting the next phrase, also the last note of the current phrase. Interestingly, this is a number much smaller than the first – 6 decreasing to 3 – which suggests that it is less of a surprise – also marking the return of familiar materials.

Crotchet Segmentation

The initial arpeggio with the added 7^{th}, Ab, is not accounted for as it falls on a weaker beat of the crotchet. What is particularly interesting to observe though, is that the harmonic movement correlates with the contour of the passage, building up towards the climactic point of the phrase and a decrease in HM from Eb to F, coinciding with the end of the phrase, a reiteration of the 3 note figure.

The overall prolongation of F is supported by an increase in the AVL from bars 41– 48, perhaps in preparation for the development of the second idea. The falling 5-prg initially depicts a decrease from F-Eb-Db, but interestingly, the subsequent movement, including the consonant skip, indicates an increase in the HM, suggesting the idea that bar 48 is driving towards the next phrase, and not a complete point of resolution. However, despite the above statement, the first note of the subsequent phrase is supported by a decrease, which can suggest the notion that a decrease is necessary in order to build up the intensity of the phrase. The prolongation of G over these few bars is represented by a slight decrease and maintains the same data point for Gb. As this was identified within the inner voice, this could be one explanation for the slight decrease, which also coincides with the melodic movement

The arpeggio and added 7th depicts the sane data point between E to C, correlating with the sequence, but also suggesting that the same amount of momentum can be felt between these two bars. The approach to Ab is represented by an increase, coinciding with the pre-cadential moment and fuller harmonic support in the bass line. The final note of the phrase or start of the next bar, F, is represented by a smaller number, suggesting slight resolution. However, this is 1 DP higher than bar 41, indicating that more tension and harmonic interest occurs on its reiteration.

As for the neighbouring movement, it is interesting to note that the principal tones, D are larger than its auxiliary tone, E – reaffirming the notion that E is "slightly" less significant. Furthermore, F at bar 48 is larger than bar 56, reinforcing the idea that bar 48 is not at a point of true resolution. The unaccounted movement at bar 55, Ab, can be added. C is on the downbeat but it essentially just an embellishment, thus prolonging the first Ab – the same tone, containing two different numbers, two different roles. The first heightens the tension whilst the second releases it slightly. The second instance of unaccounted movement, bar 46, Db can be added, supports the Cb drawn in the next point but it indirectly supports the diagonal motion between the treble and the bass reduction from bar 44: Eb to Eb and Db to Db. This then suggests that more emphasis is required on bar 46, the first beat of the bar, drawing out the inner voice, the falling melodic line.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis of the minim and crotchet segmentation reveals that the harmonic movement is much smaller than the earlier section, this perhaps suggests that the music is at a point of stability. The results gathered in the minim segmentation is fairly similar where mean, median and mode are all 3. 3 can be regarded as a relatively small number and thus this reinforces the notion of stability. It is used more often towards the end of the section. A BIP analysis will reveal its role and it can perhaps be hypothesised that the first few bars are more unstable. As for the crotchet segmentation, the mean is slightly larger than the minim segmentation. The mean gathered in this section is fairly similar to the results from bars 17 to 26. 6 is used more often (the largest mode so far) and 5 (same as the previous section) can be seen to be the "middle" number between smallest and largest numbers.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)
Within the minim segmentation, the idea of stability can in fact be seen in the VL data where 0 and 1 are most frequently used and the less frequent use of larger numbers, for instance, 6 appears once. 1 again is used more often than 0 and it supports the idea that the harmonic movement or tension can be done via smaller movement. The use of 6 perhaps has some structural significance as it appears towards the end of the section – perhaps to change the character or quality and to heighten the tension before approaching the reiteration of the idea.

In the crotchet segmentation, the large VL number, 5, appears in the first phrase of the section, suggesting the idea that more tension is felt at the start. And interestingly, the use of VL4 appears only in the next phrase, the consequent idea – double the amount of 5. So whilst 5 is not used in the consequent phrase and as 4 is used more often, more harmonic tension can perhaps be felt in the consequent idea. VL movement of 0, 1 and 2 are used very frequently in this section – almost every transformation consists of 0 or 1s. Unlike the minim segmentation, 2 is used quite frequently and it reaffirms the idea that a combination of smaller VL movement will play a role in heightening the musical tension.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 7 and 19–23)
There are some shared BIPs between the minim and crotchet segmentations with AVL3 and 6 but interestingly, this does not align with the respective bars. A larger amount of HM is clearly evident in the crotchet segmentation and the recurrence of AVL0 in the minim segmentation is questionable, given the significantly different result in the crotchet segmentation. The minim segmentation clearly depicts the frequent use of smaller VL movement whilst the crotchet segmentation contains more of a variety. It is particularly evident from this section that there are gaps and flaws with just the use of a minim segmentation and a segmentation of smaller rhythmic values, like a crotchet or a quaver one will be far more efficient.

It is particularly useful to analyse the use of consecutive HM – if they share any common BIPs and VL features. Between bars 49 to 53, there is a repeated use of HM3 with the BIPs [012] and [111].

Table 26. Bars 41–55, BIP and motivic relationships.

BIP	[012]	[111]	[012]	[111]	[111]	[1111]	[0016]
Motive	x		x^1		y	y^1	y^2
Bar	49	50	51	52	53	54	55

(x denotes a two-bar figure and x^1 is a repetition with the same rhythm with different notes.)

Table 27. Bars 41 – 55, Movement between [012] and [111].

[012]	[111]	Movement
2	1	Decrease
1	1	No change
0	1	Increase

From Tables 26 and 27, the first BIP can be perceived to be slightly larger as 2 moves to 1, which coincides with the contour of the phrase it descends. Interestingly, the use of HM3, with [111] continues after the melodic fragments x and x^1 into y – the highest point of the passage. The BIP is then extended to a larger HM of 4, where an additional semitone (1) is added on to the HM before increasing significantly to HM, the last bar before the beginning of the next section.

Table 28. Bars 41–55, Instances of AVL6 and 4.

AVL6	4 2 0	4 1 1		3 3	4 2 0	3 2 1
Bar	49	50		51		52

There are two occurrences in the crotchet segmentation with repeated HM, 6 and 4. Its BIP can be seen in the above table, Table 28. As mentioned earlier, the pairs of bars – 49 and 50, 51 and 52 – are a sequence. In the crotchet segmentation, it is particularly interesting to observe the use of BIPs within AVL6.

In the first fragment, HM 6 appears twice but an additional semitone, 1, is added a beat earlier. [024] is the common BIP and once again, we can observe the importance of smaller VL movement in conjunction with larger ones to build the momentum. The second set with three sets of BIP can be perceived to be larger and more significant than the first as smaller VL movement are less frequently used. It is then interesting to see that like the minim segmentation, that there is a decrease within the VL movement, coinciding with the descending contour of the melody.

Table 29. Bars 41–55, Decreases in VL Movement.

Individual VL movement	2 decreases to 1	4 decreases to 3
Bar	49 to 50	51 to 52

From the Table 29, it can be suggested that [33] should be emphasised to distinguish the difference between this and the first fragment. Another recurrence of HM, 4, appears in the next bar: [13] [004] [112] (though this embarks onto larger HM in the subsequent bars despite the use of the same rhythm). The decrease from the previous bars suggest that there is some stability before reaching the end of the phrase. In addition, the use of smaller VL numbers between each PCn in the bar coincides with the held note in the inner voices. On the whole, it can be seen so far that within the development section that tension is built via smaller VL movement as opposed to larger ones.

Summary

From the opening section of this movement, it can be seen that through the crotchet segmentation, the AVL results have a more meaningful relationship to the VL reduction. Key examples can especially be seen in bars 1–26, where the AVL data has correlations with performative gestures, particularly in how one shapes a phrase. It can also be seen the statistical analysis indicates that AVL4 is the mean number, and most chords generally contain an AVL of 4 and any AVLs above 4 can be regarded as “significant” as this can suggest more “tension” or interest in the musical activity. The BIPs and its repeated appearances noted in this section each contain a unique significance, thereby suggesting that BIPs contain a unique character within a piece of music (e.g. use of [0002] as an anacrusis). Towards the end of bar 26, it can be highlighted that there was significantly larger AVL but it is important to mention that not all increase in AVLs signify more “tension”. Whilst in most cases, an ascent in the VL reduction can align with an increase in DP, it is entirely context-dependent and an increase can align with a decrease as well. In this case, it was due to more layers of sounds (e.g. more notes in a chord). A sharp change in the AVL simply denotes a “significant” movement that requires further observation.

Bars 56 to 73

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 8)

Minim Segmentation

Unlike the earlier bars, the arpeggio with the added 7^{th} is supported by a decrease then an increase to the final point, F. The decrease coincides with the end of the 3-note figure, F-A-C, yet the notes are getting higher, contrasting the results. But the increase from C to F coincides with the build-up to the climax of the phrase, the highest point – indicating that the music is moving forwards to the next section. Again, C and Eb are not supported by this graph as the emphasis is on the minim segmentation. F was also forced upon bar 58 as it was not situated on the first beat.

Similarly, the issue with Eb in bars 59 and 61 are given data points as it can be perceived that they could fall on the first beat – a lot of the phrases begin on an off-beat. Two neighbouring movements occur in this area as well. The first, F-Eb-F, is supported by an overall increase in the DP. The initial decrease from F to Eb coincides with the start of a new phrase. And its prolongation to the next Eb is supported by an increase of 4, coinciding with the approach to the end of the phrase, an increase in the dynamics, movement in the bass etc. The additional neighbouring movement, with Gb is not supported by an DP, but the overall movement is an increase from the first to the last F – increase in HM and intensity to reach the final note of the section.

The 5-prg in the development section is supported by a slight decrease in HM. C# and F# are added to the DP as it can be suggested that they are metrically displaced. It is interesting that only C# to D# is an increase whilst the movement from D# to E is a decrease and remains static from that point on. This could suggest the fact that as bar 69 onwards is a reiteration of bars 63 to 65, there is less surprise in the HM and the same DP connects bars 68 to 73 together with the same amount of tension. With regards to the consonant skip, Bb, this note has been placed on a DP despite falling on the second beat. It can be suggested that the start of this phrase is metrically displaced and could fall on the first beat. The slight decrease in the DP from Bb to B despite the ascent in the melody could indicate that the music has not truly reached the climax, that it is in fact preparing for the section and also coincides with the decrease in the dynamics. It is also interesting that the intervallic movement between each chord does not exceed 4 and they generally consist of smaller numbers – suggesting the notion that the development sections need not comprise of large movements.

Crotchet Segmentation

The shape of the arpeggio with the added 7th initially depicts a decrease from F-A-C, increasing to Eb followed by a large drop to F. This contrasts slightly with the data gathered from bars 41 to 43, which depicts a steady increase to Eb but with the same decrease to F. Perhaps this could suggest that C might have less emphasis or that it retains the same notes from the previous chord. And whilst results from the minim segmentation suggests that the overall movement contains the same amount of tension, the results from the crotchet segmentation suggests that it decreases, coinciding with the end of the approach to the end of the phrase – two competing views are created here.

Much like the minim segmentation, the movement F-Eb-F indicates an overall increase in the HM. The movement between the prolonged Eb also depicts a sharp increase – reinforcing the notion of a build up to the climactic point of the phrase. However, unlike the minim segmentation, the unsupported Gb occurs on the graph as a decrease in HM. Though this differs from the minim results, the decrease does coincide with the end of the phrase and the semitonal movement to F. The prolongation of F and registral transfer is supported by a decrease in DP – the same tone – but with different structural roles, one concludes whilst the other starts a new phrase – smaller numbers coincides with the soft dynamics and prepares for the development section. The 5-prg in the crotchet segmentation follows the phrase structure more closely, whilst the minim segmentation depicts the DP over a longer span. This 5-prg can be subdivided into two parts, in accordance to the phrase division:

Table 30. Bars 65–73, 5-prg motion.

5-prg				
C#	D#	E	F#	G#
8	5	3	8	5
x		x^1		

It is particularly interesting to note that x and x^1 contain similar rhythmic and thematic ideas, essentially a sequence and the intervallic movement is exactly the same. As x^1 does not progress to an A, the sequence is broken and another idea begins. The first three notes essentially depict the peak of the phrase and its approach to the end of it with smaller movement. The prolongation of Bb to B, like the minim segmentation – depicts a slight decrease in the HM and this in turn suggests a slight amount of relaxation to approach the start of a new idea (one that develops from earlier materials. And similarly, like the minim segmentation, the consonant skip from F to Bb is supported by an increase in DP – reinforcing the emphasis on the new tonal centre, Bb – the transition from one key area to the next. It is interesting to highlight the sharp movement in bars 56 to 63 than bars 64 to 73 – the development appears to be more stable.

There are two unaccounted significant movements in bars 56 to 63 (and one that is already accounted for).

1. -6 can be supported by Db and this will thus create a neighbouring movement to Eb. This highlights the core notes of the phrase and suggests that its surrounding notes are embellishments that are neglected in the initial middleground chart. This significant movement appears only towards the end of the segment, coinciding with the build-up to the development. Eb is thus added at the end of bar 62 to emphasise this linear progression.
2. With +9 and +7 in bars 64 and 69, a problem arises. Additional notes could be added to form a CS to its previous notes. They are added due to its metrical weight on the downbeat – however there is a problem – as it occurs in the middle of the phrase. Alternatively, it is more plausible to include the bass notes G and C in anticipation of the next note, extending the prolongation. So in this instance, additional notes for the MG chart enriches the *Bassbrechung* as opposed to the *Urlinie*.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis of the minim and crotchet segmentation reveals that the overall results are fairly similar to earlier sections, especially when considering that bars 56–63 is a reiteration of bars 41 to 48 and subsequently, bars 64 to 73 marks the beginning of the development. The median and mode are the same and the mean in the minim segmentation is smaller than the crotchet segmentation, which suggests that in the overall picture, there is more cohesion between the seemingly unrelated harmonies and reinforcing the notion that the crotchet segmentation will reveal more in-depth information. Upon splitting the two sections into its structural phrases, for bars 56 to 63, the minim segmentation results are fairly similar to its first appearance whereas the mean in bar 56 to 63 is bigger by 0.02. The median is exactly the same but the mode is different: 1,5 as opposed to 3. It is interesting to note that this is significantly different when the other two sets of data are the same. As for the crotchet segmentation, again bars 56 to 63 is bigger by 0.02, the median in bars 56 to 63 is smaller by

0.5 (suggesting less of a surprise in its reiteration) and the significantly smaller mode reinforces the above statement in brackets. The significant increase in the development in both minim and crotchet segmentations reinforces the notion that there is larger HM in the development section. The median and mode are the same, and in turn establishing a correlation between the two parts.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)
Within the minim section, the overall scope reveals that this section utilises more of smaller VL numbers, like 0,1,2 and slightly larger numbers such as 3 and 4 are used much less frequently. Further division of this reveals that bars 56 to 63 uses much smaller VL movement than bars 41 to 55 (which uses a 6). 0 is used more frequently than 1 – suggesting more coherence between each set of sounds than its first appearance. It is then interesting to examine the data in the development – smaller VL movement such as 0,1,2 are used more frequently than larger ones. But it must be noted that there are evidently gaps in a minim segmentation as it only accounts for the core chords, the main beat in each bar.

Much like the minim segmentation, smaller VL numbers are used from an overall view in the crotchet segmentation – 0,2 to 1 – and larger numbers like 4 and 5 are used more sparingly. Unlike bars 41 to 55, 0 and 2 are used more in bars 56 to 63 than a combination of 0,1,2. Larger movement are not as frequently used – much like its first appearance. CT and smaller numbers are used to reiterate the materials from bars 41 to 5. And similarly, much like the earlier statements, smaller VL numbers are used, suggesting the notion that the development, is where more exploration into different harmonic regions occur. This thereby suggests that a larger HM can consist of smaller VL movement and as well as the fact that this is the beginning of the section, much smaller movement is preferred.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 8 and 19–23)
When comparing the two segmentations, only 4 out of the 6 identified BIPs occur in the same area. There is a clear preference for smaller VL numbers in the minim segmentation as opposed to the crotchet one but the larger HM consists of a combination of smaller and larger numbers – reinforcing the notion that larger movement needs the support of smaller VL numbers in order to maintain some coherence or connection to the next chord.

Within the minim segmentation, bars 60 and 61 contain the same amount of movement (5) but they contain different BIPs. The second BIP however, can be perceived to be larger due to a larger VL number: [0122] to [023]. The consecutive appearance of such "larger" numbers coincide with the climax of the phrase, in preparation for the development. The largest BIP occurs towards the start of the development in bar 66, the first accent in the main melodic line. It is interesting to observe how these numbers become larger from the preceding bars. As shown in Table 31, one can see that there are common numbers, 0 and 4, in the outer layers and it is also interesting to observe how the inner numbers increase by 1 each time (L3) and +1 from HM 6 to 8.

Table 31. Bars 64–67, Harmonic Movement and Common VL Movement.

L4	4	4	4	2
L3	1	2	3	2
L2	0	0	1	2
L1	0	0	0	1
HM	5	6	8	7

Within the crotchet segmentation, the larger intervallic movement incorporated fewer common tones, 0 and more moderately sized numbers should first be highlighted. Furthermore, as shown in Table 32, the consecutive use of AVL8 in bar 64 and 65, occurs towards the end of the first phrase in the development. They all consist of different BIPs but as highlighted in blue and yellow, it is interesting to note that there are similar VL numbers like 0 and 3 in each of the BIPs.

Table 32. Bars 64–65 and AVL8.

HM8	5 3 0 0 0	3 2 2 1 0	4 3 1 0

The first appearance of 8 is supported by 3 CT and 2 "larger" numbers, which highlights the importance of common tone relationships between PCns as it holds the foundations together and allows other VL motion to occur. Though the first can be perceived to be arguably larger due to VL 5, the next BIP, [01223], contains fewer common tones, 0, but a smaller amount of movement. The next BIP can thus be perceived to be slightly larger due to VL4, but it also shares VL1 in common with the previous BIP. Though this "large" HM, 8, supports the intensity of the phrase – the same cannot be said about the last beat of bar 70 into 71, the reiteration of the idea as the HM decreases – 13 to 10 to 8. But as these numbers are much larger, the decrease could signify the end of one musical idea and progressing onto the next one. On the whole, it can be observed that the smaller HM occurs in bars 56 to 63 and larger ones in bars 63 to 63 – coinciding with the structural sections of the movement – where the development has more harmonic interest.

Bars 74 to 89

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 9)

Minim Segmentation

The 3-prg, B-C-D#, on the whole, expresses an overall increase in HM, coinciding with the build-up to the end of the semiquaver musical passage. Yet C is not supported by a DP as it falls on the second beat of the bar. It can be implied, however, that C contains more harmonic tension as it falls between DP 6 and 11. The overall increase also coincides with other musical parameters – dynamics and ascent in the melodic register. The consonant skip from D# to F# is also interesting as firstly, this note is not directly supported by a DP yet it coincides with a crucial moment in the music – the start of a series of repeated phrases. Although F# is not situated clearly on a DP, it falls between 8 and 7, suggesting that a similar amount of tension can be felt between the preceding idea and the current idea. In fact, upon closer examination, the contour of the rhythmic fragments is fairly similar and hence creating a closer tie to the relevant sections.

With the prolongation of F#, two of these notes are not supported by DP as they fall on the second beat of the bar. This raises the issue of the importance of metrical placement when doing a segmentation of the harmonic content, and that different segmentations need to correlate with any changes in the melodic materials. What needs to happen when the segmentation does not align with the melodic content? It seems unjust to force a note onto a particular area. Therefore, a quaver segmentation might be needed for moments like this, one possible solution to account for all these rhythmic displacements. Bars 82 to 89 can be perceived in two distinct phrases as shown in Table 33:

Table 33. Tracing the amount of HM between Bars 82–85 and 86–89.

Bar	82 – 85	86 – 89
AVL	7.5 – 9	2 – 5 – 5.5
Movement	1.5	3

Bars 86 to 89 essentially elongates the idea at bars 82 to 85 and as seen from the DP, a sharp decrease in HM divides these two segments. The sharp decrease can contain some structural significance as it is building up towards the climactic moment of the section – as seen by the steady increase in the DP from bars 86 to 89. However, it is also worth noting the similarity between the two sections – where the overall movement between the two moves from 1.5 to 3, an increase of 1.5 – suggesting that the overall movement within these two phrases, no matter how long or short is built up gradually. The highest point, 9, also coincides with the dynamic contour – *forte*.

There are four significant moments that are not accounted for in this section. With bar 90, it can be suggested that F# (in between bars 89 and 90) can be inserted. And with bar 77, once again, if the bar lines were taken out, C would fall on a strong beat, thus implying once more that metre can complicate the way we perceive the phrases. With bar 84, A from the inner voice can be added as this creates a consonant skip to A, reinforced by the score.

Crotchet Segmentation

Interestingly, the overall movement between DP is fairly similar to the results from the minim segmentation – where B to C is an increase and C to D# is supported by a slight decrease. However, the movement between C to D# is not as big as the minim segmentation. It moves overall from 4 to 6, 1 DP smaller than the minim segmentation. Instead, both segmentations suggest that the point of tension lies with C, and B and D are slightly more stable. This defies the dynamic contour as denoted in the music as it depicts a gradual increase in dynamics. Unlike the minim segmentation, the consonant skip from D# to F depicts a decrease. This could suggest that a decrease is necessary in the build-up to the climactic moment of the section – the start of a new musical fragment – phrasing off the end of the preceding idea and leading into a new one.

With the prolongation of F#, five key points can be made. Firstly, the movement between the first pair of F# is supported by a significant increase in HM, clearly dividing the two phrases, whereas the second contains more tension, aligning with the start of a much longer segment. Secondly, within the next movement, the repetition of the short fragment, bars 86 to 87, this contains a significant decrease. This is perhaps due to the fact that is much less of a surprise, the reiteration of familiar materials. Thirdly, by bar 88, the dynamic markings in the music is at *forte*, this is supported by a large increase from AVL3 to AVL8 in the graph. It appears that in this particular context, that an alternating motion between the phrases occur where one contains much more tension than the other. Fourthly, this pattern continues through to the last F# on the graph. Although this F# is on a higher register, it coincides with a lower DP. And on the whole, it is interesting to observe that the overall contour of the F# prolongation depicts a slight decrease in data points.

The same results are gathered in the minim segmentation as well. This therefore suggests several things: One, that the heightened tension occurs within the individual segmentations; two, that the possibility that the highest point occurred much earlier on in the phrase; and three, a decrease in the AVL to coincide with phrasing off/concluding the development section. There are ten significant movements that are unaccounted for in the middleground chart in this section: one, in bar 87, there is a -6 and F# can be added to the chart as this coincides with the end of the phrase, the second half of the beat; two, in bar 89, there is a -6 and Eb can be added as this represents a brief change in the pattern, and Eb can then act as a LN to F#; three, in bar 87, there is a +5, A can be added as this will create a consonant skip and this falls on beat 1 of the bar; four, in bar 86, there is a -6, and F# can be added as this coincides with the end of the phrase, the second half of the beat; five, in bar 83, there is a -7 and an F# can be added as well; six, in bar 83, there is a +5, A can be added as this creates a consonant skip, and it falls on a downbeat, beat 1 of the bar; seven, in bar 80, there is a -6 and A can be added as well; eight, in bar 79, there is a +5, F# can be added as this then creates an arpeggio and in turn emphasising the last appearance of the musical fragment; nine, in bar 78, there is a +5, C#/Db can be added as this connects to C in the 3-prg; and lastly, in bar 77, there is a -8, Eb can be added as this creates a consonant skip, a rhythmical emphasis. With bar 78, although this breaks the established pattern formed by the treble reduction, a C#/Db can be added to the MG graph as a form of link between B to D, suggesting a sense of tonal grounding in this “turbulent”/“unstable” region.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis of the minim and crotchet segmentation reveals a slight decrease in the data points from bars 74–81 and 82–89. This indicates that with the support of the musical score, that there are more harmonic movement, exploration to different PCns to the later bars, which consist of repetitions of the same harmonic materials and rhythmic ideas. It is interesting to compare bars 74–81 to its earlier appearance, bars 63–73. Whilst the results from the minim segmentation reveals similar results, the crotchet segmentation reveals an increase from 6 to 7.43. Furthermore, the median and mode are significantly larger, reinforcing the build-up in the harmonic intensity within the development section. Both minim and crotchet segmentations reveal that 6 is most frequently used, a slightly larger number, coinciding with the structural ideas of the music. On the whole, within the two sections, it is interesting to observe that the crotchet segmentation is always larger than the minim segmentation – reinforcing the fact that a crotchet segmentation has a closer relationship to the individual notes of the phrase and a minim segmentation plays a larger role in the overall phrase structure. The slightly smaller mean in both minim and crotchet segmentations in bars 82 to 89 suggests that there is more repetition and the harmonic materials suggest that the music is moving towards a slightly more stable musical moment, but the use of larger movements, 7 and 8 within the crotchet segmentation suggests that on a deeper level, musical tension is created within the inner VL movement.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)
In both minim and crotchet segmentations, 1 is used more frequently than other numbers and larger VL movements are used much less frequently. With the minim segmentation, as stated previously, 1 is most frequently used then followed by 0 and 2. Between the further two segmentations into different sections, there is not much difference in the results, larger VL numbers are slightly more apparent in the second segment. It is also apparent that the use of 0,1,2 occurs in almost every single HM, especially in conjunction with larger numbers. The most "profound"/significant HM in this section includes [134] as it only uses one smaller number in conjunction with two "larger" ones and it can be heard that it is a larger movement. With the crotchet segmentation, much like the minim one, there is a large presence of smaller VL numbers, 0 and 2 are almost on par within the two divided sections. 2 is the third most used as it involves the change of a tone. Interestingly, the use of VL5 is not used at all in the first segment and it appears twice in the other segments. Again, the support and combination with smaller VL numbers enables smooth transformation between each PCn. The use of 3 is also quite common in the crotchet segmentation, differing from the results gathered in the minim segmentation. This further reinforces the importance of carrying out a closer examination into chords/PCns.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 9 and 19–23)
It is immediately apparent when comparing the results from a minim to a crotchet segmentation that there are no shared BIP materials – though if the common tone factor were to be taken away, it may be possible to assess and uncover more similarities. It is also apparent that the crotchet segmentation contains far more occurrences of smaller VL numbers as the calculations are done on a smaller and more "detailed" scope. Within the minim segmentation, the largest HM in this passage occurs in bar 77, which is peculiar as it coincides with the middle of a sequence. In fact, this is the same with the second highest HM as well as at bar 85. Both of these individual BIPs include the use of 4 and 5 – slightly larger numbers to illustrate the movement to the next chord.

On a different scale, it is worth discussing the use of much smaller VL movement creating a smaller BIP in the second section – BIP [02] occurs in bar 84 and BIP [002] occurs in bar 87. Neither of these are supported by a particular key note but when relating this back to the music, these two points occur at the start and end of the phrase and it is the movement in the middle of this that is significantly larger. It almost suggests the notion of cohesion at the start and end – binding the ideas/movement together. In the crotchet segmentation, it can firstly be highlighted through Table 34 that [01123] appears three times in this section, twice at the start of the first division and once in the second division. This aligns with three phrases within the music, where there the HM increases by a semitone each time. It is also interesting to note that [01123] at the first segmentation coincides with the start of the motivic idea.

Table 34. AVL movement in bars 74–81.

Bars	74 – 76	76 – 78	79 – 81
AVL	7	15	7
BIP	[01123]	[023334]	[01123]

Table 35 presents the movement between each VL in the previously mentioned AVLs. It is interesting to note that the recurrence of HM8 with the same BIP has some structural significance in that it opens and concludes with the same intervallic movement. Interestingly, its later appearance at bar 88 coincides with the final statement of the motivic ideas from the preceding bars, almost like a declamation.

Table 35. VL movement between BIPs in bars 74–81.

BIP[01123]	BIP[023334]	BIP[01123]
3 2 1 1 0	4 3 3 3 2 0	3 2 1 1 0

There are several common denominators between 7-15-7 that are worth a closer examination. Firstly, the common tone that is used throughout holds a notion of stability, ensuring that there are notes in common between each transformation. The recurring use of 2 and 3 that is shared amongst these PCn movements suggests that smaller VL movement is perhaps far more efficient in building up the harmonic tension within the phrases.

Summary

From bars 56 to 89, there are once again more instances of examples that both contrast and align with the AVL and again, the minim segmentation has shown to be more useful in relating the overall shape of the phrases, whilst a note by note examination is more useful within the crotchet segmentation. It can also be seen that there are many unaccounted significant movements in this section as well, which led to further questions as to whether the melodic reduction is lacking detail or if the segmentation requires more depth. Furthermore, the statistical analysis revealed that there are larger HM in this section, which aligns with the developmental section, where there is more harmonic activity. What is particularly interesting in this section, is that the individual movement within the AVL, the VL movement, is an attributing factor to account for tension. There are more instances in this section where the increase of AVL aligns with the build-up to climactic moment, an example of this can be seen in bars 74-89, where build up to climactic moment of the section aligns with phrasing off, aligning closely with performative gestures. Similarly, there are more suggestions in this section that state in addition to the AVL, other secondary parameters are needed to support this analysis.

Bars 90 to 106

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 10)

Minim Segmentation

Much like the exposition, the arpeggio with the added 7th is supported by a decrease in HM, from 6 to 3. Despite the last note G, coinciding with the middle of the phrase, there is a sense of resolution upon its arrival, a bar before the conclusion of the phrase. Once again, Bb is initially unsupported by a DP as it falls on a weaker beat but as that particular DP follows on from a significant increase, a note has to be inserted an the most logical option is Bb as it drives to the next note of the arpeggio, D. On a more local scale, it is interesting to look at the way the very first phrase where the highest DP falls on Bb, followed by a decrease to D. This can correlate with the idea of tension and release – Bb holding the most tension and D as a point of relaxation resolving the first subphrase. Furthermore, the fact that F is also on the same DP can suggest that the same amount of "intensity" is established in the next bar.

Overall, the movement from G in bar 95 to A in bar 101 indicates a decrease in HM, suggesting that there is a sense of stability after the restatement of the main theme, coinciding with the decrescendo in the music and descent of the register. With the prolongation of A, it can be noted that the first two As are located on the same data point. As they are part of a sequence, essentially a repetition, they naturally contain the same amount of movement. The slight decrease on the last A coincides with the gradual build up in momentum, a decrease before the climactic moment of the section. The ascent to B is naturally supported by a significant increase of harmonic movement, correlating with the dynamics (marked *forte*), higher register and other musical parameters. It is also worth highlighting at this point that although bars 90–95 do not contain any notes in the middleground chart, there are no immediate significant movement that requires a specific note. However, as there is quite a jump from the previous graph on its last note to this one, a note that can be considered for the final middleground chart is F# as this will demonstrate the strong presence of F# as a prolongation during the final moment of the development section.

Crotchet Segmentation

Whilst the minim segmentation suggested that the AVL on Bb contains more tension than its neighbouring notes, the crotchet segmentation follows more closely to the contour of the phrase and privileges C as the stronger tone of the bar. However, much like the minim segmentation, the overall movement from G to G is supported by a decrease in the harmonic movement. It is interesting to note that D is the highest point of this phrase, perhaps indicating that D is not the true point of resolution in the phrase. There is in fact a strong pull to the next section, the next part of the phrase, suggesting that this graph correlates with the phrase structure. However, the sharp decrease from D to F suggests that a smaller harmonic movement correlates with the beginning of the next phrase, that there is more stability at the start of the phrase. Much like the minim segmentation, there is a decrease in the harmonic movement from F to G, indicating that the phrase is ending.

Much like the minim segmentation, the movement between the two phrases, bars 95 to 101, with G to A, this is supported by a decrease and it is particularly interesting to note that they both share the same amount of harmonic movement, moving from 6 to 3. With the prolongation of A, the first two As are once again on the same data point, 3, the exact same number as the minim segmentation. This is due to the fact that the melodic materials at this point in the music form a sequence and it would seem logical that they would share the same amount of harmonic movement if the harmonic contents are exactly the same. However, unlike the minim segmentation, the last A is also supported by the same data point, which thus suggests that perhaps all three points share the same note, in maintaining the same amount of harmonic tension, prior to the build up at bar 107. This then suggests a sense of stability throughout these few bars and despite the appearance of a crescendo at bar 105, the same amount of tension is continued from its previous bars.

Similarly, the movement from A to B is a significant increase, suggesting that there is a significant change in the harmony in relation to the G key centre. This can also suggest that a there is a large increase in musical tension as well and this coincides with other musical parameters such as dynamics, higher register and faster rhythms in the bass line. There are four moments of significant movement in this section: one, much like bars 1 to 16, a G can be added at the end of bar 100 as a way to prolong the tonic note, G (from bar 99); two, at the end of bar 97, D can be added to the final middleground chart, as this connects to the previous D identified on the first beat; three, at the start of bar 96, F can be considered for inclusion, although this does not occur in the opening bars, one can perceive more harmonic tension due to more layers within the chord. An additional G can then be added to the second half of bar 97, which sustains the inner voice movement thus creating a leading note movement from bar 95, G can then be prolonged into bars 99 and 100; and four, in bars 91-93, the following movement can be observed: -4, +7, -10, +9. As it was already evident that there is a lack of notes from bars 90 to 95, the significant movement uncovered reveals that additional notes can be added to support the prolonged F#. F# can be added in bars 91 and 93, the first of which occurs on a weaker beat but it is significant in driving it to G. And similarly, G can be added in bar 92, the first of which is on the first beat, and the other, Bb is an embellishment, yearning for F#. LN is therefore created from these new additions.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis reveals that, on the whole, the approach to the recapitulation is supported by smaller HM and this is echoed in both minim and crotchet segmentations. However, it would be far more fruitful to relate this data with the structure of the movement, where bar 95 marks the beginning of the recapitulation. It is firstly very interesting to observe the sharp contrast between the two sections in the crotchet segmentation as the numbers are significantly higher in the bars preceding the recapitulation – almost double the mean in the recap. This connects to the data in the previous section, strongly establishing the appearance of large HM in the development section. The mean and median of the crotchet segmentation for the recapitulation is also similar to bars 1–16, 3. However, the mode is significantly higher and it indicates perhaps that there are more harmonic variety in the recapitulation, differing from the opening bars. Whilst the crotchet segmentation indicates an increase in HM in the development, the minim segmentation indicates a decrease from the preceding sections. There is not much difference between the two divisions either. But it is evident that the recapitulation contains smaller movement than the development from the data. Again, the minim segmentation provides data from a broader perspective but it is evident that a crotchet segmentation will reveals more in-depth details.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)

Once again, across both minim and crotchet segmentations, it is evident that smaller VL numbers are privileged over larger ones. Numbers larger than 3 are used much less frequently as well. In the minim segmentation, numbers such as 2 and 3 are used more frequently than 0 and 1 in the last four bars of the development. When the recapitulation appears, smaller VL numbers can be seen with only one use of VL4 and 5. In fact, the two larger VL movement occurs only at the start of the recapitulation, almost depicting an element of surprise with the running bass line, different to the opening bars. In almost every single movement, one can observe the use of smaller VL numbers to support the movement

In the crotchet segmentation, it is immediately apparent that there is an overwhelming use of 0 particularly in the recapitulation, where many of these movements frequently contain more than one 0. Larger VL movements appear more so at the end of the development than the recapitulation. This can suggest that more stability is more apparent in the recapitulation due to the presence of common tones. With the exception of bar 107, all the BIPs contain 0s and as usual, the use of larger movements is supported by smaller VL movement. Bar 107 marks the beginning of a new section, more harmonic might therefore be involved.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 10 and 19–23)
There are two BIPs in common between the two segmentations but it is interesting to note that there could be more shared BIPs if for example, 0s are taken out of the equation. Although the minim segmentation produced a short sequence of repeated BIPs, it is interesting to observe that there is a sequence of repeated series of HM and BIP on a crotchet level.

Table 36. Bars 101–104, BIP[012].

Bar	101	102	103	104
BIP	[012]	[012]	[012]	[012]
	x		x^1	

In the minim segmentation, Table 36 presents the recurring use of [012] as one unique feature of this section. The appearance of [012] coincides with the repeated two bar fragments. The gradual decrease coincides with the notion of stability (sharp contrast with the opening bars).

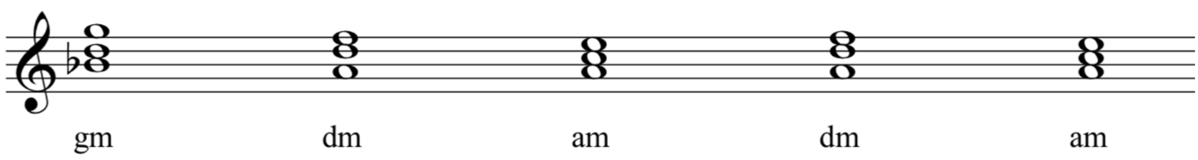
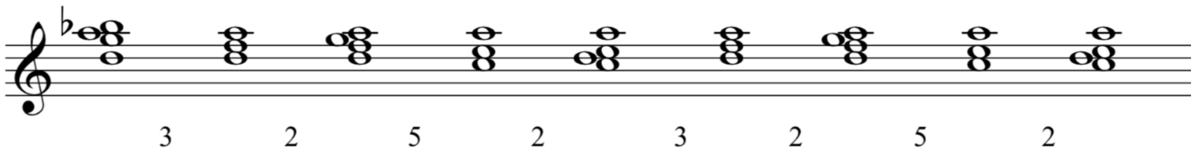


Figure 82. BIP[012] in Bars 101–105.

Figure 82 presents chords i-v-ii-v-ii in bars 101 – 105, with the movement of 3 between each chord. The chord V function along with the repeated BIP[012] can in this instance depicts a sense of incompleteness. Therefore, whilst there is stability with the repeated use of BIP[012], the back and forth motion from the dominant to the supertonic chord suggests some instability. The fact that one can label these chords with some tonal function implies that stability can be established with standard chord. Bars 97–106 can be described to be a more stable due to the presence of 0 that is shared among each of the harmonic transformations. In the crotchet segmentation, there are two interesting moments in this section that are worth closer examination. As pointed out in the minim segmentation, a repeated series of BIPs appears in the repeated musical ideas. In the crotchet segmentation, as shown in Table 37 and Figure 83, a series of different numbers appear twice in the melodic sequence.

Table 37. Bars 101–104 and AVLs 3-2-5-2.

Bar	101		102		103		104	
BIP	[0012]	[0002]	[0122]	[0002]	[0012]	[0002]	[0122]	[0002]
HM	3	2	5	2	3	2	5	2
	x				x^1			



	x	x^1

Figure 83. Bars 101–104, AVLs 3-2-5-2 and its respective chords.

From Table 38, it can be seen in the very same bars (101–104) that the increase from AVL2 to 5 is accomplished through smaller VL movement, thus the movement might not be as large as initially perceived, due to the presence of common tones between chords. The added fourths and seconds in Figure 83 are a key part of the key of the chord, rather than being perceived as extended harmonies. From an overall view, the decrease in HM does suggest a relatively stable region. Furthermore, the repeated chords that coincide with the sequence relates to the contour of the phrase – start as a low point – high point with high data points – end of the phrase with smaller data points

Table 38. Tracking the VL movement between AVL2 and AVL5.

2	2
0	2
0	1
0	0

Another interesting feature of this section is the repeated series of AVL3 as shown in Figure 84. This occurs between bars 103–106, in preparation for the build-up to the climax. Although a repeated series of the same harmonic movement can suggest stability, Table 39 presents the different BIP embedded within it and how the slight shift by a semitone, tone, and tone and a half builds the intensity.

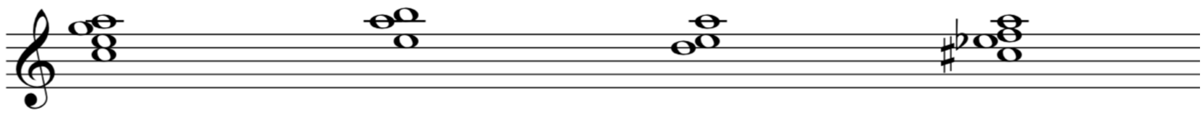


Figure 84. Bars 103–106 and its BIP.

Table 39. Bars 103–106, VL Movement and its Characteristics.

12	3	111
2 CT to the next point, 3	Larger movement	Less CT from previous point, 3
Creates tension within the inner VL		

Bars 107 to 116

VL Reduction to AVL Data (Refer to Volume 2: Appendix 1, Figure 11)

Minim Segmentation

The small prolongation of B from bars 107–109 is represented by a decrease from 8 to 2. This bears some structural significance, in that a decrease may be needed to close the phrase and as the largest amount of tension is already established at the start of bar 107. Additionally, in the arpeggio, 0 is not supported directly by a DP as it falls on a weaker beat of the bar.

The overall movement thus far depicts a decrease, correlating with the phrase structure, but it is the opposite of the melodic contour as the notes ascend in the register. Interestingly, the continuation of B to the next DP on bar 113 is the same, this could suggest that the same amount of tension can be felt across these bars, despite the change in melodic materials. From an overall scope, it is evident that from the high AVL at bar 107, more stability occurs in subsequent bars through the use of smaller numbers. The registral transfer between the two Bs is represented by an increase in DP, coinciding with the use of faster rhythm, driving the music towards the next key idea. It could even be suggested that in this particular instance, the increase in HM denotes more harmonic tension, containing unfamiliar and unexpected sonorities.

Again, it is not on a specific DP as B falls on a weaker beat of the bar. C in bar 117 is on DP 8, which is also actually the same DP as the first bar of this segment, bar 107, containing the large HM can denote some structural significance in this. It clearly divides up the two key areas, larger movement can also perhaps be linked to unrelated key areas from the tonic? Despite the *mp* sign, there is a large HM, indicating that dynamics may not necessarily have a direct correlation to harmonic tension. All significant movement in this segment is fully accounted for, generally the movement between chords incorporate smaller numbers, e.g. 0 to 3.

Crotchet Segmentation

Much like the minim segmentation, within the arpeggio, the initial movement from B to D is represented by a large decrease in DP. However, the movement to F# is represented by an increase in the DP from 2 to 5. This could suggest that F# is unstable and is not completely resolved, as this occurs within the antecedent phrase, it is in fact logical for the increase to occur. Whilst the minim segmentation suggests that the largest HM occurs mainly at the start and the phrase is "closed" or concluded by a decrease, further segmentation into crotchets have revealed an alternative reading to the phrase.

Table 40. Prolongation of B in Bars 106–113.

<table>
<tr><td>Bar</td><td colspan="2">106</td><td colspan="2">109</td><td colspan="2">113</td></tr>
<tr><td>HM</td><td colspan="2">9</td><td colspan="2">5</td><td colspan="2">7</td></tr>
<tr><td>Movement</td><td></td><td colspan="2">-4</td><td colspan="2">+2</td><td></td></tr>
</table>

With the prolongation of B as shown in Table 40, the biggest difference between the findings here and the minim segmentation is that bar 109 and 113 depicts an increase in HM. The increase coincides with the change in musical materials in driving the music to bar 117, containing different rhythm, with four consecutive quavers as opposed to a dotted quaver followed by five consecutive quavers. The increase also gives bar 113 more significance as its own individual phrase as opposed to be subsumed or tied together with bar 109. Each of the Bs identified in this are pivotal in the phrase structure, where they either occur at the start or end of the phrase.

The registral change from B to B is represented by a decrease, from 7 to 3, suggesting that the idea (consisting of four consecutive quavers) from bars 113 to 116 are more connected than initially realised, as they could in fact be considered as a sequence, the "extended" harmonies (created by the pattern of four consecutive quavers) descend in each bar and this is through stepwise and m3 motion. Incidentally, this also coincides with the descent in the register and a decrescendo, suggesting that there is more stability. The approach to C, like the minim segmentation, is represented by an increase. However, unlike the minim segmentation, the increase is just by 1 and it strongly suggests that the chord that precedes bar 117 is more closely related than initially realised. This further reinforces the earlier statement that the minim segmentation plays a role in articulating and defining the larger phrases, whilst the crotchet segmentation reveals more details on a local level. Additionally, there are three unaccounted movements: the first two that can be seen in bars 109 and 112, F# can be added, as they are metrically significant, they fall on the first beat of the bar, also prolongs the last note of the arpeggio and the third instance can be seen in bar 114, where A can be added, which gives the passage (with four consecutive quavers) more support. In turn, this creates a lower N movement between the two Bs.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis reveals that there is an overall decrease in the amount of HM. This may be due to the frequent appearance of common tones between each chord. However, within the minim segmentation, the median is larger than the opening bars (bars 95-106). The frequent use of 2 and 5, 5 in particular suggests that it is only at certain regions/bars that contains a larger amount of movement and there may be in fact more tension/instability than initially realised. However, the mode in the crotchet segmentation suggests that much smaller movement is involved in these bars – which is somewhat unexpected at the "climactic" moment of the section – yet, it reinforces the idea that "louder", more significant moments in the music need not be established through larger movements. In both segmentations, 2 is commonly used, which reinforces the use of such a smaller number in "climactic" moments. The results between the two segmentations are fairly similar, which is very unlike other sections that produced a sharp contrast in results. Therefore, this shows that the notes gathered must be fairly similar in the segmentations.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)

Much like previous sections, smaller VL movement is used much more frequently than larger numbers. The largest VL number was 5 in the minim segmentation and the smallest identified VL number was 4 for the crotchet segmentation. In the minim segmentation, it is interesting to observe the frequent use of 0 initially in the first 6 bars, tying up the phrase of bars 107–112 together. 1s are used in the last 4 sets of movements, denoting that more movement is involved in the lead up to bar 117. The use of 5, a larger number, is always supported by smaller numbers such as 0, 1, 2. It is also very noticeable that almost every change in HM all involved a change of VL2 – 2, which is essentially a tone, can be regarded as a “significant” number, a number large enough to change the colour of the chord. In the crotchet segmentation, almost every set of BIP includes the use of 0. Very little use of numbers larger than 3, 4 is used in conjunction with smaller numbers such as 0 and 1. The frequent use of smaller numbers follows on from previous sections, recap to contain more common tones and smaller movement than the development. 2 is used much lesser than 0 and 1 which is interesting, suggests the notion that the changes between chords rely on 1, more repeated harmonies may be involved.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 11 and 19–23)
When comparing the result between the minim and crotchet segmentation, there is one BIP in common between the two divisions and it is particularly interesting to note that only once do they align at the same “spot”/area – it occurs at the beginning, in bar 108. Another common trait that is shared between the two sections is that there is a large use of 0 and 1 in the VL movement in conjunction with other numerical values. In the minim segmentation, there is one particularly interesting feature that surrounds HM5. HM 5 is seen throughout these few bars and supported by the same BIP [122]. So whilst the notes as presented in the score may seem like they are completely unrelated chords, there is in fact a pattern between the movement from one set of sonorities to the next.

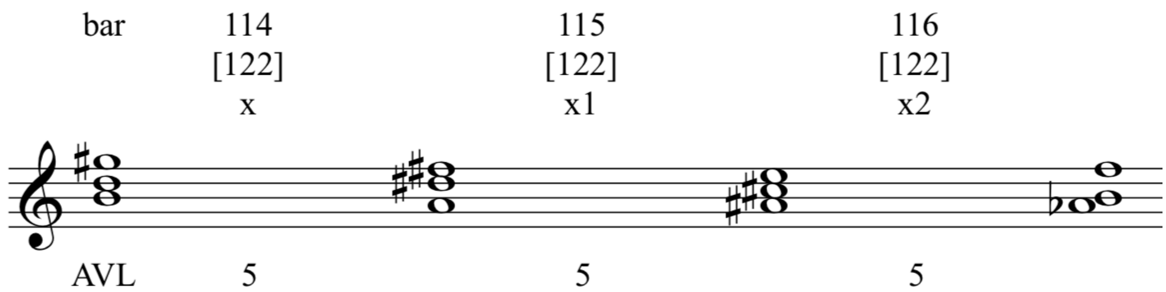


Figure 85. Bars 114–116 and its BIP.

From calculating the individual VL movement in each layer and ordering them from the smallest to biggest, this is particularly useful in shedding a new light to the analytical data – as it reveals the PCn movement’s similarities and its common traits. For instance, bars 114 to 116 are part of the melodic sequence and it can perhaps be regarded as “natural”, where it can perhaps be assumed that they will share the same intervallic content. Bar 113 does not share the same intervallic content – perhaps this is due to the fact that it is “missing” a note on the first beat. In general, it can be seen that 0s are used predominantly in the first half whilst more 1s are used in the later sections, which in turn could suggest a gradual build up in intensity.

In the crotchet segmentation, there are also several interesting features, as shown in Tables 41 and 42:

Tables 41 and 42. Observing the BIP and AVL relationship in bars 107–111.

Bar	107	108		109			110	111		112	
AVL	1	2	2	5	1		1	2	2	5	1
	[001]	[002]	[002]	[014]	[0001]		[001]	[0011]	[0002]	[0122]	[0001]

A B A B

BIP	2 0 0	1 1 0 0		2 0 0	2 0 0 0		4 1 0	2 2 1 0
Bar	108	111		108	111		108	111
Set	A			B			C	

Tables 41 and 42 present a repeated AVL pattern, 1-2-2-5-1, within an idea and its sequential material. The BIPs within this pattern as shown through Sets A, B and C, are similar and they share similar. For Set A, it can be argued that more tension occurs in bar 108 than bar 111 as VL 2 is used whilst bar 11 “splits”/divides 2 into two sets of 1s. And similarly, for set B, evidently there are more layers in the second group, bar 111 than bar 108, but it can be argued that bar 108 contains more tension as there is one less use of 0. Additionally, with set Cm bar 108 can be perceived as containing more tension due to the use of VL 4 whilst bar 111 breaks this down into two lots of VL2. Whilst one can observe the similarity between the two sets of HM and how they coincide with the antecedent and consequent phrases in the music, different BIPs are obtained within it.

Table 43. Recurring BIPs in Bars 114–117.

Bar	114		115		116		117
HM	7	3	6	3	7	3	4
BIP	[1114]	[0012]	[1113]	[0012]	[1114]	[0012]	[0112]
	x			***	x^1		

Table 43 presents the BIP contents for bars 114–117 and recurring feature can be seen through ideas x and x^1, where x presents 7-3-6 and x^1 presents 7-3-4. The BIP between the two groups, [0012] can perhaps be regarded as a tool to bridge the two phrases. AVL3 can be seen to contain the same BIP each time. From a metrical perspective, this passage can even be seen as groups of 2 beginning on the last quaver beat of each bar. The same BIP can be seen in most of the x groups, with the exception of HM 6 and 4, the latter contains smaller VL movement in Bar 117, thereby suggesting a sense of conclusion to the section or phrase.

Bars 117 to 129

<u>VL Reduction to AVL Data </u>(Refer to Volume 2: Appendix 1, Figure 12)

Minim Segmentation

The initial arpeggio, C-Eb-G is depicted by an overall decrease in HM from 8 to 0. It can be immediately noticed that once again Eb is not directly supported by a specific DP as it falls on the second half of a weak beat. The general decrease has a strong correlation to the notion of stability, particularly with the use of repeated chords, suggesting a moment of release and "calm before the storm" idea – setting up the key area. Three repeated AVL0s are then seen across the following bars but this is hugely contributed to the fact that they are all on the same chord. Further examination must take place especially within the crotchet segmentation in order to find out what happens exactly between each beat, as there are other HM occurring at the same time. With the 3-prg, a significant movement of +6 is represented in the graph with a G moving to F. Although this is different to the registral movement, an increase in the HM to a descending melody, the increase marks a change in the rhythmic material, illustrating that we are approaching the climax of the phrase. The fact that the next note of the 3-prg, Eb, is on the same DP indicates that both bars contain the same amount of harmonic tension, maintaining the intensity and the climactic moment of the section

There are also two sets of 3-prgs in this section, the first depicts a decrease from Eb to C and the second depicts an increase from Ab to C. With the first instance, Db is not directly represented on the graph as it falls on the weaker beat of the bar. The overall descent aligns with the descent of register as well, particularly in phrasing off the section, which in turn establishes the notion that there is more stability at the arrival of the end of the segmentation – with more common tones, perhaps the "true" conclusion to the section. And with the second instance, it can also be noted that Bb is not directly supported by a note either as it falls on the second beat of the bar. The overall contour of this from the AVL descends, contrasting the ascending melody. The two 3-prgs driving to C all appear to have one thing in common, more common tones and more stability to close the phrase.

The ascending 6-prg in bars 125–130 contains chromatic features but it can be highlighted that F# is not supported by a DP. Chromatic features do need to be included with this analysis, despite going beyond traditional Schenkerian principles, as they do play a fundamental role in the music to build up the intensity. This is reflected in the overall shape of the AVL as it increases from 5 to 9. Interestingly, there is a decrease from E to F, perhaps this is due to the fact that this section is based on the Dm triad and F is part of the chord, a temporary release of tension before driving to F#. As for the ascending 5-prg, which also contains chromatic features, although this is written in the soprano voice in the music, it is an inner voice in the Schenkerian graph. The overall contour moves from 5.5 to 5. Several notes are not directly supported by a DP. It can also be seen that the movement from F# to G decreases, perhaps this is because G can be perceived to be more stable (as it occurs on a tonic note and the leading note yearns to be resolved to the tonic). DPs are also smaller than the 6-prg which in turn suggests that it contains less tension.

Crotchet Segmentation

Unlike the minim graph, the DP for the arpeggios are all the same, on 4. This suggests that stability is established in that bar by maintaining the same amount of HM. This contrasts the melodic contour though as it ascends. Eb falls on the second half of the beat (the second quaver) and therefore is not accounted for. It can be argued that this reading is more accurate as it reflects the HM on a more detailed level. The prolongation of G is supported by data points, 4-5-3 and these numbers contrasts the results gathered in the minim graphs (which depicted all 0s). The slight increase and decrease of DP actually aligns with the contour of the phrase, the high data point of 5, with the arrival of the "climactic moment" of that phrase, bar 118 and the decrease coincides with the descrescendo and the end of the phrase.

With the 3-prg from G to Eb in bars 120–122, there is a slight increase in the DP, a build-up in intensity towards the end of the section. Interestingly, G and F are connected in maintaining the same amount of tension, perhaps even a sense of stability after the decrease beforehand. The increase to Eb coincides with more layers of music as it prepares to conclude the phrase. As for the other 3-prg, Eb to C, this is depicted by the same DP. The movement actually happens in Db where it increases slightly, suggesting Db as the point of tension, a static movement from Eb to C, perhaps, it is through other voices that will depict more varied movement.

As for the other 3-prg, Ab to C, in bars 122–124, this depicts a slight decrease from 5 to 4, aligning with the end of the phrase, a decrease to depict resolve, a release of tension, where the inner voice has a closer resemblance to the phrase contour. With the 6-prg chromatic ascent in bars 125–130, the results are fairly similar to the minim segmentation where it increases from D to D#-E and decreases to F just slightly, but F to F# contains the same amount of HM. This thus suggests that there is the same amount of tension occurring in this area, maintaining it before driving to the next section. This therefore presents a very different HM data in the inner 5-prg chromatic ascent as it "swings back and forth", ascending and descending in DP.

Table 44. Bars 125–129, decreases and increases between selected notes in the 5-prg.

	F		F#		G		Ab		A
increases		decreases		increases		decreases		decreases	

Table 44 presents the chromatic movement between F and A The two decreases towards the end denotes more stability in the inner voices whilst the soprano line increases significantly, that there is a need for at least one voice to be stable. With the first half of the ascent, it can be noted that the increase in DP coincides with the appearance of consonant notes, suggesting that it is vital at the moment for consonant notes to be emphasised. It is also interesting that the chromatic notes are represented by a decrease, perhaps the emphasis is more on the consonant tones in this section.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis of this section reveals that the mean between both minim and crotchet segmentations are fairly similar. The median in the crotchet segmentation is slightly smaller as well, with a difference of 0.5. The mode is the same in both minim and crotchet segmentation but the crotchet segmentation has two numbers, 5 as well as 3. The frequent appearance of HM 3 is interesting as it highlights the importance of having a balance between "smaller" and "larger" intervallic movement – perhaps a balance between stability and instability in the second thematic idea. Assuming now that a crotchet segmentation has more insights to share than a minim segmentation, the slightly larger mean suggests that there is more tension within the detailed segmentations. On the whole though, it is worth noting that the mean, median, mode is larger than the previous section, indicating an overall increase in the harmonic tension, more harmonic movement and intensity in the second idea.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)

Both minim and crotchet segmentations reveal a large use of 2 in this section, which is quite peculiar as other sections produced 0 or 1 as the most common VL number. Even a quick comparison to its Fm equivalent at bar 41 where 0 is more frequently used. The use of larger VL movement, ones bigger than 2 are less frequently used and once again, they are always used in conjunction with smaller intervals. However, the use of 5 can be seen in the crotchet segmentation and not so for the minim segmentation, this reinforces the notion that a more detailed segmentation will reveal more detailed results on the movement between each set of sounds. The frequent use of a tone can suggest the notion that there is more harmonic changes, out of the smaller VL numbers – 0, 1, 2 –, it is 2 that ultimately changes the colour of the chord. 1 is used more frequently than 0, reinforcing the earlier statement that more harmonic intensity can be seen here through smaller VL movement (consistent movement) 2 and 1s used in almost every transformation.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 1, Figures 12 and 19–23)

There are 5 BIPs shared between the minim and crotchet segmentations but only one BIP [112] occurs in line with the respective bar in both segmentations. 5, 6, 0 are clearly used more often in the minim segmentation, whilst 5, 4, 3 (a more consistent set of numbers) are used more in the crotchet segmentation. The large movement in numbers in the minim segmentation further reinforces the need to examine the crotchet segmentation in detail to obtain a more accurate representation of the harmonies.

Table 45. Bars 118–120, BIP and phrase tension.

Bar	118		119		120
BIP	[000]	→	[000]	→	[000]
	crescendo				*descresc.*
	Building up in intensity				release
	Phrase				

Table 45 presents the phrase intensity in bars 118–120. The consecutive use of 0s in these bars can be regarded as a little peculiar as if one listens to the section with closer attention, there are definitely more than one chord being used. As these chords are all the same, Cm, it suggests that with every change of harmony and when it moves back to Cm, that there is a sense of grounding and foundation to the overall contour of the phrase. So despite all these “turbulent”, significant movements that are not accounted for in a minim segmentation, they are held together by the Cm sonority.

Table 46. Bars 124–127, AVL increases.

Bar	124		125		126		127
BIP	[112]		[122]		[123]		[1124]
AVL	4		5		6		8
Mvt		+1		+1		+2	

With Table 46, the steady increase presented coincides with the notion of a transitional section, where more unexpected harmonies occur, faster rhythm and increase in the dynamics. The intensity of the section reaches the peak at bar 127, which is interesting, particularly as it does not appear in the last two bars of the section. When the BIP for these bars are placed sequentially in a vertical manner, the following can be observed as shown in Table 47:

Table 47. Bars 124–127, Shared VL Movement within BIPs.

				4
	2	2	3	2
	1	2	2	1
	1	1	1	1
Bar	124	125	126	127

As a result from identifying patterns within the VL movement in Table 47, the remaining numbers are: 1-2-3-4, thus creating a numerical sequence. 1 and 2s are shared in these 4 BIPs and this suggests that intensity can be built from a combination of smaller numbers. As for the crotchet segmentation, one feature in particular can be highlighted: the consecutive use of 3s, as shown in Table 48.

Table 48. Bars 119–121, VL Movement within AVL3.

	AVL3			
Bar	119	120		121
BIP	1	1		
	1	1	3	2
	1	1	0	1
	0	0	0	0

General observations can be made for bars 117–129. There are almost no repeated BIPs, but they all do share 0 in common. Interestingly, only the first two BIPs are the same, but incidentally, this coincides with the close of the phrase. AVL3 is accomplished through multiple uses of VL movement 1. With the movement to the consequent phrase, this contains the same AVL but the VL numbers are larger – 003 –, suggesting more significant change to introduce the next melodic idea. Therefore, so despite the same set of numbers, harmonic tension is established through the VL changes, [3] as opposed to [111]. The movement to bar 121 appears to be "more stable" in that there are smaller VL numbers used, but they can be argued as containing the same amount of tension as the individual VL movement. As shown in Table 49, the total still adds up to be the same, 0 to 1, +1 and 3 to 2, -1.

Table 49. Bars 120–121, VL movement.

Bar	120	VL MVT	121
BIP	3	-1	2
	0	+1	1

Bars 130 to 144

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 1, Figure 13)

Minim Segmentation

The arpeggio, containing a dominant 7th and coinciding with a prolongation of G is supported by a large decrease of HM, which in turn suggests that most of the tension occurs at the very start of the phrase. However, Bb, F and G are not directly supported by DPs as they do not fall on the first beat of the bar and considerations regarding metrical displacement were assessed as well. The decrease might not be as accurate as it only utilises the first/core beats of the bar. Furthermore, there is a pedal note across these few bars and that will no doubt be reflected in the VL calculations. The movement from G to F in bars 132–133 is also not supported directly on a DP. Both notes can be seen to be on the same DP, suggesting that there is some relationship between the two phrases, where the antecedent and consequent phrases are connected. The upper 3-prg, from F to D, in the subsequent bars is represented by a significant increase in DP from 2 to 6. The increase though, coincides with the closing of the phrase, which is interesting, as it suggests that it is not the true end of the phrase and in the larger picture, it wants to drive onto the next phrase, building on the intensity. The lower 3-prg also depicts an increase where the final tone is on the same DP, shared by both upper and lower prgs.

The prolongation of F from bars 136–139 does not fall on specific data points but it can be implied that it will contain the following DPs: 2-6-4. This prolongation is represented by an increase and decrease in the DPs. The movement on the whole correlates with the contour of the larger units of phrases. The first increase coincides with the repetition of a melodic figure, and as a result giving its second appearance more emphasis. The subsequent decrease coincides with the shift in register (which is slightly lower) and the start of the coda, but it is interesting to note that despite the repetition of earlier materials – perhaps this is due to the release of harmonic tension. Eb, within the descending 3-prg, from F to D, is not supported directly by a DP but it can be seen that there is an overall decrease, coinciding with the shape of the phrase, a descending melodic contour, decrescendo, release of tension. So on a "local" level, this phrase has a "closed" notion – which has been phrased off. This begins in a more intense manner then it decreases. The inner 3-prg, unlike its first appearance is represented by a decrease. Despite the same idea occurring twice, it follows the upper voice of the phrase more closely, mirroring its movement. The subsequent 3-prg, Bb to D, in bars 140–141, presents a different set of data again. Although some DP may not be entirely accurate, it generally suggests that they are static, maintaining the same amount of tension and therefore, Bb to D contains different roles each time. The overall movement from G to G, with the inclusion of a N note, indicates a slight decrease from the first to second G, where it moves from 9 to 8, larger numbers, but they are slightly smaller, particularly in the approach to the coda. The N note contains a slightly smaller note value, giving prominence to the core note, G.

Crotchet Segmentation

The arpeggio and the dominant 7th is represented by a decrease from the tonic to the 7th. However, there is an increase to approach the tonic. The increase to the tonic suggests that the phrase is not truly closed and it is driving to the next section. The highest point of tension occurs at the start of the phrase and the increase to G coincides with the dynamics, increase in volume, ascent to the highest note of the register. But like the minim segmentation, there is an overall decrease to approach the end of the phrase. The 3-prgs from F to D (bars 133–136) and Bb to D (bars 137–139) are different to the results gathered in the minim segmentation. Both upper and lower layers depict a decrease in the HM. This may suggest that D is not the true conclusion to the phrase and it actually drives it to the next phrase. In the inner voice, C and D in bars 134–135 are supported by the same DP, suggesting that the same amount of tension can be felt between the two notes. The prolongation of F is represented by a decrease in the DP, an initial decrease then a static movement. Unlike the minim segmentation, the reiteration of the musical figure is supported by a decrease in the HM, aligning with the decrescendo and the gradual closing of the phrase. The same HM to the next F suggests that there is a closer harmonic relationship to the phrase as it does start off with the same idea – which can suggest a close melodic relationship to the next phrase, except where it deviates to a more consistent quaver figure.

And again, unlike the minim movement, the upper and lower 3-prgs are represented by an overall increase in the HM. This thus suggests that the reiteration of the musical figure requires more emphasis. With the upper 3-prg, the initial decrease to Eb correlates to the notion of PN, with the core notes, F and D and the subsequent increase to D then aligns with the metrical placement, on the first beat of the bar. The increase in the inner voice, Bb to C, strongly suggests that tension is built up by the inner voices. Like the first 3-prg identified, the movement from Bb to D is represented by a decrease then an increase to D. The decrease aligns with the metrical placement of C but the same argument cannot be made with D, perhaps it can be argued though that the increase coincides with fewer voices, where the bass is eliminated. The overall movement from G to G across this section is generally supported by a larger decrease than the one identified in the minim segmentation. This suggests that there is more stability than initially realised with the approach to the coda. The smaller intervallic movement, with the neighbouring movement, F, further reinforces the tonic tones and that F is just an auxiliary note. There are five unaccounted significant movements in the chart: one, +4, G from the bass can be added, despite falling on the second half of the two-note quaver figure. This provides a clear end to the G tonality or even, reinforcing the tonal centre; two, Ab in bar 142 can be added at this point, as it creates a longer 3-prg from bar 140 to 145, tying the section together; three and four, C and D can be added in bar 143 and this in turn creates a 3-prg from bars 140–143; and five, an additional Bb at bar 144 can be added, which then creates a descending arpeggio of the tonic area, driving back to the tonic note, G.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis reveals in contrast to its previous section, the beginning of the second theme, that the HM is slightly smaller. However, they share the same median, 4. Interestingly, the minim segmentation produces a larger number than the crotchet segmentation. It can be assumed by now that a crotchet segmentation will contain a more detailed view of the HM, Therefore, these bars suggest that there is less harmonic tension dur to the smaller Mean. It is interesting to observe the mode where both segmentations share 3, but additionally, the minim segmentation contains the frequent use of 2 and 6, a smaller and larger number, aligning with the larger mean with the minim segmentation, As this segmentation was carried out with the core beats, it is natural that the gathered results will contrast significantly to its crotchet counterpart. Overall, in comparison to its first appearance back at bars 41 to 55, the numbers are much smaller, aligning with the structure of the movement in approaching the end of the movement. This can perhaps suggest that smaller movement has more associations with the notion of release and closure.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)
Both minim and crotchet segmentations reveal the frequent use of VL1 in these few bars. This is 1 smaller than its former section, again coinciding with the notion of smaller movement to approach the end of the piece. Both segmentations also utilised larger movement minimally and they are typically supported by smaller VL movement. The only exception to this can be seen towards the end in the crotchet segmentation where 0 jumps sharply to 4 as one layer of voice is present. More CTs are present in the crotchet segmentation as opposed to the minim segmentation which reveals that 0 and 2 are used almost as frequently as each other. 0s are perhaps more prevalent in the crotchet section as it analyses/examines the musical materials from a closer lens, in crotchets, a smaller segmentation than its minim counterpart. In both segmentations though, 0 and 1s are more obvious at the start of the section, and larger combination of VL numbers are used at the end, driving it to the next section.

<u>BIP Observations</u> (Refer to Volume 2: Appendix 1, Figures 13 and 19–23)
When comparing the data between the minim and crotchet segmentations, several observations can be noted. Firstly, it can be seen that 0s feature in the crotchet segmentation and none so for the minim segmentation. As shown in Table 50, BIP [011] aligns in both segments but [011] appears more frequently in the minim than crotchet segmentation ([012], [114], [123] do not align but there is only one shared occurrence, total 4 BIPs in common).

Table 50. Bars 131–134, AVL 2 and its BIP.

Bar 131		132		133		134
BIP	1 1		1 1		1 1	

	0		0		0	
HM	2		2		2	

In the minim segmentation, there is one particular BIP, [011], that occurs consecutively across two phrases, coinciding with antecedent and consequent ideas. The repeated same HM can therefore suggest a connection between the two phrases. Furthermore, this repeated idea, consisting of 0 and 2 ST suggests that the idea of harmonic tension, musical tension, can be established through smaller VL numbers and a larger movement is not necessary.

Table 51. Bars 140–145 and its ascending AVL.

b. 140		b. 141		b. 142		b. 143		b. 144		b. 145
BIP	3 1 0		3 2 0		3 3		5 2		5 3	
	5		5		6		7		8	

From Table 51, one can observe the steady increase in the HM, +1 each time to reach the coda. BIPs all evidently will contain different VL numbers and values but it can be noted that VL3 is a common factor in most of this numerical pattern. Significant movement occurs mainly towards the end of the pattern, bars 143 to 145, and containing VL numbers such as 3, 2, and 5. This section is really driven by VL3, which reinforces the notion that tension can be built up from repeated m3 intervals. As for the crotchet segmentation, several interesting observations can be noted.

Table 52. Bars 130–133 and its AVL.

b.130		b.131		b.132		b.133
BIP	3 0 0	2 1 0	0 0 0	1 1 0	2 0 0 0	3 2 1 0
AVL	3	3	0	2	2	6

From Table 52, firstly, it can be seen that a pair of repeated HM coincides with a specific rhythmic pattern. The decrease of 1 occurs within the antecedent phrase whilst it increases significantly to begin the consequent phrase. The highlighted HM coincides with the rhythmic figure (dotted quaver-semiquaver-crotchet), and the smaller number on its second appearance could suggest perhaps less emphasis. But this does not align with other musical parameters in the music, as there is a crescendo and the use of a higher register – which again reaffirms the notion that musical tension can be created via smaller VL numbers. The importance of CT can clearly be seen in these few bars, as it almost suggests the notion that it holds the music together, especially despite the appearance of chords that do not fit the implied tonal centre. It can also be highlighted that larger VL numbers are not used in this section. Additionally, there is a recurring use of [12] within a repeated musical figure as shown in Table 53.

Table 53. Recurring BIPs.

BIP	2 1	3 0 0	2 2 1 1	5 1 0 0	3 1 1 0
BIP	2 1	3 1	2 1	2 1 1 0	2 1 1 0

Table 54. Observing the difference in AVLs.

AVL	3	3	6	6	5
Difference	0	+1	-3	-2	-1
AVL	3	4	3	4	4

From Table 54, within the first row, more tension can be noted due to the appearance of VL5. But in the second row, it can be noted that there is the repeated use of [0112], and that smaller VL numbers are used. VL1 is shared across all HMs – a constant value. It is therefore evident that in this particular instance, the reiteration generally comprises smaller movement. Initially, there is an increase but perhaps this can be explained with a different set of harmonies.

Bars 145 to 156

<u>VL Reduction to AVL Data </u>(Refer to Volume 2: Appendix 1, Figure 14)

Minim Segmentation

The full arpeggio, spanning from G to G, is supported by a large decrease, from 8 to 1, contrasting the melodic contour of the passage where it increases in the register. Furthermore, it does not reflect the dynamics in the passage. The decrease suggests a sense of stability to begin the coda. The decrease is also attributed to the pedal tone that is present in these bars. The large number that begins this phrase can have structural implications as well – where a large, significant movement indicates the beginning of a new idea. With the prolongation of G, the following can be observed in Table 55:

Table 55. Bars 145–154, AVL Movement.

Bar	145	148	150	154
AVL	8	1	1	9

The overall increase in HM with G suggests that more tension can be felt in the lead up to the final note of the movement, the tonic note. The increase in AVL can also be explained through the shift in tonality, from major to minor. The decrease to 1 in the middle is particularly interesting to observe as well – it can suggest a sense of stability before the final moment in the piece. It also reinforces the idea that the presence of larger movement does not necessarily have to correlate with the climactic points of the phrase. It may be the case that a smaller HM in conjunction with a crescendo and an ascending contour/higher register range to build tension. The movement from Bb to B is depicted by a decrease in HM – coinciding with the change from a minor to major sonority. The decrease does not correlate with the chromatic ascent in the notes but it does show how diatonicism prevails in this passage and that chromatic tones contain a larger amount of tension than diatonic ones. However, the movement to A in bar 151 is supported by an increase from 1 to 5. This coincides with the climactic moment of the phrase, the build up towards the end, the arrival of the tonic. It increases again by +4 to reach the tonic, G, contrasting the surrounding musical parameters, where it contains a decrescendo and a descent of the melodic register. As seen in Table 56, the final arpeggio at the end decreases initially to reach D as a brief moment of release but then, it increases significantly to reach its tonic. As the treble reduction does not contain a linear progression to reach the conclusion, it can perhaps be argued that the increase aligns with the larger melodic movement. Therefore, in the bigger picture, the increase can have programmatic implications – where the first movement acts as an introduction to the sonata, leading into subsequent movements.

Table 56. Bars 150–154, AVL Movement.

Note	G	D	B	G
HM	1	0		9

Crotchet Segmentation

With the arpeggio, the first three notes coincide with the phrase contour – where G to Bb is represented with an increase, coinciding with the peak of the phrase and Bb to D with a decrease, coinciding with the end of the phrase. It can be seen that G and D are on the same DP, 3, indicating a close relationship between the start and end of the phrase. The subsequent increase to return back to the tonic notes, G, coincides with the highest note of the section, an increase of dynamics, reinforcing the consequent phrase of the final musical statement. The overall increase from G to G also correlates with the overarching contour – building up towards the climax of the phrase. It can also be seen that the movement from Bb to B natural is supported by an increase in HM, which coincides with the registral increase, an increase of tension, a shift in tonality. Also note that there is a slight increase in HM, coinciding with the climactic moment of the section. With the prolongation of G as shown in Table 57, the results differ from the minim segmentation:

Table 57. Bars 145–154, AVL Movement.

Bar	145	148	150	154
HM	3	7	4	11

The increase between bars 145–148 coincides with the build-up to the highest note of the phrase. The subsequent decrease between bars 148–150 is quite interesting, as it suggests that the second phrase, the reiteration of the melodic figure, contains less tension despite the dynamic markings. This could indicate that the harmonies are fairly similar, that there is more cohesion than initially realised. As for bars 150–154, the large increase coincides with the constant change in harmonies, with some unexpected tones, and there is no cadence or a sense of finality till the appearance of the tonic note. This could therefore suggest that the conclusion is only established through reiterating the tonic note.

On the whole, there is an increase in this section, much sharper than the minim segmentation, reinforcing the idea that the additional segmentation is crucial to identify the inner movements. As for the descent, a 3-cprg, Bb-B-A-G, this is supported by an overall increase of HM, aligning with the previous discussion on the AVL of the tonic prolongation. This may suggest that the 3-prg which actually occurs in the "inner" voice, may be more significant than initially realised. This aligns and supports the statement that unexpected sonorities occur right towards the end of the movement. With the descending arpeggio, this resulted in the following data:

Table 58. Bars 150–154 and AVL Movement.

Note	G	D	B	G
HM	4	4	4	11

It is immediately interesting to observe that the first three notes all contain the same HM, 4, before increasing significantly to the final note, G. All this may suggest that these three tones all contain the same amount of tension and the element of surprise only occurs at the end, maintaining a sense of stability before the final moment. There are also two unaccounted DPs in the graph, in bars 151–152. With bar 151, -5 can be supported by A, which prolongs the previously identified A, part of the 3-prg. And with bar 152, +5 can be supported by D, the first of the repeated dotted crotchet-quaver figure. The initial MG suggests that the second is more significant but evidently, from the HM, the first D has to be included in the final MG chart. This is then prolonged to the next identified D in the next bar.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 1, Figure 16)

A statistical analysis reveals that the movement concludes on a larger HM. This is particularly interesting as one would expect the numbers to be smaller, aligning with the release of musical tension. Perhaps this may suggest that the movement will move directly to the second movement, maintaining a higher amount of tension. The mean in the crotchet segmentation is larger than the minim segmentation, indicating that there is more movement on a local level. Both minim and crotchet segmentations share the same median, reinforcing the average number of HM, 5 from the mean. Interestingly, the mode in the minim segmentation indicates frequent use of 1 and 5, 2 very different numbers. So whilst there is more tension that is associated with 5, it is grounded by a smaller harmonic movement. The constant switching back and forth between tension and release also contributes to the higher amount of intensity in the coda – which suggests a sense of instability for the conclusion to the movement. The mode in the crotchet segmentation is slightly smaller, 4, but it is still larger than its previous section.

VL Movement (Refer to Volume 2: Appendix 1, Figure 18)

In the minim segmentation, what's immediately interesting from this is that VL5 is used as frequently as VL2, a smaller number, more than VL1. VL0 is used the most frequently, which aligns with the presence of CT in the bass line. The more frequent use of larger numbers also coincides with the unexpected harmonies, resulting with the increase in musical tension. But with the crotchet segmentation, an immediately striking observation is that VL0 is used with every HM, firmly establishing the use of CT in this last section. As a result, this gives the phrases/section a sense of grounding despite the overall large HM. VL1 is less frequently used here as larger movement clearly prevails in the last section of the piece. But these larger numbers are used in conjunction with smaller numbers, specifically, 0 – suggesting that that tension occurs within the VL as opposed to a general overview of the chord. On the whole, in both minim and crotchet segmentation, it is evident that 0 (the most likely note being G) is the common "factor" that links the musical materials together. They both contain larger VL movement and few occurrences of VL1.

BIP Local Observations (Refer to Volume 2: Appendix 1, Figures 14, 19–23)
When comparing minim and crotchet segmentations, it can be immediately seen that there are 3 BIPs in common, but they do not align on the table and do not occur at the same time. With the minim segmentation, as shown in Table 59, the following can be seen:

Table 59. Bars 148–151, Minim Segmentation, AVL Movement and Recurring Ideas.

Bar	148	149	150	151
HM	1	1	1	5
BIP	[001]	[001]	[001]	[023]
	x		x^1	

From Table 59, one can see that there is a repeated use of HM1 across the three bars consecutively. With the motive "x", only the last note is different in the melody and the bass line progresses on a different metre to the melody – treble: two bars; bass: three bars. The AVL clearly suggests that the second motive has more emphasis due to the larger AVL, 5. Based on the overall scope of things, the idea that VL1 is present only in the first 3 bars can suggest that all three of them contain the same amount of tension, that the first three BIPs are more stable and the fourth contains more tension. The two common tones that occur throughout the repetition of the two-bar figure only shifts by a semitone each time. This suggests that the same amount of tension is built up with the semitonal movement – minimal movement, the smallest possible of movement each time round.

Focussing on the same sequence, the crotchet segmentation resulted with the following data in Table 60:

Table 60. Bars 148–151, Crotchet Segmentation, AVL Movement and Recurring Ideas.

Bar	148		149		150		151	
HM	7	11	5	2	4	5	7	2
BIP	[025]	[0245]	[0023]	[002]	[013]	[0023]	[025]	[002]
	x				x^1			

From the above table, it can firstly be noted that both figures conclude on the same AVL and BIP. Secondly, both figures indicate that the phrases are "closed" through a general decrease of data points towards the end. The first phrase (x) decreases by 3 (AVL5 to 2), and the second (x^1) by 5 (AVL7 to 2), thus suggesting that the second phrase (x^1) is more significant in concluding the idea. It can also be seen that AVL7, 5 and 2 across both x and x^1 contain the same BIP, repeating the same VL movement each time. Thirdly, the continuous increase, AVL4-5-7, in x^1 can perhaps be attributed to A natural at the start of bar 151, which clearly affirms the change to a "major" mode. There is also an absence of a descending bassline as well. As demonstrated in Tables 61 and 62, the significant increase and decrease in the first instance may have a direct correlation to listeners' perceptions, as there is an element of surprise, a metrical displacement, with a crescendo involved as well. The boxes coloured indicate common VL movement between BIPs.

Table 61. Bars 148–149 and its BIP collections.

		5	-2	3		
5	-1	4		2		2
2		2		0		0
0		0		0		0

Table 62. Bars 150–151 and its BIP collections.

	3		
3	2	5	2
1	0	2	0
0	0	0	0

Summary

From bars 90 to the end, it can be noted that the appearance of the recapitulation aligns with the decrease in HM, and this can be especially in the minim segmentation. Bars 95–101in particular illustrate more instances of AVL aligning with the melodic reduction as well as secondary parameters such as dynamics and register. The statistical data also show an overall decrease in HM, marking the end of the section, which therefore aligns with preconceived notions of closure and ending to a movement/piece. Like preceding sections, there are more instances of shifts within VL movement as well as prolongation of notes that have links to building intensity. The presence of smaller VL movement is also used, much like other sections and there are instances where decreases in the AVL align with the end of the phrase as well (e.g. bars 122–124). Similarly, the consecutive use of certain BIPs suggest some links to a build-up in intensity, such as BIP [000] between bars 118–120. The final eleven bars also contain a large decrease in the minim segmentation, thereby strongly suggesting that minim segmentation is useful for examining larger spans.

BIP Global Observations

This section highlights recurring BIP and AVL features in both minim and crotchet segmentations within its formal structure.

<u>Minim Segmentation</u>

Exposition

The following BIPs have been noted to recur throughout the exposition:

- [0122] – used across each sub section, five times in total
- [0123] – used in bars 1-40
- [012] – used in all but bars 17-26

In particular, Table 63 presents the following characteristics of [0122]:

Table 63. BIP[0122].

[0122]	
Bar 9	• Middle of a phrase (small) • Repetition of a melodic figure • Occurs just before the climax
Bar 19	• Middle of a phrase (larger) • Driving towards the climactic moment of the phrase
Bar 39	• Occurs towards the end of the phrase • Climactic region • Marks the end of the idea/transition section
Bar 46	• Middle of the phrase • Driving to the end of the larger phrase • Sustains the dynamics
Bar 60	• Middle of a phrase (smaller) > larger • Climactic region • End of the section

It can also be noted that in the first theme, AVL5 appears the most frequently, where [0122] occurs four times in the exposition, once in the recapitulation and other variants of HM5 occurred six times across the rest of the movement.

Development

There are no common BIPs in the development but it can be observed that AVL4, 5 and 7 are used three out of four sections – one would naturally expect, predict more harmonic variety in development sections. The following appearances and generalised functions of AVL4, 5 and 7 are noted below:

AVL7 – in each instance, AVL7 is used as a vehicle to increase tension

- [1222] – bar 67
- [124] – bar 79
- [124] – bar 83

AVL4

- [0112] – bar 70
- [013] – bar 80
- [112] – bar 86
- [112] – bar 74
- [022] – bar 75

Table 64. Tracking VL movement in AVL4 and its varying BIPs.

[0112]	--------- -	[112]	--------- -	[022]	--------- -	[013]	--------- -	[112]
	-0		+1, -1		+1, -1		+1, -1	

From Table 64, it can be seen that despite the different BIP, there is a gradual progression, a build-up within the VL movement, but more notably, the gradual disappearance of 0, and more use of VL2.

AVL5 – there are two different functions here: one, where it is used to phrase off; and 2, where it reinforces the significance of the section.

- [0014] – bars 64 and 71
- [00113] – bar 68
- [0122] – bar 73
- [122] – bar 88 (start of phrase/transitional section)
- [14] – bar 92 (peak of climax)
- [23] – bar 94 (end of the phrase/section)

Table 65. Charting the VL Movement for AVL5.

	3							
4	1	4	2					
1	1	1	2	2	+2			
0	0	0	1	2	+2	4	-	3
0	0	0	0	1	0	1	+	2

				y

From Table 65, it can be noted that with fragment y, one can notice the gradual build-up in VL tension with the movement that occurs within the inner voices. This aligns with the structural idea in the music. With the largest VL number in each set, it can be noted that the number pivots back and forth between 4 and 3. This could have some relationship to the notion of tension and release through the pairing of numbers: tension (4,4) and release (1,3) (2,2).

Recapitulation

There are no common BIPS in the recapitulation but it can be noted that AVL5, 3, 2 and 4 are used in 3 out of 4 subsections. The various occurrences for AVL5 and its BIP are noted below:

- [0122] – bar 97
- [023] – bar 98
    - Same as Exposition. Same occurrence
    - Bar 97, 98 – start/end of a subphrase
        - Part of a larger picture, building up towards the climax
- [005] – bar 111
    - Bar 111 – occurs in the middle of a phrase
    - Bars 114-116 – driving towards next section, occurs in the middle of a phrase
- [1112] – bars 114, 115, 116
- [0113] – bar 129
- [023] – bar 123
- [1112] – bar 128
- [122] – bar 125
    - Bar 123 – occurs towards the end of the section
    - 125-128-129 – same section, not used consistently, once at the start and twice consecutively at the end – emphasises the HM

Coda

[023] was notably used in both sections, recapitulation and coda. AVL8 can also be highlighted here in through the following instances:

- [35] - bar 145

- [035] – bars 155-156
    - The additional 0 suggests a sense of cohesion in approaching the final moment of the movement.

Each of the above BIP was only used once across both sections.

Crotchet Segmentation

The most frequently used BIPs in the exposition are:

- [002] – it is however interesting to note that beyond the exposition, [002] also occurs at bars 41–55 and bars 56–63.
- [0012]
- [112]
- [023]

It is particularly interesting to observe that bars 17–26 do not share any common BIPs with its surrounding sections. However, one can observe the following variants in bars 17–26. From the table below, with the exception of [012], all the BIP in bars 17–26 contain more common tones, indicating that the PCn itself is much larger, but they are connected through the frequent use of CT.

Table 66. Bars 17–26 and its BIP.

BIP			Comments
[002]	->	[0002]	More presence of CT (+1)
[0012]	->	[012]	Less presence of CT (-1)
[112]	->	[0112]	More presence of CT (+1)
[023]	->	[00023] [0023]	More presence of CT (+1/+2)

It can perhaps be argued that because of the overall AVL3, [012] utilises less CT in order for the musical material to develop and allows larger intervallic content to be featured. The following observations can be seen for the BIP, [002].

Table 67. BIP[002] and its occurrences.

[002]	
Bar 2	• Middle of the phrase (start of the larger one) • First beat
Bar 11	• First beat • Start of the phrase
Bar 40	• Second beat

	• Last note of the phrase
Bar 44	• Second beat • Start of the phrase
Bar 45	• Second beat • Middle of the phrase
Bar 58	• Second beat • Start of the “local” phrase • End of the larger phrase
Bar 62	• First beat • Middle of the phrase

From Table 67, due to its smaller overall harmonic content, it can be stated that the common characteristic at each of these occurrences is that it provides a bridge, a form of transition, sense of grounding to the phrase’s gradual build-up to its peak. Likewise, with [023] as shown in Table 68, [023] tends to be used in the middle of the phrase and perhaps can be seen as a vehicle to stimulate tension.

Table 68. BIP[023] and its occurrences.

[023]	
Bars 14 and 15	• Start to middle of phrase (2x)
Bar 38	• (2x) middle of the phrase
Bar 50	• (2^{nd}) – every second bar, pattern
Bar 52	• (2^{nd})
Bar 54	• (2^{nd})
Bar 56	• Building towards the climax of the phrase
Bar 60	• (2x) middle of the phrase

Similarly, with [0012], all of its appearances coincide within the middle of the phrase, and this can be described as a tool to stimulate, build tension. Smaller intervallic content can be a useful tool, rather than using larger intervals. A shift of a semitone and tone can therefore contribute to its structural significance

- Bar 1 – 2^{nd} beat, middle of the phrase.
- Bar 2 – 2^{nd} beat, middle of the larger phrase
- Bar 29 – first beat, middle of the phrase
- Bar 47 – second beat, middle of the phrase, towards the end
- Bar 59 – first beat, middle of the larger phrase.

Another instance of recurring BIP is [112], where its occurrences always fall on the first beat, commencing a phrase:

- Bar 17 – start of a new section, first beat

- Bar 33 – first beat, start of a new phrase
- Bar 41 – start of a new section, first beat
- Bar 54 – first beat, start of a subphrase
- Bar 63 – first beat, end of the section, start of the development

As for the development, it can be noted that there are no common BIP in this section, and notably, smaller BIP can be seen in the first section, more often than the second half. And as for the recapitulation and coda, it can be noted that [003] was used in all sections except bars 107-116:

- Bar 137, beat 1 – start
- Bar 147, beat 2 – start
- Bar 130, beat 1 – start
- Bar 120, beat 2 – start to middle
- Bar 105, beat 2 – start to middle

BIP Local Observations

<u>Minim Segmentation</u>

The following observations can be noted:

- Both exposition and recapitulation utilise 0 frequently but it can be noted that with the next few numerical values that are used more frequently, the recapitulation utilises HM3 and 2, smaller numerical values than the exposition, which uses HM5.
- HM1 is used more frequently in the outer sections and none so n the recapitulation
- HM2 is used more in the recapitulation than the exposition – [002] and [0011] in common
- HM3 – exposition and recapitulation – [012] in common
- HM4 – mostly used in exposition, much fewer use in other sections
- HM5 – used 11 times in the exposition and 10 times in the recapitulation – with similar BIP content
- HM6 – most occurrence in the exposition, much fewer in the coda.
- HM7 – none so in the recapitulation
- HM8 – development to the end
- Overall – larger HM used mostly in the recapitulation and development but the largest HM occurs in the exposition – HM13

Crotchet Segmentations

Exposition and Recapitulation

Larger AVLs can be seen more in the exposition than the recapitulation, particularly with the following AVLs 3, 5, 4, 7, 6. The recapitulation contains AVL generally smaller than 10, as it reiterates earlier material, suggesting less "harmonic" surprises. Therefore, a relationship/similarity can be seen between the two sections, not just in its melodic and thematic materials, but in its harmonic contents too.

Other general comments include the following:

- AVL0 was used in Exposition, Recapitulation and Coda and none so for the Development – which is expected when relating back to our concept of sonata form.
- Larger AVL movement – AVL8 and 9 used more frequently in the exposition and development and less so for the recapitulation
- Gradual decrease in the use of HM6 (more so in the exposition and less so by the time we have reached the coda)
- Smaller movement – for instance, AVLs less than 3 used much more in A and A1 than development sections

Local to Global Views of the AVL

Minim Segmentation

The following tables, Tables 69–73 present which BIPs were used the most and least.

Table 69. Global Observations for Overall use of AVL.

Overall HM								
Most								Least
5	4,6	3	1,8	7	0	9	2,11	10,13
Used in 3 out of 4 subsections	Moderate to larger numbers for more emphasis					Less frequently used		

Table 70. Most and Least Use of AVL in the Exposition.

Exposition						
Most						Least
4	5	3,6	1,2	7	0	10,13
2 medium sized HM to start off the movement			Interesting, used less than HM3, larger values			Larger VL number – not used frequently

		used for more emphasis.			

Table 71. Most and Least Use of AVL in the Development.

Development				
Most				Least
5	4,6	7,8	1,3	2,9,11
	More frequent presence of larger HM			Larger VL number – not used frequently

Table 72. Most and Least Use of AVL in the Recapitulation.

Recapitulation					
Most					Least
5	2	3	6	0,4,8	9,11
	Used more than the exposition – less tension than the exposition perhaps?			Used more than exposition	

Table 73. Most and Least Use of AVL in the Coda.

Coda			
Most			Least
5	1,8	3,6,7	0,4,9
			Larger VL number – not used frequently

From the above tables, it can be seen that although there is no common BIP on a global level, there is a common BIP in the exposition. Any identified HM that recurs within the subsections play a structural role, heightening the musical tension, occurring in the middle of the phrase. At times, it can even be a feature of the section, opening and closing with the same HM. A deeper analysis into the VL movement in the HM reveals more details, where tension can be heightened via VL movement.

Table 74. Qualifying the AVL movement.

Harmonic Movement (AVL)	
0	"small" movement
1	
2	
3	
4	"medium"-sized movement
5	
6	
7	"large" movement
8	
9	

10	
. . .	

Crotchet Segmentation
Tables 75–79 presents the most to least used AVL across the movement in the crotchet segmentation:

Table 75. Global Observations for Overall use of AVL.

Most											Least
5	3	4	2	6	7	8	1	9	10,11	0,12	13,15,17
Small-medium sized numbers are preferred									Larger movement are less preferred		

Larger harmonic movement can be noted to be used much less frequently and smaller to medium-sized AVL is sufficient in most instances to build tension with the phrases, larger movement are used most likely when there is something, a significant moment of the phrase/idea/section that requires a strong emphasis.

Table 76. Most and Least Use of AVL in the Exposition.

Most									Least
5	2	4,6	3	7	8	0,9,11	1,10	12,17	13,15

It can be noted from Table 76 that larger HM are less preferred and medium sized ones to start the work, sets up a "sense of expectation" and perhaps turbulence/creating a tense start to the movement.

Table 77. Most and Least Use of AVL in the Development.

Most						Least
8	7	3,4,5,6	10,12	2,9	1	11,13,15

From Table 77, 8 can be seen to be the most used AVL as well as being one of the largest AVL values used in the section, coinciding with the overall structure. As this occurs in the development section, one would expect larger movement and more unexpected harmonies.

Table 78. Most and Least Use of AVL in the Recapitulation.

Most							Least
3,5	4	2	7	6	1	8	0,9

It is interesting to note that in the recapitulation that AVL3 is used as often as AVL5, coinciding with the reiteration of familiar materials, and less unexpected harmonies.

Table 79. Most and Least Use of AVL in the Coda.

Most				Least
3,4	5,7	6	2,9,11	0,1
Moderate to larger numbers preferred				Smaller numbers not preferred, contrasts our concept of "conclusion"

Like the recapitulation, AVL3 was used the most often. AVL4 is also used as often, which reinforces the notion of medium-sized numbers to conclude the movement.

BCxVL Data

Bars 1–16 (Refer to Volume 2: Appendix 1, Figure 24)

In this section, it can be noted that the repeated series of bc[2] in bars 13–15 coincides with the overall increase in the AVL from the crotchet segmentation. The increase in tension therefore can be attributed to the use of faster rhythm and increase in intervallic movement – driving towards the descent of the 3-prg. It can also be noted from this graph that there is a frequent use of bc[222] in lines 2 and 3, which are supported by AVLs 3, 4, and 6. Even in the only appearance at L1, this is supported by AVL3. There is also a consistent use of bc[2] in the opening 16 bars, and these can be categorised in groups of 2 or 3. This can be perceived as the driving force, propelling the music forwards. With bc[2] and bc[611], when observing the crotchet segmentation to the set of bc, it can be noted that in each occurrence, the AVL increases, establishing a consistent pattern. What is even more interesting is that with the first 5 appearances, the pattern of increase: +1, +1, +2, +3, +4 to bar 7, coincides with the end of the first phrase, thereby suggesting that rhythmic fragments can contribute to our understanding of phrase structure and has a role in heightening tension.

As for the use of larger rhythmic values, the appearance of longer durations such as 10 and 28 are generally supported by smaller AVL in the crotchet segmentation, invoking the idea that a minim segmentation plays a role in the bigger picture. It can also be noted that the use of bc[4] and the further segmentation of L3 from bar 13 onwards contains some structural significance, emphasising the identified PCn. Interestingly, bar 5 contains more rhythmic movement than the previous bars and this is supported by an increase in the AVL in both the minim and crotchet segmentations. Similarly, the build up towards bar 13 where there is more rhythmic movement in L1 and different rhythmic values in L2 – longer duration, bc[16] and bc[4] in L3 is supported by an overall increase in HM in both minim and crotchet segmentations.

Bars 17–26 (Refer to Volume 2: Appendix 1, Figure 25)
From this analysis, it can be seen that bc8 in L3 is generally supported by medium AVL number in both minim and crotchet segmentations and the arrival of bc16 is supported by a large AVL in the minim segmentation. With the HyM L3, with the grouping of 6 ½, the slight deviation in rhythmic activity from [62422] to a repeated [62] is supported by a much larger movement between harmonies in the minim segmentation and in the first two [62] figures in the crotchet segmentation. Interestingly, on the last [62], this is supported by the same amount of HM in the crotchet segmentation, maintaining the same level of tension before the climax of the section. The larger AVL here is supported by a larger bc, giving the rhythm slightly more emphasis, and the change in rhythmic activity where two lines contain the same quantity also coincides with the significant increase in AVL. With bc[222], it can be noted that this idea appears very frequently in these bars and it is particularly interesting to observe the correlation of the bc in L2 against the crotchet HM. The harmonic movement within each set of bc[222] is supported by an increase in crotchet segmentation, occurring 7 out of 9 times. In the other two instances, it is static but it is of what one can perceive to be a larger number. Bc[222] is therefore arguably the driving force, as it keeps the music moving and aids in the increase of tension. The overall hypermeasures, in L6, coincide with the shape of the treble line of the VL reduction, with its clear division of phrases, both rhythmically and melodically.

Bars 27–40 (Refer to Volume 2: Appendix 1, Figure 26)
Four key points can be stated from the bcxVL analysis. Firstly, with HyM L3 on bc1, the minim segmentation suggests an increase in tension (from 4 to 6) but the crotchet segmentation indicates a decrease. This can be due to other musical parameters such as dynamics, but as L2 of the bc is supported by a decrease in the melodic contour – moving by step – this could explain the decrease as well. Secondly, with HyM L3, on the grouping of 5 ½, same observations can be made here, where crotchet segmentation decreases and minim segmentation increases with the bc1 movement. In addition, the appearance of bc18 aligns with a larger AVL in the minim segmentation. But as it progresses, the AVL becomes smaller, perhaps coinciding with the "decay" of the sound. Thirdly, with HyM 4 ½ , it is interesting to note that these few bars only contain two layers of rhythm, yet they are

supported by larger AVL, bc1 to a crotchet segmentation depicts an overall increase, same with the minim segmentation from 4 to 5. Fourthly, observations can be made on the use of bc[1111], as shown in the table below:

Table 80. bc[1111] and its AVL Movement.

AVL	7		10		5		5		9		5
Mvt		+		-		0		+		-	
	heightening		Repetition of the same pattern		sustains		Increase in tension coinciding with the absence of L3, emphasising the last 4 bc1		resolution		

On the whole, there is a more frequent use of bc1 in this section, and the use of bc2 differs slightly in these bars, where it is used in conjunction with bc224 and bc226. However, despite these modifications, the use of bc2 does generally coincide with the increase in the crotchet harmonic movement, moving the music forwards and heightening the tension of the music. Though this cannot be stated the same for bc in L1, it is more apparent in L3, where the long series of bc2 begins on a crotchet AVL 4 and moves to 11. When it moves to 6, a much longer duration, this is supported by AVL 12, suggesting that the music has reached its the climactic point, and this coincides with other musical parameters too. With regards to the minim segmentation, this appears to contain more significance on a broader scale. For instance, the repeated bc2 passage in L3 correlates with an overall decrease in AVL, suggesting that the inner movement between each bc2 contains a gradual decrease. This ties in when one's listening of the music and how one would perceive the arch of the phrase. On the whole, this section presents a close correlation between the AVL and rhythmic data to one's perception of tension/release.

Bars 41–55 (Refer to Volume 2: Appendix 1, Figure 27)

With the hypermetric levels of this section, particularly at the higher levels, the chart reveals that this section consists of what we frequently perceive with archetypal progressions. We can see particularly with L2A that there is a clear division of phrases into what can be loosely coined as antecedent and consequent ideas. What is even more interesting is the mirror image between the two sections in L3: 7 ½ consists of a smaller group of 3 ½ and 4 and the other 7

½ consists of 4 and 3 ½ - there is symmetry in this instance, same number of bars on a wider scale with a mirror movement in L2A. Within L2A, it can be seen that there is an alternating pattern with the subdivision of phrases in L2 – more segmentations in phrases 1 and 3 (L2A) and longer ones in 2 and 4. From an overall view, HyM L3 is more closely related to the treble and bass reductions. There are some insistencies between L2A and the treble and bass reductions. In fact, the metric divisions suggest that the 4-prg occurs at the start as opposed to a 5-prg. There was more congruence towards the end of the section where the division of phrases aligned with the treble and bass reductions. Within the first grouping of HyM L3, it can be noted that bc[314] was supported with two different groups of AVL: AVL6 and 6 and AVL 3 and 3. Despite the presence of the same bc content, this is supported by different harmonic content, thereby suggesting that the first contains more of an element of surprise and harmonic tension than the second. With bc1, this aligns with the use of 4 consecutive bc1, which correlates with an increase in HM, reinforcing the idea that faster rhythm can denote larger HM. In general, it can also be noted that with bc4, the data is more closely aligned with crotchet segmentation than a minim segmentation. Within the second group from HyM L3, it can be observed that the repeated series of bc2 towards the end of the section coincides with the increase of the HM. However, in the last half of the section, where bc2 is used as a tool to stimulate musical tension, unlike the earlier bars, the HM from the crotchet level illustrates a consistent/repeated use of AVL5/6. Therefore, in this scenario, bc2 can be seen as way to maintain the momentum in the music.

Summary

From the first 55 bars, it is interesting to observe how rhythm was a key factor in supporting the AVL data and the VL reduction. In particular, there was an increase in AVLs in the crotchet segmentation. For example, recurring patterns such as bc[2] and bc[611] aligned with an increase of AVL. From these bars, it is clear that rhythmic fragments contribute to understanding of phrase structure. Hypermeasures can also be seen to coincide with the shape of VL reduction, resulting with clear division of phrases. Much like the preceding observations, there are again instances where AVL data contrasts the rhythmic data, which further suggests the notion of examining secondary parameters in future studies in order to get a more well-informed insight to the music. There is notably more rhythmic activity towards the end of bar 40, aligning with appearance of second theme. From the second theme onwards however, more correlations can be seen between the bc and VL data, and consecutive bc patterns seem to be aligned with either maintaining the momentum of the music or increase.

Bars 56–73 (Refer to Volume 2: Appendix 1, Figure 28)
Several interesting points can be raised in bars 56–73. Firstly, bc[314] can be seen to be supported by different data points when comparing this to the earlier section, bars 42–55. Although the numbers are different, it is evident that in both cases, the repetition is always supported by a decrease in harmonic movement: bars 56 – 73: AVL 8-8-2-3 and bars 42 – 55: 6-6-3-3. Secondly, it can also be seen that the series of bc4 at the start of this section – bars 56–73 – are all connected on a higher level by beginning and ending on the same AVL5. Thirdly, the pattern bc [10 2] that appears twice in this section correlates with a decrease in both minim and crotchet segmentations. In this context, the appearance of longer note values – bc10 – can suggest a decrease in the HM as there will be common tones shared across the change of chords It is however interesting to observe the correlation of larger rhythms e.g. 6,8,10 and its correspondence with larger intervallic movement within the crotchet segmentation. Fourthly, it can be seen that the HyM levels corresponds and is in congruence with the treble and bass reductions and the new additions made in the analytical chart assists this as well. Lastly, it can be seen that bc1 in this section is again associated with larger HM, and this is particularly evident in the crotchet segmentation. This suggests more harmonic tension is involved when a series of shorter rhythm appears.

Bars 74–89 (Refer to Volume 2: Appendix 1, Figure 29)
With this section, one can immediately observe that the lower hypermetric levels present a regular phrase structure, comprising 2.5 bars each. An interesting feature can be immediately seen in the beat class level, L2, where it presents [[10]44][844]. One can see that there is a movement from 4 to 8, and 7 to 9, portraying an increase in HM, which aligns with the bigger picture, where shortening the rhythm is used here as a tool to build tension. This therefore shows that the inner layers of rhythm can contribute to one's perception of tension. One can also observe that there is also a slight decrease with the following bc: 10 to 9, 10 to 7. Another interesting point can be seen in HyM L3, where the identified groupings do not align with the treble and bass reductions, especially at the start, where it does not align with the designated notes. HyM L2 however, does correlate with the treble and bass reductions at most points. One can also note that tension built in the opening bars of the section by the consistent use of bc2 and bc1, where the use of [111111] can be perceived to increase and

“accelerate” the tension and [222] as a way to keep the pulse steady and provides a sense of “grounding”.

Other interesting points can be made with selected bc and its correlation to HM. For instance, with the use of bc10 in bc L2, it can be seen this bc10 is supported by a decrease in the HM in the crotchet segmentation but an increase in the minim segmentation. This can suggest that in the broader scheme of things, the use of a longer rhythm increases the tension but a more detailed segmentation indicates otherwise, where the use of more common tones can equate to smaller AVL movement. This section also projects a gradual decrease in the use of bc2, that is overtaken by the use of bc1. With the use of bc4 in bc L2, it can be seen that bc4 is supported by an increase in HM both instances, which reinforces the importance of the note itself. Bc in L1 further reinforces this (and in L3), and the change from the previous bc1 pattern is reinforced by other musical parameters. It can also be noted that the appearance of bc2 after the series of bc1 is generally supported by a decrease in HM, so in this context, bc2 can be perceived to be more rhythmically “stable” than bc1. With the last HyM grouping, the rhythmic and harmonic contents can be seen to contribute in marking the beginning of a new section, as there is an increase in HM when bc1 is repeated across multiple lines. Therefore, the rhythmic repetition in this instance can suggest an increase in musical tension.

Summary

From bars 56, there were different uses of established bc patterns from the opening bars. For instance, bc[314] correlates with decreases in the AVL data instead. This section presents more instances where shorter rhythm can suggest more harmonic tension. It should be noted however, that this is context-dependent and other secondary parameters should be considered as well. Bc[2] can notably be seen as more stable than bc[1] especially in bars 74–89. Additionally, observations in this section also reveal that rhythmic repetition can have a strong correlation to an increase in musical tension, as seen through the AVL and VL data.

<u>Bars 90–106</u> (Refer to Volume 2: Appendix 1, Figure 30)

With the recapitulation, it can be firstly noted that the HyM L3 is exactly the same as the opening bars. There also tends to be a use of larger bc towards the end of the section. In addition, the use of bc4 is halved as this section progresses, where bc4 initially appears eight times in L2A but this appears only four times in L3. It is also interesting to highlight how bc[114] becomes bc[11114], where bc1 doubles upon its second appearance. In addition, it

can be noted that the HyM aligns with the treble and bass reductions, thereby suggesting that the rhythmic analysis correlates with melodic and harmonic analysis. One can also observe the repeated use of bc1 in the first half of the section, which coincides with the use of broadly speaking, larger HM. The appearance of bc[62] in the reprise, the first phrase in particular, is supported by a decrease in the HM. The HM increases in the next phrase, which coincidentally aligns with a change in rhythmic ideas. This is due to the presence of a longer duration, bc6, which may imply some common tones within the crotchet segmentation.
In the middle of the section, at start of bc[2222] in BC L3, it can be seen that in instances where bc2 is repeated across multiple voices, this correlates with an increase in HM. This therefore suggests that in this particular context, faster rhythm can denote more intensity. Another interesting point can be made with bc[62] as shown in Table 81, as if this is taken as the core rhythmic figure, the extensions identified (which are essentially multiples of 2) can be seen to be a variant or being originated from bc[62].

Table 81. bc[62] and its multiples.

<table>
<tr><th colspan="4">Bc[62]</th><th>Description</th></tr>
<tr><td colspan="3">6</td><td>2</td><td>Core</td></tr>
<tr><td colspan="2">4</td><td>2</td><td>2</td><td>Ext. 1</td></tr>
<tr><td>2</td><td>2</td><td>2</td><td>2</td><td>Ext. 2</td></tr>
<tr><td>11</td><td colspan="2">4</td><td>2</td><td>Ext. 3</td></tr>
</table>

Furthermore, it can be seen that at moments where all the bc are aligned and when they occur at the same time, this is supported by an increase in the HM. This can be seen especially in the crotchet segmentation. Towards the end of this section, it can also be noted that the longer duration, bc16, is supported by and also aligned with bc2 and 4. This is supported by an increase in the HM across both minim and crotchet segmentation, thereby suggesting that in this particular context, a fuller rhythmic texture correlates with an increase of HM, suggesting more more musical tension. Lastly, bc2 towards the end of this section plays an important role, as a vehicle to stimulate musical tension. Bc4 occurs on every second bc2, a subtle way to increase tension and providing an additional layer of rhythmic activity.

<u>Bars 107–116</u> (Refer to Volume 2: Appendix 1, Figure 31)
From this section, it can firstly be noted that HyM L3 aligns with the soprano and bass reductions, L2 reflects this mostly as well. Larger BC notably occurs within the inner layers as opposed to the lower levels. There is a frequent use of bc2, a key feature of L3, which then becomes more prominent in L1 and later on in the very same section, both lines double up on

bc2 at the same time. It is interesting to note that the longer durations in L2 can perhaps be seen as containing two functions: one, to provide some grounding to the rhythmic activity in L1 and to the “metrically displaced” bc4 in L2A; and two, it adds a different layer to the other two rhythmic lines, providing rhythmical variety. In the BC of L3, it can be noted that bc[2222] is supported by an increase in the AVL, in preparation for bc[6]. An interesting point can be made with BC[62], where it is consistently supported by a decrease in the crotchet segmentation (interestingly, the second number within the HM is always 1). The longer duration, 6, will no doubt contain common tones across the crotchet segmentation. But it can also be noted that subsequent HM after bc[2] is supported by an increase each time – smaller number could suggest more tension, due to more rhythmical activity and variation.

However, if bc[62] is taken as the core idea of the section, then the following statements can be made: one, bc[422] is an extension of bc[62] where the subdivision of 6 into 42 gives the set more rhythmical activity; and two, bc[2222] is simply another extension, dividing 6 into equal units. On a larger scale, it can be noted that the absence of L2 and 2A towards the end gives the bc2 further emphasis, which can therefore suggest that the overall scope indicates more intensity, where crotchet segmentation indicates more fluctuation. It is also interesting to note that at moments where all 4 bc layers align, there is an increase in the HM for both crotchet and minim segmentations. This can perhaps suggest that when there is alignment, the rhythmic elements are more coherent, resulting in an increase of HM. Bc2 can alsobe seen to be the driving force in this section – smallest rhythmic value but consecutive and long passages of bc2 contribute to the sense of urgency, propelling the music forwards
(right at the end of the section) The slight change of bc in L3 coincides with the increases in the minim and crotchet HM, as it has structural significance.

<u>Bars 117–129</u> (Refer to Volume 2: Appendix 1, Figure 32)
In this section, it can firstly be noted that in L3, bc4 initially appears as a group of 6 but this is halved (to 3) and then reduced further: from 6 to 3 to 2. It can also be seen that before the commencement of a series of bc, more specifically series of larger HM in both minim and crotchet segmentations, drives the music, to build the musical tension. HyM L3 in this section also aligns with the contents of the treble and bass reductions. An interesting instance can be seen with Bc[4446] in L1 to bc[6668] in L2 as the contents in the inner layer is diminished. The presence of shorter rhythm in this section correlates with the formal structure of the work, the second theme of the movement.

L2 of the HyM also correlates to the shorter/smaller progressions in the treble reduction, which in turn suggests that further segmentation can be done in the 6-prg, 5-prg sections. The gradual decrease in the use bc4 coincides with the gradual increase of the use of bc2 across multiple layers. In addition, bc[22] in L1 at the end of this section is supported by an increase, in both minim and crotchet segmentations, and this drives the music to the next section. Bc4 is also consistently supported by an "average"-sized number AVL, where the values between 3 to 5, within the crotchet segmentation. This only applies to instances where bc4 occurs consecutively. There is also notably more varied rhythmic activity towards the end of the section, which is supported generally by larger AVL. Bc[314] at the start of this section is supported by the same amount of AVL in both minim and crotchet segmentation. This in itself is interesting as there is more activity in the rhythmic parameter than harmony. Bc[314] is firmly supported by bc4 in both L2 and 3, that there is a strong emphasis and drive in the phrase, but it is not reflected in other musical parameters.

<u>Bars 130–144</u> (Refer to Volume 2: Appendix 1, Figure 33)
From this section, it can firstly be seen that the notes from L3 are in L1 towards the end, suggesting more of a melodic significance, as there is no presence of harmonic accompaniment. There is also a recurring use of bc2, alternating between bc2(5x) and bc (3x) in L3. In addition, there is more rhythmic activity towards the middle of the section, with recurring bc2 in L3 supported by moments of bc4 in L1 and 2. With bc4, bc4, bc 22, its two occurrences are supported by increases in the crotchet AVL, therefore moments when all three layers coincide are significant, as this is reflected in the harmony, treble and bass reductions, phrase markings and dynamics. Bc[314], within L1 in the first four [1] fragments, can be seen to be represented by a steady increase in crotchet AVL from 0,2 to 2, 6. Therefore, one can see an increase in tension across more than one musical parameter: rhythm and harmony and dynamics. Within bc [1] in L1, where it occurs in groups of 4, this can be seen to be generally supported by an increase in crotchet AVL, whilst the second set is an exception, where the AVL is the same. When correlating this to other musical features and where it occurs in the phrase, the same AVL with bc1 may represent a sense of stability.
An alternative reading to the phrase based on the rhythmic activity contains the following: L1 [22224] and L2 [22]. One can note that the use of bc2 is halved, bc[224] was then repeated in L2 before transforming again to become a shorter duration: bc[222]. Bc22 in this instance can be seen to be a regular set of bc whilst bc31 can be seen to be an irregular set. With Bc4 to

bc6, right at the end of the section, this was represented by a decrease in the crotchet AVL but the minim AVL indicates an overall increase, reinforced by bc[24], producing two different readings: one in the crotchet segmentation, this suggests phrasing off the current section; and two, in the minim segmentation, this builds up towards the final section of the movement. Lastly, as for the repeated series of bc2 in L1 towards end of section, this AVL fluctuated significantly, with a large range of AVLs in the crotchet segmentation but interestingly, the consistency of bc2 is supported by a steady increase in the minim AVL.

<u>Bars 145–156</u> (Refer to Volume 2: Appendix 1, Figure 34)
In this final segment, it can firstly be noted that the HyMs mostly, do not correlate with the treble and bass reductions, especially in L2 and 3. It is also interesting to note that bc[4] occurs in groups of 5 and the frequent appearance of the varied form of bc[62] as bc[422]. Bc[62] occurs most frequently in this section, and this runs throughout the section. Furthermore, the additional notes in the treble reduction are quite significant, as they align with the grouping of HyM L2. With bc[62], like the preceding sections, they are supported generally by a decrease in AVL. This was not the case in the first appearance, perhaps this is due to the first appearance of the inner rhythmic layer, L2. The appearance of larger bc such as [24] and [8] are supported by larger AVL from the minim segmentation. Interestingly, bc[4] is generally supported by decreases in the crotchet AVL, however, the last set increased, thereby suggesting that it has a different function. Bc[422] is also generally depicted by a decrease, where the last set depicts an increase but it coincides with the final phrase of the movement. The decrease can denote "stability", grounding the tension in other bc/VL. The increase can denote "instability", coinciding with repeated bc[62]. This perhaps also suggest that more than one factor has to be considered at the same time. Whilst on one level, bc[62] on its own produces varying data, but in conjunction with bc[4], the two layers create a sense of drive and tension towards the final moment of the piece. With bc[62], it can be noted that bc6 has been subdivided into 4 and 2. One can therefore state that bc [422] is a variant of bc[62] and forms part of the rhythmic features of this last section. On the whole, the enlargement of bc at the end of the piece coincides with the decrease of AVL in both minim and crotchet segmentations

Summary

With the final section, there are similarities to the opening bars, particularly in HyM 3. It can also be seen that there was a use of larger bc aligning the ending, closure of the movement. A recurring feature from these observations thus far is its performative implications. For instance, smaller bc alongside the AVL and VL data in this movement can suggest more tension which in turn can act as a prompt for the performer to bring out more of these rhythms. Interestingly, it is interesting to note that with the opening of the recapitulation, whenever there is alignment, the rhythmic elements were more prominent and can result with an increase of AVL. Bars 130–144 also present more instances where increases in the AVL aligns with recurring rhythmic patterns and this was also reflected in the phrase marking and dynamics. On the whole, with the first movement from Hindemith's Piano Sonata No. 2there are more instances where the AVL and VL data aligns with bc data and this information can assist the performer in better shaping the phrases.

Concluding Remarks

The analysis of this movement, through carrying out a VL Reduction, VL labour, bcxVL analyses as well as gathering observations on the frequency of certain AVL and BIP, has shown that extending current theoretical methods have yielded more results, in showing more clarity to understand post-tonal harmonies, and in particular, works that embody both tonal and post-tonal harmonies. In this movement, it can be observed that there is a strong correlation can be made between the harmonic data against the melodic voice-leading reduction, the fluctuation in the AVL has a direct link to one's perception of tension and release as well as filling in the middleground VL graph. The BIP observations as well as the statistical data play a bigger role in shedding light on the correlation of these data against the structural and formal organisation of the piece. Ultimately, the application of the hybrid theoretical approach to the first movement of Hindemith's Second Piano Sonata has revealed the close interrelationship between VL labour to establish closure in phrase functions and to assist in identifying moments of tension and release within the music.

Chapter 4

Case Study 2
Stravinsky, Concerto for Piano and Wind Instruments, First Movement

Much like Chapter 3, the analytical findings of the second case study – the first movement of Stravinsky's *Concerto for Piano and Wind Instruments* – are presented in this chapter.[270] The presentation of these analytical charts, graphs and the following discussion are segmented into the piece's smaller phrases and key sections according to its formal sonata structure. The rhythmic segmentations for this movement are carried out in crotchets as well as quavers and semiquavers, which correlates with the natural downbeats of the music. The segmentation and calculation process can be seen in Volume 2: Appendix 2, Figures 35–41.

The first movement's overall formal scheme can be broadly described in the following manner:

Table 82. Formal Structure for the First Movement of *Concerto for Piano and Wind Instruments*.

	Intro			Exposition					Development			Recapitulation					Cadenza				Coda
Total bars	32			83					61			82					51				14
Bar	1-14	15-28	29-32	33-43	44-63	64-86	87-109	110-115	116-141	142-171	172-177	178-188	189-208	209-231	232-252	253-260	261-282	283-299	300-308	309-312	313-327
No. of Bars	14	14	4	11	20	23	23	6	26	30	6	11	20	23	21	8	22	17	9	4	14
Idea				A	A^{1}	B	C	Trans.	B^{1}	C^{1}	Trans.	A	A^{1}	B	C	Trans.					
Key	Am	Cm	Am	Am	Bm	C-D	Bm	E?	Am	C#-Em-Gm	E	Am	Bm	C-D	Bm		Dm	Am	Bm		Am-A

As such, the data will be presented in a similar manner to the formal structure and much like Chapter 3, this will be carried out under the following categories: VL reduction to AVL data; Statistical analysis – Mean, median, mode, and Voice-leading (VL) movement; and BCxVL data. The BIP local and global observations will then be presented to conclude this chapter.

[270] It can be noted that this work by Stravinsky has been the focal point of a study by Donald G. Traut, in his text, *Stravinsky's "Great Passacaglia" – Recurring Elements in the Concerto for Piano and Wind Instruments*. Traut's monograph focusses on identifying the "Recurring Elements" (Res) across the movements, analysing the compositional elements (linking these to Baroque gestures) and uncovering the work's deepest structural levels (Donald G. Traut, *Stravinsky's "Great Passacaglia": Recurring Elements in the Concerto for Piano and Wind Instruments* (Rochester: University of Rochester Press, 2016))

As with Chapter 3, this chapter should be read in conjunction with Volume 2: Appendix 2, where it provides the relevant analytical charts. Unlike the previous chapter the bcxVL analysis are presented in different groups of segmentations that do not always align with the formal structure, due to the practicalities of designing the charts.

Bars 1 to 33

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figure 42)
With the first neighbouring movement, bars 1–4, in the AVL for the very first phrase, 1-6-6, G# evidently is on a much larger number, as it is on an unresolved tone, in turn providing a sense of tension, yearning to reach the home note, A. Interestingly, the return to A is supported by the same AVL on G#, 6. This could indicate that A, whilst from a melodic standpoint, suggests that it is complete, the bigger picture of this clearly demonstrates that it is propelling onto the next phrase, that the first phrase marks the beginning, pre-empting subsequent ideas. The step movement from A to B is on the same data points(DP), maintaining a sense of continuity between the antecedent to its consequent phrase. The movement from B to Ab increases again from 6 to 7, coinciding with the middle of the phrase, much longer in length than the first phrase. With the 3-prg, Ab-Bb-C, 7-4-2, one can evidently note the gradual decrease that coincides with the end of the 2nd phrase, suggesting more stability. In fact, C has a dual role – it concludes the end of the phrase and the start of the next one, suggesting that this new phrase begins on a more stable area and pre-empts the C minor tonality in bar 15.

With the transitional phrase, C-B-C, supported by the numerical values of 2-7-2, one can observe the lower neighbouring movement, B, as the point of tension, which wants to return to C, and situated on the weaker beat of the bar. Curiously, bar 15 marks the start of a new tonality, a reiteration of the opening figure that is also on 2, a smaller number and much like the opening, which begins on 1. This then creates a relationship between the A minor and C minor sections: an increase of just 1 can indicate that the C minor section has slightly more tension and reinforces the new key change. With the overarching shape, A-B-C, supported by 1-6-2, each of these points mark the start of a new idea. B being the PN, not part of the A minor chord, and this will resonate as being dissonant, hence resulting in a larger HM content.

Significant movement in this particular *Concerto* include numbers equal to or larger than 4. As such, six instances of significant movement are identified in the first 15 bars: one, in bar 2: +4 is accounted for with G#, which is a lower neighbouring note to A. The increase coincides with "unresolved", unstable note – heightening the sense of tension; two, in bar 7, +4, accounted for with Ab – progression to the development of the initial idea. This correlates with the frequent change in chromatic harmonies[271]; three, in bar 9, there is a -4 and +5 and in bar 12-13, there is a +6 and -7. -7 is accounted for, at the start of a new phrase, the rest are unaccounted. A closer examination reveals that there are two different 3-prg embedded in that section – the identified ascending 3-prg and another, descent to F. -4 is supported by G, PN to F, perhaps the decrease in this context phrases off the short figure – subsequent increase foreshadows the large leap in the melodic line, F is not the point of resolution, but it leads into the next phrase – F has a dual function in this case. Interestingly, +6 in bar 12 can be supported by another F, in turn, creating a prolongation to the F identified in bar 9.[272]

Much like the opening figure, C-B-C is supported by an increase in the VL movement created by the motion to the lower neighbouring tone and with the same HM on its resolution to C – this indicates a strong relationship to the opening bars – not only are they similar melodically and rhythmically, but also in their rhythmic contents. The only slight difference is that C begins on AVL2 not 1, 1 DP higher than the start, correlating with the change in tonality. The subsequent B in the same bar is supported by a decrease, aligning with the end of the phrase and B has two functions: as a way to phrase off; and to sustain the tone to the next bar as it falls to Bb, the start of the new phrase. This B is prolonged for the phrase and supported by an increase from 3 to 6, aligning with the build-up to the climactic moment of the section. Naturally, the first note of the next section, bar 22 with D, is supported with AVL8, confirming the earlier statement that we have reached the peak of the phrase. The lower neighbouring movement in the next phrase, D-C sharp-D, supported by the AVL values of 8-7-4 denotes that the gradual decrease in the AVL values can perhaps represent a temporary release of tension, phrasing off the first climactic moment.

[271] It can be seen that so far, the two increases play a pivotal role in stimulating the tension of the phrase, suggesting a sense of incompleteness.
[272] This can be seen as an an excellent example of how these significant movements can help in enriching the MG chart.

Bars 25 to 27 contain a 4-prg, D-C-B-A, supported by AVL values 4-5-7-7. This is interesting to observe as despite the descending contour, it is supported by an increase in data points. This thus suggests that there is multiple build up moments and it is most likely the case that this particular increase has an important role in driving the music back to its original statement in bar 29. The subsequent prolongation and leading note movement is supported by AVL 7-2-3. The decrease in this context, to G sharp, although it is an unstable tone, does support the closing of the phrase. Then the slight increase to 3 for A creates an emphasis on the note itself, reaffirming that A minor tonality. An interesting overall point from the different key areas is that there is a subtle increase each time as shown in Table 83.

Table 83. Charting overall AVL movement in bars 1–33.

Am	Cm	Am
1	2	3

This can potentially suggest that there is an increase in tension through the defined key areas. Additionally, the larger projection consisting of the 3-prg, C-B-A, spanning bars 13 to 29 contains AVL values 2-7-3, supporting the notion that B, the passing note, can be associated with a larger amount of tension as it can arguably be seen as "unstable" and yearns to be resolved back to A.

Table 84. AVL Movement for A-G#-A.

AVL	3	6	3	4	8
Notes	A	G sharp	G sharp	A	A

From Table 84, we can observe that these identified notes form a neighbouring phrase, with AVL values of 3-6-4. G sharp with the higher data point suggests that the passing note is unstable and holds a higher amount of tension. The return to A is on a value higher than its first presence, which suggests that it is unfinished, that it is continuing to its next idea. The decrease from 6 to 3 within the prolonged G sharp is interesting as the melodic contour actually increases. This clearly indicates that registral shift does not have a direct correlation to harmonic tension. The decrease coincides with the end of the phrase, a gradual approach to its closure. In the bigger picture, the As are generally supported by an increase from AVL 3-4-8. Therefore, despite the same note, the harmonic contents suggest that even though we have reached the end of the introduction, there is an increase in the tension an anticipation of the A materials, building the momentum to the next section.

There are eight instances of significant movement in this section: one, in bar 15, there is a decrease of 5, which is accounted for and represented by C, marking the start of a new sub section and gives more emphasis to the arrival of C minor; two, in bar 16, there is an increase of 4 which is accounted for and represented by B, the leading note to C, and reinforces the notion that B is a point of tension in this context and needs to be resolved to its tonic; three, in bar 20, there is an increase of 4 that is unaccounted for (whereby its movement was not represented by a note from a VL analysis), but this point of the phrase is important, it is the last note of the subphrase but should the note be denoted as G sharp or Ab? If G sharp is added to the chart, this creates a consonant skip to the outer Bs, but if this is respelled as Ab, this would create instead a chromatic neighbouring movement. G sharp may be the best candidate for inclusion in the middleground chart; four and five, in bars 22 and 23, there is a decrease and increase of 5 that is unaccounted for in the charts. E and D respectively can be considered for inclusion for the middleground. This would then create two neighbouring movements within the phrase, one lower neighbouring movement and an upper neighbouring movement embedded within it. The significant decrease on the passing note, E, reaffirms its metrical placement, on the weaker beat of the bar and that its principal notes, D are more important and has a higher amount of tension – working within the inner voice – where both Ds are on the first beat of the bar; six, in bar 30, there is an increase of 4 which is accounted for with G sharp, the leading note to A, the increase supports the peak of the phrase, G sharp being the unresolved note and yearning to return to A; seven, in bar 31, there is a decrease of 5 which is unaccounted for and the most likely note that can be considered for inclusion is G sharp, which prolongs the entire bar and sustained by a minim. Alternatively, E may be another substitute but this is less likely as it is within the inner voice and establishing a step progression with it is a more appropriate reading.
8. In bar 33, there is an increase of 4, which is accounted for with A, marking clearly the start of a new section, building up the tension of the phrase.

On the whole, four out of eight instances of significant movement are unaccounted for and when pinpointing these in the music, we can observe that they are of certain significance to the phrase structure, whether melodically or harmonically which therefore prompts for us to consider adding notes create a detailed middleground chart. We can also note from Table 85 that AVL 7 was repeated four times in a consecutive manner between bars 26 and 27, with the following BIP values.

Table 85. AVL 7 in Bars 26 and 27.

Bar	26		27	
	4 3 0	5 1 1	6 1 0	6 1 0

The first BIP in bar 26 [034] appears to have a larger change due to the VL movement of 3 and 4. The other VL movement in this set all contains at least two smaller VL movement vslurdto support the larger individual VL movement. On the whole, when placing these values back to its musical context, we can observe that they fall within the middle of a descending step progression. As AVL7 can be considered to be a larger value, it can be argued that it sustains the amount of tension in that particular phrase.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

A relatively moderate AVL number opens the movement, neither large or small. The mean is slightly towards a larger number, 5, but considering the shift in tonality from A to C to A, a larger number is more appropriate to account for the changes in the harmony. 3 is used more frequently than 4 – this indicates the importance of smaller harmonic movement as opposed to a larger one to create movement within the phrases.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

As anticipated, larger VL movements are used much less frequently than smaller ones, 0, 1, 2 used the most in the opening bars. It is interesting to point out that 1 is used almost as often as 0, therefore suggesting the importance of minimal movement, combination of both common tone and a movement of a semitone is vital in changing the colour of the chord and maintaining a sense of stability at the same time – common tone retains the same note, providing a sense of grounding, similarity – movements are therefore done by a semitone.

BIP Local Observations (Refer to Volume 2: Appendix 2, Figures 42 and 57–59)

This section is divided into its two main thematic materials, bars 1 to 15 and 15 to 33. In the first section, bars 1 to 15, HM 6 and 3 are used the most frequently. This could potentially suggest that there is a variety of movement rotating between a smaller and larger intervallic movement. Next most frequent use of HM value is 4 – but again, a number that is neither large nor small. But in all cases, the BIP is comprised of a combination of smaller numbers such as 0 and 1. The only exception to this is the presence of BIP6, as this is unsupported by any other minimal movement but this occurs at the second phrase of the section – in turn suggesting a renewed emphasis, sharper and more defined change to the start of the new phrase – that it is more significant. All the BIP in this segment is used just once, with the exception of [0012] and [012] (which are of a similar structure) – used twice. [0022] is also used twice, contains two CT, in common with [0012]. In bars 15 to 33, more variety can be seen here in comparison to the introduction. There are some BIPs that are in common with the introduction. BIPs that appear twice are of a smaller HM, e.g. 2 or 3. Again, with all the BIPs, there is an emphasis on retaining CT and ST, a combination of 0 and 1 alongside larger VL movement. All BIPs contain at least a small number like 0, 1. It is however interesting to point out that there is more use of large HM than smaller ones. HM of 5 to 8 are used 4 to 5 times – perhaps the larger movement has a role in setting up a sense of instability? – turmoil, tension, setting the scene. When comparing the two segments, there are eight BIPs in common and in both cases, HM 3 is used the most often. The following BIPs are used in both sections: [01]; [0012]; [012]; [0022]; [05]; [0222]; [1122]. On the whole, some general comments can be made on this section: one, that the introduction comprises larger harmonic contents than the following sections; two, as the rest of the data is similar, the introduction could be perceived to be slightly more unstable due to the larger harmonic content; three, the use of larger VL occurred more frequently in the A section than in the introduction and four; both the introduction and A emphasise the use of VL0, 1, 2.

Bars 33 to 63

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figure 43)

The prolongation of A decreases from AVL8 to 2 in the first phrase, the largest amount of tension is implied at the start of the phrase and the decrease coincides with the end of the phrase, for the music to reach a point of stability. There is a consonant skip from A to D in bars 33–34, supported by a descent, which strongly suggests that bar 34 is the beginning of the phrase. Similarly, the subsequent unfolding on D (to A) depicts a decrease in data points, mirroring the descending melodic contour, suggesting that the music has reached the end of its statement.

The short prolongation of A between the first and second subphrase is supported by the same data point. A subtle representation that there is a sense of continuity. The smaller AVL suggests a sense of stability to the close of the former phrase and to the start of the new phrase. Within the soprano voice, from A to D, in bars 38–39, these two notes are supported by the same data point. So despite the ascending melodic contour and change of rhythm (shorter patterns), the harmonic data suggests that the unfolding contains the same AVL value, denoting the same amount of tension, maintaining the momentum. However, within this, there is an unfolding in the inner voice where D descends to G# and interestingly, this is supported by an increase from 1 to 2. This could therefore suggest that the increase in momentum between that phrase to the next is driven by the inner voice as opposed to the upper voice. The 3-prg, D to B, supported by AVLs 2-7-5, aligns with preconceived notions of a typical step progression. As C is a passing note and it occurs at the peak of the phrase, this naturally contains a large amount of tension. The larger AVL on B suggests that it is anticipating the next phrase, not a resting point, perhaps more emphasis on the note. Bars 43–44 contain a prolongation as well as a LN movement. Overall, it decreases in its AVL, aligning with the end of the section. The sharp decrease in the N movement reinforces this. It is also interesting to note that A# is not supported by a specific DP, thus suggesting that further segmentation might be needed. However, the slight increase between bars 43 to 44 with its local Bs reinforces the first beat of the bar, the opening of A^1 and shows how there is a sense of drive to bar 44.

In the A^1 section, within the LN movement, the core notes contain the same amount of data points – A#, the PN is on 0 – so in this context, as the presence of Bs is a lot more frequent, A# is an auxiliary note that simply embellishes the passage. The overall increase in AVL from B to C suggests and reinforces the notion that these few short bars act as a transitionary passage to the main idea. Overall, the prolongation of C from bars 47–55, is represented by a decrease in data points, suggesting that there is a sense of stability established in the opening phrase, the decrease almost suggests that there will be an increase subsequently for the following material, in anticipation of the shorter rhythms. Within this, the consonant skip from C to A initially suggests that the start of the phrase (A) begins on a point of stability. Interestingly, this is followed by another decrease as A moves to C, this defies our expectation that there should be an increase in the AVL as the music is building up towards the semiquaver passage, but perhaps the sense of tonality is needed to be established first.

The overarching 3-prg, B-A-G, supported with AVLs, 3-6-4, correlates to the preconceived notion of a step progression where A being the PN contains a higher amount of tension (although it can be said that there can be two differing views here). Overall, it moves from 3 to 4, presenting a slight increase but it contributes to the climactic moment at bar 59. The beginning of the decrescendo passage at bar 55 is marked by an increase of data points, which provides a strong emphasis on the beat. Subsequently, the stepwise descent is supported by a decrease, aligning with the melodic contour. The movement from E to G, an ascent (as represented directly by the orchestra) is supported by an increase, representing the huge shifts in harmonic material, the chromaticised harmonies. G to D is also supported by an increase in data points, aligning with the constant shift in harmonies, faster rhythm (semiquavers), more tension and fuller instrumentation. Subsequently, the decrease from D to G (the start of the next phrase) simply indicates a release in tension, after the rhythmic and harmonic activity in the preceding idea. There are two instances of significant movement in the A section. The first can be seen in bar 39, this was accounted for D, the start of the consequent phrase, alongside the secondary theme, -4. Perhaps this was due to the large transformational shifts in the first phrase. With the second instance however, the first beat of bar 39 was unaccounted for. D would be a reasonable addition to the phrase. But this would mean that the unfolding will finish on the first beat as opposed to the second. This is interesting, as despite the thematic material beginning on the second beat, the large increase in the harmonic data suggests that the first beat is equally as important. The first beat D will then be connected to the second D.

There are seven instances of significant movement that were not correlated with a note in the line graph from the A^1 section. Firstly, in bar 45, -6 was not accounted for. B should perhaps be considered for inclusion for the middleground graph and this is an important point in the music, it marks the start of the accented passages and can also be connected to previous Bs. Second, there are two significant movements in bar 47. +4 was accounted for but not for -6. C should perhaps be added as this will take into account the registral shift in the orchestral section and highlights its entry and the exit of the piano. Thirdly, in bar 48, the subsequent significant increase in the next bar is unaccounted for. C could perhaps be added as it supports the identified C in the previous bar, creating a connection, the highest point of the subphrase. Fourthly, in bar 54, as there is a significant decrease, -4, which was not correlated with any note; B could be added to the middleground chart. In turn, this actually creates a step progression from A to C, which is effective as it creates a linear progression. The last two instances of significant movement occur in bars 62 and 63, -4 and +4, the second of which was accounted for. With the first, there are two options, G# would be a suitable option as it would then create a consonant skip to D, the D in the piano, the highest note played in this section can be heard more prominently and this will in fact create a connection to the already identified D on the next beat.

On the whole, from looking at the overall section, bars 33–63, it is interesting to observe the descent in the harmonic tension with each entry of a phrase, the largest of which at the start of A and by the time B enters, it is on a smaller data point. Although a note was not identified at the end of A^1, it can be seen that A^1 starts and ends on the same data point, an overall increase of 1 from the previous phrase. It does generally defy our expectations that A^1 should contain larger AVL as it extends A but it is perhaps within the local movement that truly depicts how the notion of tension and release can be felt. So far, a crotchet segmentation has been very effective in identifying moments of tension and release but perhaps with certain phrases, a quaver or even a semiquaver segmentation would be far more effective, especially with the large chordal motion in the piano part. The appearances of 0 and smaller BIPs do raise questions – do they necessarily signify stability? What does it do specifically – is it context-based?

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

An initial view of the statistical data revealed that the data points are slightly smaller than the data obtained in the introduction (applicable for both A and A1 sections). But a closer view of A indicates that the data results are slightly smaller than A1 and this is perhaps due to the fact that A is only 10 bars long but it actually reveals that A1 extends the thematic figure (through its harmonic contents, with more variety of harmonic colour). Both A and A1 are still within the mean of 3 range, with A1 being slightly larger. Both median and mode are one notch larger than A, supporting the identified larger mean of A1. In the overall picture, the fact that this section is slightly smaller than the intro suggests that the introduction can be perceived to be more unstable and contains a higher amount of tension. The A section can be seen to be more stable, where it establishes the A minor tonality and the main melodic motives.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

As anticipated, smaller VL movement is much more preferred – particularly where 0 is used most frequently, followed by VL1 and 2. Interestingly, voice leading movement larger than 3, from 4 to 6, are mostly used in A1 and the use of 6 in A. As A1 is an extension or development of A, the use of such larger numbers is to be expected, to change the harmonic colours. However, it is worth noting that almost all the movement includes the use of 0. This clearly reinforces the notion that the retainment of smaller numbers such as 0 and 1 are critical in establishing a relationship between chords/PCns that bear no similarities or relationship in conventional terms. A sectional analysis, examining this section in smaller segments, reinforces the large use of smaller voice-leading movement and highlights the presence of 6 in A, the only VL value that is considered substantially "larger", while the use of such larger VL movement, 4 and 5, only occurred in A1.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 2, Figures 43 and 57–59)
There are three sets of BIP that are in common in this section: [000], [002] and [0022]

1. The repeated [000] at bars 45-46 is particularly effective in sustaining the momentum as it occurs at the start of the new section. A1 provides a sense of stability after an unstable end to A. A1 in this respect acts as a form of continuity, where it flows on from A and these few bars can be perceived as a transition to the actual melodic figure at bar 50.
2. Repeated [0024] in bars 51-52 – this is a large BIP but the presence of such a large HM suggests that even though some voices have finished off their respective phrases, the canon-like quality of this passage, where the bass line is still stating the figure, pushes the music along to the next bar. As such, this HM maintains the high amount of tension. Interestingly, this large movement is accomplished through two common tomes, a tone and a M3 [0024]. This reaffirms the notion of how within the large HM that are generally perceived as unstable, the CT helps in the transition and on a very local scale, contributes to a sense of stability within the transformation.
3. Bars 56 and 58 can be argued to be fairly similar. Bars 55 – 58 consists of a rhythmic sequence, with two different identified patterns, which denotes an overall increase by 1, a gradual build up in tension.

Similar comments can be made in bars 55 and 57, with the AVL 4, 5, 1 and 2, with BIPs [13], [23] [001] and [0002]. The first appearance of the pattern (bars 55 and 56) can be argued to be more significant as it produces a larger AVL in total, 9. It can also be argued that the harmonic movement mirrors the contour of the phrase, in how the phrase is differentiated each time – a sequence – but with different weight of tension

In the A section, there is a frequent appearance of [002] where it appears five times.

1. [002] first appears in bar 34 in the middle of the phrase
2. [002] next appears in bars 37 and 38, twice, in the middle of the phrase, driving it towards the next section.
3. [002] then appears in bar 39 between the beginning and middle of the phrase
4. [002] then appears at the end of the phrase in bar 43 and also acts as a transition to A^1.

Overall, it can be seen that [002] occurs within the two-quavered pattern and this BIP appears to provide a sense of stability as the phase proceeds to its highest point. The fact is that this BIP always reoccurs on the two-quavered pattern, the "core" beats that provide a constant pulse to the section.

In the A^1 section, bars 44–63, there is a frequent appearance of [012], appearing five times.

1. [012] first appears in bar 46, and there are two ways of looking at it: Firstly, occurring at the end of the phrase and secondly, the lower voices with the two-quavers provides a sense of continuity.
2. [012] then appears in bar 54, as part of a four-semiquavered figure and the start of the driving two-quavered pattern in the orchestra, in the middle of the phrase
3. [012] then occurs in bars 60 and 61, twice in a row, during the climactic moment of the section.
4. [012] occurs in bar 63 at the end of the phrase, but also anticipates the consequent phrase.

These two instances of recurring BIPs, [002] and [012], so far play a structural role in building momentum, sustaining the sense of tension within the phrase, in providing a sense of continuity.

In the A^1 section, there is a frequent use of [000]. This only occurs in the first five bars of the section, almost setting up the expectations of the section, perhaps alluding to a false sense of expectation, a sense of stability, repeated use of specific harmonies.

Bars 64 to 86

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figures 44

The 3-prg, G-F-E, in bars 64–66 is supported by an increase and decrease in data points, reinforcing the preconceived notion that F, the PN, is not part of the chord, and contains a higher sense of tension. The last note of the 3-prg, E, is on a data point higher than the first note, G, this thus suggests that this 3-prg is part of a bigger picture, that more is yet to come. It is already evident that there is something missing, on the second part of the bar, a significant movement that is not accounted for.

With the 4-prg, this was represented with AVLs 4-4-3-0 and slurred movement from E to D. The gradual decrease aligns with the connected notes E to D as it rounds off the phrase, providing a sense of conclusion to the phrase. Similarly, the same can be stated about the 4-prg as it rises from E to A, as A is the first note of the next section, a sense of resolve as E rises to A, yet this is a contradictory statement as one would expect ^5 to ^8 to contain a higher amount of tension, especially in the leadup to ^7, the leading tone. The overall prolongation from bars 70 to 73 depicts an increase, aligning with the increase of tension as the phrase reaches the peak. This also suggests that the reiteration of the phrase is more emphasised. On a more local level, the two 3-prgs that are identified depicts a sharp increase: 0-1-6, indicating that all the movement from bar 70 is driving towards this specific moment in bar 73, which coincidentally is also of a longer value, the last note of a subphrase, also a dissonant tone. Interestingly, this is followed by a small decrease in intervals upon its return to A, perhaps indicating the end of the first subphrase, firmly establishing the key of the section.

However, the same 3-prg that is repeated subsequently depicts an overall decrease in the data points, perhaps to denote a false sense of stability, before propelling onto C#, a significant leap in the melody. Interestingly, the movement from A to G# indicates a decrease at first, aligning with the melodic contour, but increases to reach F#, suggesting that the prior movement is driving to F# as the core tone. The same comments can be made above with the second layer of melody identified – D-C#-B and B to D – which acts as a harmonic support to the upper melody.

With the 5-prg in bars 75–79, overall this increases from AVL10 to 11, suggesting that despite the higher range of register at the first tone, C#, the final note, F# can be perceived to contain slightly more tension as it can be seen as a point of continuation, not a complete phrase, and it could even be argued that F# is the climactic moment of the solo section. On a local level, there is a decrease initially from C# to A, aligning with the end of the first subphrase. However, this is subsequently followed by an increase in data points from A to

F#, aligning with the ascending bass figure, which is a feature to assist in heightening the tension as the solo section drives to its climax.

The prolongation of F# from bars 74–79 depicts a sharp increase from AVL 3 to 11, suggests and reinforces the point previously made that due to the identified harmonic contents, bar 79 can be argued to be the climactic moment of the solo section. This is also marked by the consonant skip between F# and G# in bar 74, where 3 increases to 10 within these two notes. In bars 79–86, there is a 6-prg, F#-E-D-C-B-A supported with AVLs 11-0-4-8-6-3. Overall, there is a decrease from 11 to 3, aligning with the structure of the phrase, the conclusion of the solo section, to help create a point of stability. This point of tension can within this 6-prg lies within the movement from D to C as it increases significantly from 4 to 8. Interestingly, this is also mathematically proportionate as this increase occurs right in the middle of the eight-bar phrase, with three bars on either side of the increase: 3-2-3

On a global level however, it can be noted that the descent from F# to A is supported by a decrease. It is vital to look within it, as there is an “inner” sense of tension on a local level. The neighbouring movement, F#-G-F#, is supported by an overall decrease from 11 to 5 but it is interesting to point out that the passing tone, G, is on a significantly lower number, 3 and increases to 5. This suggests that although bar 86 marks the end of one section, the increase can be an indicator that the solo section is part of a larger unit, that there is a yearning to move immediately onto bar 87. In the bigger picture, taking into considerations of the notions of tension and release, the data points gathered on the chart can be argued as an efficient way to depict the rise and fall of harmonic tension through its harmonic activity.

There are thirteen instances of significant movement in this section. The first, in bar 64, was unaccounted for and there are two possibilities. Either A from the orchestra can be added, which then means that G has to be subsequently added immediately on the next beat, as this will then create an upper neighbouring movement that can be identified amongst the other melodic features. Alternatively, a stepwise descent or unfolding will have to be featured on the middleground chart. From the piano line as B, the point that will be emphasised, is dissonant and will require more thought on it. The first option is more plausible, so the significant movement identifies the missing melodic features of the middleground chart. In bars 69 and 70, there is an increase of 4 and decrease of 7. -7 was accounted for and represented in the VL graph but not +4. A would be the best option to include in the middleground chart as it is in fact the actual beginning of the solo section. It can perhaps be argued that this point should be regarded as the core note for the 4-prg instead of its subsequent appearance. However, as A appears on the last beat of bar 69, bar 70 with the reiteration is metrically stronger, on its downbeat. There is an increase of 4 in bar 74 which is unaccounted for and the note best suited for inclusion for the middleground chart would be A as this marks a change in rhythmic activity, from quavers to semiquavers and a descending melodic line as opposed to the almost static A line preceding it. In bars 75 – 76, there are four consecutive significant movements: +4, -6, +5 and -4. Two out of four instances are accounted for (the first +4 and +5). B would be the best candidate for inclusion in the middleground chart. Although B is much stronger on the downbeat of bar 76, it is pre-empted by (-6) its appearance in the previous bar, B, which can be argued as being metrically displaced as it should appear on the downbeat as opposed to the second half of the beat. Similarly, B on the second beat of bar 76 can be given more thought. B is repeated four times in a row and there is a certain sense of pull towards a descent onto a more "stable" note. B in this context is a passing note and has been emphasised continuously. In bar 78, there is a +5 that is unaccounted for, C# would be the best candidate as it is an octave lower than its first appearance at bar 75. The last beat of bar 78 can be perceived as a "diminution" technique, where the descent is repeated across the span of semiquavers as opposed to being stretched out over three bars. In bar 79 and 80, there are three significant movements: -6, -5 and +7. Only one of the three is accounted for. The first significant decrease, -6, can be accounted for by including F# as it is repeated on the second beat. Similarly, E can be added on the second beat of bar 80 as it is prolonged from the first beat. Interestingly, as the prolonged Es now depict an increase, this highlights the running bass line as a vehicle to stimulate tension. Lastly, there is a +5 in bar 84 which is accounted for and supported by C.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

The overall data values are much higher than preceding sections, aligning with the change of thematic materials, marking the start of the B section. The mode is slightly smaller than the mean and median, but nonetheless, it is evident that larger AVL is preferred. In fact, it is interesting to observe the steady increase in the mode from A to B: A=2, A^1=3, B=4 – aligning with the change in the thematic materials, with more tension in the second idea.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)
Again, the use of smaller VL numbers such as 0, 1, and 2 are most frequently used. Almost every BIP contains the already identified smaller numbers and they are always used alongside larger VL numbers such as 4, 5, 6. It would be interesting to examine if such larger VL movement coincides with the peak of the phrase or a moment within the music that is particularly significant. Interestingly, the use of larger VL numbers such as 4, 5, 6 occurs halfway through the piano solo and more frequently towards the end of the section, indicating that more momentum is built up towards the end of B.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 2, Figures 44 and 57–59)
As expected from uncovering the statistical data, the overall HM values of less than three are used less frequently. Larger harmonic movement is used quite often here, where numbers larger than 8 can be seen in this section and none so in the intro and A section. This appears from the middle of the piano solo, and in particular, the use of HM10 occurs at the start of bar 75, the start of a new phrase, marking the end of the first set of melodic materials and the entry of the new rhythmic idea. Interestingly, the appearance of the highest HM, AVL11, occurs four bars later, not only is it just one data point higher, but it is rhythmically related to bar 75 as it begins once again with [dotted crotchet quaver] before diverging into different rhythmic materials. It is interesting to also point out that bar 79, whilst it appears to be more rhythmically involved, both bars 75 and 79 contain three layers, bar 79: 2/3 [4 semiquavers] but bar 75, 1/3 [4 semiquavers].

It is also interesting to point out the use of AVL8 that appears twice in a row between bars 84 and 85 has a structural significance as it occurs when the orchestra re-enters, building upon the piano's solo, the second last beat of bar 84. The appearance of 8 again subsequently on bar 85 on the very first beat emphasises its entry, aligning with the preconceived notion that the first beat should contain more emphasis. There is fewer use of 0, occurring mainly at the first phrase. The consecutive HM does not occur in this section, it is more varied, which could be another indicator of how this section can appear to be more "unstable".

[012] appears four times in this section: firstly in bar 70, on the second beat, in the middle of the middle of the phrase; secondly in bar 74, on the first beat, in the middle of the phrase; thirdly in bar 82, on the second beat, in the middle of the phrase; and fourthly, in bar 86, on the first beat, towards the end of the phrase. In all four cases, they are followed by an increase

in data points, [012] acts as a vehicle to stimulate more tension. In three out of four cases, [012] appears in the middle of the phrase, the last one occurs just before the final beat of the phrase. All four instances also occur within the piano solo as well.

Bars 87 to 110

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figures 45)
Overall, there is a slight increase in data points as F# descends to Bb. Although this contrasts the descending contour, it indicates that the last note, Bb, is not on a point of stability and there is more to the phrase, heightening the sense of tension. There is a 5-prg at the beginning of this section, containing the notes F#-E-D-C-Bb with the data points 5-9-4-3-6. On a local level, it is interesting to point out the significant increase from F# to E, as this indicates the peak of the phrase of the 5-prg. This is immediately followed by a decrease to 4 as it moves to D, suggesting a sense of stability to the descent. This actually coincides with the change of rhythm in the orchestra too, as it moves from quavers to crotchets. This descent continues to C with 3, suggesting that the 5-prg is about to reach its conclusion. However, this is followed by an increase, suggesting a sense of incompleteness, this can also be attributed to the use of Bb as opposed to B. Bb does not belong to the archetypal F# descent.

Following on from the 5-prg, the data points suggests an increase in the 3-prg from Bb to D, 6-1-7, aligning with the ascending melodic contour. This suggests that the prior musical material is driving to this particular moment in bar 93, which actually marks a change in the rhythmic materials in the orchestra. However, it is interesting to observe the internal movement, as the passing note is supported by 1, a significant decrease. Whilst on one level, this gives the core tones, Bb and D more emphasis, it can also demonstrate how the shift to a significantly smaller number can provide a sense of stability yet plunging onto a higher number to give it emphasis. With the 4-prg, F#-G#-A-B, with the data points 5-6-7-7, there is a steady increase of 1 each time, almost suggesting that there is a steady build up in the momentum. However, above the 5-prg and 3-prg, an upper 4-prg can be traced, an ascent from F# to B, reinforced and supported by an increase in data points. Again, this shows how this section (from F#) is driving to bar 93. Interestingly, both A and B contain the same amount of data points, this can suggest that the peak of tension is at A as opposed to B.

There is a 4-prg, B-A-G#-F# on data points 7-2-0-3. This falling stepwise motion in the piano is supported by a decrease from data points 7-4, aligning with subsequent melodic materials as F# is repeated in the following beats. It is implied on a more local level that F# is the highest point of tension in this context due to the decrease in data points from B to G#. Although this contrasts the ascending bass line by the orchestra, it suggests that a wide variety of harmonic movement is not truly necessary to build tension and other factors will need to be considered as well. There is a registral shift from bar 93–96, on D, which is supported by a decrease in data points, aligning with the registral descent but there is also a structural significance. Bar 96 marks the start of a new phrase, change of rhythm in the orchestra but the smaller number suggests that it is related to its preceding phrase, hence establishing similar, harmonic contents.

There is subsequently a 6-prg, D-E-F#-G#-A#-B, supported by data points 3-8-3-5-2-4. Overall, this depicts a decrease in data points from 3 to 4, perhaps suggesting that the musical activity from bar 96 is driving to this particular moment at bar 100. However, even if the increase is not significant, a higher sense of tension can be felt on a global level. The local movement between each note is interesting as G# and A# do not belong to the implied tonality, D. Whilst one would expect a larger amount of harmonic movement, closer to the final note, there was actually a decrease from G# to A# and the build-up occurs between A# and B instead. Unlike other instances, the passing note E, is supported by a large harmonic movement, emphasising the “weaker” beat of the bar. Core tones D and F# are supported by 3, on the downbeats and subsequently, G# is supported by an increase in data points, but as A# is not resolved, and the movement is somewhat expected, it is presented by a smaller number.

The consonant skip between B and D is also supported by an increase in data points, aligns with the climax of the phrase, a change in rhythmic activity in the piano. The same can be said about F# to B, a prolonged consonant skip, an increase in harmonic movement. However, it is interesting to observe that the prolongation of B is supported by the same data points. It can almost suggest that the entire section from bars 93–104 is one whole phrase, bound together by a high amount of tension, establishing a global view of the section. The inner 3-prg, G-F-E, in bars 104 to 105 is supported by 3-5-5, despite the descending contour, and it is evident that within the inner voices, tension can be felt as well. Interestingly, the movement from B to F in the two phrases, bars 104-106 is supported by a slight decrease in data points. This is perhaps to pre-empt the final moment of the phrase, demonstrating how the two phrases are similar. The movement from F to Db is supported by a decrease, pre-empting the 7-prg. The 7-prg contains an interesting shape of the movement, an increase of data points to reach A, which coincidentally marks the close of the phrase, a change in rhythmic activity, a high amount of tension that is not resolved and the subsequent movement depicts a decrease of harmonic movement, denoting a sense of finality and closure to the phrase. The overall shape from F to E, in bars 106–111, depicts a decrease of harmonic movement, aligning with the structure of the phrase, the peak to its closure. The neighbouring movement depicts an increase, but it does suggest more movement and tension in the following section. Overall, there has been no change in the harmonic movement from the start of bar 87 to 110, suggesting a sense of unity.

There are twelve instances of significant movement in this section, seven of which are already accounted for: one; in bars 87 and 88, there is a movement of +5 and -5 that is unaccounted for. A and F# from the orchestra's melody line can be considered for inclusion. This creates a consonant skip from bars 87-88 and it can be argued that F# in bar 87 is prolonged to bar 88 and the ascent to B starts from there; two, in bar 99, beat 2, the +5 is unaccounted for, the best option for this would be B, as this note actually pre-empts the downbeat, which in turn suggests that the point of tension in the 6-prg is on the upbeat to bar 100. But then, this would raise the question of whether the first or second B is more structurally significant, the result would change as it does depict an overall increase in the 6-prg, the second B is more likely as it will then feel more resolved than the first; three, in bar 103, beat 1, there is a movement of +6 that is unaccounted for. This large increase can be accounted by A, this will in turn create a lower neighbouring movement to the following B, which emphasises the semiquaver passage played by the piano, that the quick movement is driving towards a resting/high point. The fact that this A is on a data point that is significantly higher than the subsequent B suggests that A is the highest point of tension within the neighbouring movement and four; in bar 110, beat 1, there is a movement of +4 unaccounted for, the note most likely for inclusion is D#, the upper voice of the bassline in the piano part. This D# can be perceived to pre-empt the following D#, identified on the next beat. The first one is significantly larger than the second, which is a pint of stability reached by the second beat. The first one also establishes the new key area, significantly different to its precedent, and much like the instance in bar 103, the neighbouring note contains a higher amount of tension than its initial note, where a non-chordal note contains a higher amount of tension.

Overall, it can be seen especially in this section that a lot of significant movement occurs with the linear progressions and neighbouring movement, prompting for more observations to be given to each individual movement identified with the keynotes in the soprano line.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

A statistical analysis of the overall data of section C reveals an average of 4 across mean, median and mode. Interestingly, the mean and median are slightly smaller than for section B. So although section C is clearly the statement of a second theme, the harmonic data suggests that it is in fact B that contains more harmonic tension. This then raises the question of why the secondary theme of A, B, is more harmonically varied. Nonetheless, it can be identified that the harmonic data of C is larger than A. Perhaps it can be said that despite progressing to a new sub-idea, in this context, a more grounded sense of stability can be felt.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

One striking feature that can be noted with this section is the more extensive use of VL numbers smaller than 2. This is much less frequent in preceding sections. So whilst on one level where the statistical data revealed that the overall harmonic data is slightly smaller than B, the individual calculations of the VL movement strongly presents data which suggests that more harmonic movement can in fact be seen and analysed on a more local level. As usual, smaller VL numbers such as 0, 1, 2 are used more frequently. Only in one instance, in the second half of bar 97, 0 is not used, 2 is the smallest VL number, which turns out to be structurally significant, as it occurs towards the climax of the phrase. Although the total number is not "large", it does indicate that there is a heightened sense of tension within the VL movement in the chord.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 2, Figures 45 and 57–59)

There is a large use of HM2 to 6 where [0022] occurs the most frequently – appearing three times in total. With instances of larger HM, ones larger than 7, each BIP only occurs once, perhaps this is because the range of possibilities is greater when dealing with a larger number. There are also two instances of consecutive HM: one; AVL3 occurs three times in bars 95–96 and two, AVL6 occurs three times in bars 105– 106. With the first instance, AVL3 appears in the following manner:

Table 86. BIPs for AVL3 in Bars 95–96.

	2 1 0 0 0	2 1 0 0 0	1 1 1 0
AVL3	95		96

From Table 86, it can be firstly noted that this occurs towards the end of the three-bar phrase and the first two BIPs share the same contents, bearing some structural significance. The fact that there is another HM immediately after the conclusion of the phrase creates a sense of continuity into the next phrase. Furthermore, the transition into the next phrase can be described as a smaller value as 1s are used opposed to 2s. Despite the appearance of 0s in [00012], that are used more frequently than [0111], the change can be described to be smaller, semitonal movement. The PCn is evidently smaller than its predecessors and as a result, the HM is comprised of fewer VL numbers. However, it can also be argued that [0111] can be perceived to be larger due to fewer common tone transformations and relying on semitonal movement. Nonetheless, it is evident that there are implications on the structure with this specific use of HM. With the second instance, HM6 appears in the following manner:

Table 87. BIPs for AVL6 in Bars 105–106.

	3 3 0 0	3 2 1 0	3 2 1
AVL6	105		106

As seen in Table 87, once again AVL6 occurs at a transitional point of the phrase. Bar 105 is the last bar of the two-bar phrase, leading it into the next phrase, reversing the roles – where the musical idea is played in the orchestra instead of the piano and vice versa. Of the three movements identified in the above table, the third movement can be perceived to be smaller than its predecessors as there are three movements in common whilst there are only two in the local one. Interestingly, the same amount of intensity can be felt within the first two changes as within the inner voice, one decreases whilst the other increases. From another perspective, it can also be argued that due to the absence of 0 in the third shift, from [0123] to [123], the last shift is more significant. But as they almost contain the same BIP, there is still a strong relationship between movements. The use of 0 in bar 94 is interesting as there are common tones between PCns, suggesting that the occurrence of large AVL values should not be directly correlated to a higher amount of tension.

Summary

From the very opening bars, there are many instances where the AVL data aligns with the VL analysis and has direct links to phrase and sectional closures. There was a recurring theme from the beginning where unresolved tones (e.g. neighbouring notes) contained a larger AVL figure (e.g. opening figure G# has a larger AVL) which is then followed a smaller AVL as a resolution. There are many instances in this first 110 bars where an increase in AVLs do aligned with identified linear progression from the VL analysis. Key changes within the first 33 bars are also linked to an increase in AVL too (e.g. moving from Am to Cm to Am in bars 1-33). Like the Hindemith case study, there are numerous instances of significant AVL movement without a note and this case study further sows how the AVL can enrich a VL analysis. From the statistical data, the mean AVL is 3 and it is through smaller VL movement such as 0, 1, and 2 that attributes to movement between chords. VL0 was the most commonly used VL in this opening section. Much like the first case study, examining the AVL fluctuations and its relationship to the music can be seen to be context-based and every work needs to be treated on a case by case basis. This first movement of Stravinsky's *Concerto for Piano and Wind Instruments* suggest that it is the AVL data and local movement as opposed to the key notes of the larger phrases that shed more insight to the relationship with building and releasing of tension. Recurring BIPs can be seen as well, and an instance of this can be seen within bars 33-63, where this unique BIP can play a variety of roles, in providing stability or a build-up in tension. Bars 64–86 have also revealed interesting insights to the music when comparing the local and global phrase shaping to the AVL, both for the performers in assisting with phrase closures and build ups and for the analyst to see how it is similar and dissimilar. From these bars so far, the AVL data has a closer relationship with the VL reduction than the Hindemith case study. As the music develops, the AVL mean from statistical data appears to be larger, suggesting that there is more harmonic activity. There were further indications from the data presented so far that accounting for rhythm and other musical parameters are important as well. Towards the end of this first section, by bar 110, there was a slightly larger AVL mean.

Bars 111–141

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figures 46)

There is a 4-cp at the start of the section, G is unaccounted for on the chart. The overall shape for this section seems to suggest that the highest point of tension is on the second beat of the bar before returning to the same point as the first note. Interestingly, the next shift, the neighbouring movement, is supported by a decrease in intervallic movement, contrasting the registral ascent in the music, perhaps this is due to the fact that the tonality is being established in the transition, also the start of a repeated fragment. However, whilst one would expect an increase with the reiteration of the lower neighbouring movement, there was an overall decrease again from 2 to 0. Unlike the first instance though, there was a significant increase to F#. This suggests that the non-chordal tone is more significant in this context as the as the driving factor to increase tension. Overall, whilst one can hear the increasing momentum in the music, this is heavily attributed to other musical factors such as rhythm and dynamics. The harmonic elements clearly demonstrate parsimony and the close relationship each transformation has, despite the seemingly unrelated chords, that bear no relationship to each other.

The 7-cprg from G to C#, two of the notes are not directly supported by any key note. It is interesting to observe how the overall contour of the passage mirrors the musical movement. There is an increase in data points from 0 to 7 from G to B, clearly marking the start of the ascent and the first beat of the next bar. This is then followed by a descent to reach C#, the first note of the next section. This clearly indicates the peak/highest point of the transition and how release is accomplished/shown before starting B. Overall, the entire transition is shaped by AVL5, same starting and ending point, a larger number correlating with the notion of a transitional passage. The slight prolongation of C# from bars 115–116 retains the same number but the slight shift to C natural depicts a decrease in harmonic movement, aligning with the melodic shape but defies the overall phrase structure as it is gearing towards the peak of the phrase. The movement C-G-F, in bars 117–119, contain the same data points for C and G, but it decreases to F, coinciding with the conclusion of the phrase in the orchestra, creating a sense of finality. Upon the orchestra’s re-entry, along with a slight deviation of rhythm in the piano, this is marked by a significant increase in harmonic movement, a clear emphasis for the start of a new phrase.

Interestingly, the unfolding from bars 120–122, is greeted with a decrease in harmonic movement, suggesting a sense of stability is established after such an accented start to the phrase. There is a prolongation of D, aligning with an increase in data points, supported by other surrounding factors, a change of time signature, “unison”/ reinforced musical figure by the soloist and orchestra, driving towards the start of the musical idea in bar 126. There is a descending 3-cprg, which is supported by a decrease as well, aligning with the end of the section, with more stability being established. With the ascending 3-prg, A-A-B-C-C, this was supported by data points 2-6-7-6-8, an overall increase in data points, aligning with the contour of the phrase as it drives to the highest point. On a more localised level, the prolongation of A is initially represented by an ascent, giving some drive to the repeated rhythm and meandering melodic line. This ascent continues to B as well, aligning with the ascent in the register. Although it decreases slightly to reach the first C, it suggests a sense of release, stability, reaching the highest note of the phrase. The increase of 2 to next point suggests that the section is still unfinished and there is a certain drive to propel onto the next phrase.

Underneath the 3-prg, there is an inner 3-prg, D-E-E-F. What is particularly striking is the two significantly different data points for the passing note, E, perhaps they contain different functions – the first of the pair is part of the moment of the phrase that drives the phrase but the second E has a very different role, in which it marks the final moment in the phrase. On the whole, it can be seen that bar 126 is driving towards its reiteration at bar 132. A short arpeggio can also be seen within this phrase, supporting the results gathered in the other two lines, an increase in data points, aligning with the ascending contour. There is a 5-prg in the bass piano line that depicts a high amount of tension, sustained on 8. A sharp decrease between F and E suggests that there is a sense of stability established on the second note, but this is followed by an increase of data points to Bb, suggesting a significant amount of emphasis on the first beat of bar 136. Above this 5-prg, C to E, this is supported by an increase, aligning with the peak of the phrase.

There is a 6-prg, descending step progression supported by a decrease in harmonic movement. It is interesting to point out on a local level that A is supported by an increase, which defies one’s preconceived notion of the third beat of the bar, but it reinforces the importance of this passing tone/non-chordal tone. D and A are also supported by the same data points, where a relationship can be established between the two passing tones. With the inner 3-cp, a decrease in data points can be seen for the ascending contour, creating a sense of stability as opposed to instability – C# to B, same data points. The movement from G to A, bars 139–140, is supported by an increase, aiding in the drive to bar 142, supported by other musical factors such as rhythm. With the descending 5-prg in the piano and orchestra, this is depicted by an increase in data points, a push for the music to propel onto bar 142, an increase in harmonic tension, which is supported by other factors e.g. rhythm, change in time signature. The ascent occurs from G to F and E to C#, where E is set on a point of stability. The passing notes are the driving factors in the passage. The same can be said with the movement from B to C# and A to G#, an overall increase.

There are sixteen instances of significant movement, where only six are accounted for. In bar 120, there is a significant decrease of -10. A can be added to the middleground graph, A is represented as a minim note, suggesting that the unfolding should start on beat 2 as opposed to beat 1. In bar 121, +4 and -4, the unfolding could be removed and replaced with A—A-B-C-D. A 4-prg may be more suitable than an unfolding due to the harmonic content, as each note is heavily weighted. In bar 123, there is a decrease of 7 on beat 2. D could be added. This derives from the piano line, represented as a minim note, which is sustained for an extra beat above the inner lines, maintaining the high amount of tension. In bar 124 on beat 2, there is a decrease of 6, Db could be added to the chart, adding to the prolongation of D from perhaps the previous bars. This depicts the slight change in tonality before sliding back to D. In bar 125 on beat 3, there is an increase of 6, continuing from the previous point. The shift back to Db is actually reinforced on the last beat of this bar, an additional D, which is already emphasised by an accent. In bar 127, beat 2, there is an increase of 5. F could be added as this will form a consonant skip to preceding and following As. In bar 132 on beat 2, there is a decrease of 6. C could be added as this will be prolonged from the first beat, a sudden "drop out" of the orchestra, a significant reduction in harmonic density In bar 135 on beat 2, there is a decrease of 4. D starts a beat earlier and prolongs to the next beat, part of the 3-cp/6-prg).

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

The transition and B^1 on the whole, is represented by data that is larger than C. The median and mode are slightly larger than the mean, AVL5 as opposed to AVL4, aligning with the structural view, with the approach of the development, with more harmonic activity, a higher sense of tension. Interestingly, when these statistics are further segmented into its respective sections, the transition and B^1, it can be observed that the transitional passage appears to contain less harmonic tension than B^1, contrasting the normative view that there are more unexpected harmonies and "turbulence" in transitional passages. In fact, the mean is smaller than section C, this may suggest that it might not truly be necessary for transitions to contain hugely divergent harmonies, therefore suggesting that the shifting of key areas can be accomplished via smaller voice-leading movement. The larger mean and median in B^1 has a structural significance, not only is the results exactly the same as B in bars 64–86 but it suggests a sense of familiarity in the musical materials.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

As anticipated, smaller VL movements are preferred than larger ones. Almost every transformation is supported by either VL0, 1, 2. It is interesting to point out that in instances where 2 is the smallest number, this marks a pivotal point in the phrase – a climactic moment, change of rhythm, or emphasis on particular notes. In the first section, B^1, it can be observed that the appearance of combinations of larger movement coincides with the build-up to the climax of the phrase, leading it into the new idea at bar 126. This is then continued into the new idea, towards bar 132, perhaps suggesting that this particular phrase requires a significant amount of emphasis, reinforced by the orchestra doubling the piano part – it can then be seen that upon its reiteration that only a fragment of it appears and is not reinforced by the orchestra. Similarly, combinations of larger VL numbers can be seen towards the end of B^1 too – bars 138–142.

BIP Local Observations (Refer to Volume 2: Appendix 2, Figures 46 and 57–59)

There is a wider range of BIPs in the first half of B^1 than in the second half; this is probably attributable to the transitional passage between bars 111–115 and the fact that the melodic idea does not come in until bar 126, it can also be seen that larger HM is more present in the first half than the second. There are three instances of common BIP between the first and second half of B^1. The transitional passage was not included for consistency as it can be considered as a separate idea in itself. It is worth noting that the second half of B^1 is longer in length than the first.

It is interesting to point out where [0001] occurs in the two segments of B^1, they both share a common feature, in that it occurs in the middle of the 3/8 bar, beat 2, rounding off a new phrase. However, the main different between the two sections is that the second instance, the second beat does lead onto the third beat whilst the second beat in the first instance is in fact the last beat of that phrase. Despite earlier comments made on the fact that larger HM can be seen in the first half, the overall average of the second half is larger than the first, which begs the question of tension perception for this passage, as the global view of the section does not provide sufficient information and a more localised analysis is crucial in order to assess any harmonic patterns.

Table 88. AVL movement in Bars 127–129.

BIP	4 3 1	4 3 0	3 3 0	3 2 0 0
AVL	8	7	6	5
Bar	127		128	129

One interesting feature of this section is the descending HM between bars 127–129 as shown in Table 88, how the movement between PCn are transformed by such small movements. It can be seen that in each of these transformations that there are two numbers in common, aligning with NRT's core principles of parsimonious motion, the shift decreases by 1 each time. Interestingly, this also aligns with the descending melodic contour and the entrance of the orchestra (to support/complement the soloist). Evidently, not every descending contour will contain a descending HM but, in this context, it contains a strong structural significance too.

The start of this section contained a four-bar passage, where bars 2 and 3 exhibit the same amount of AVL, this was preceded by AVL2, so the general feel of this passage evoked a slight increase in tension. There was a repeated use of HM 3 in bars 117–118, [03] repeated three times followed by [12]. Interestingly, on a local level, it can be argued that the last transformation before bar 119 is more prominent, as it breaks away from the [03] pattern, with no common tones, and the use of a semitone instead.

There was a repeated use of AVL6 in bars 140–141, with the BIPs [033], [024] and [0222]. This coincides with the climactic moment of the phrase, leading into the next section. The first two BIPs can be argued to be more significant than the last one due to the appearance of the larger VL numbers, 3 and 4, the peak of the AVL6 to the start.

Bars 142–171

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figures 47)

Table 89. AVL values, 8-crpg, Bars 142–147.

C#	D#	E#	F#	G#	A	B	C#
7	6	3	10	9	6	4	7

As shown in Table 89, the 8-cprg in bars 142–147 is represented by a variety of data points. What is immediately striking about this passage is that both C# starts and concludes on the same data point. The two middle notes, F# and G#, contain the largest amount of harmonic movement, a signify ant amount of emphasis, and the G# is reinforced by the octave transfer in the orchestra. The decrease can represent the setting up of stability, easing into the phrase. The second decrease aligns with repetition of the bassline, a brief moment in the release of tension, before increasing to return to the tonic. Above the 8-cprg, there is an unfolding descending from B to C#, from AVL9 to 6. This descent aligns with the contour of the phrase as C# marks the last note of the phrase. Interestingly, the consonant skip to G#, the first note of the next phrase is marked by another decrease in data points. This may be due to the fact that G# is situated on the weaker beat of the bar or in the bigger scheme of things, the phrase is leading to the true climax of the section later on. The 5-cprg, C#-D-E-F#-G, is supported with AVLs 7-3-7-4-1. This interestingly contains a wide variety of harmonic movement. It seems to indicate that the downbeats, beat 2 are more emphasised than the weaker ones. This actually aligns with the core tones and passing notes. The only anomaly to this is that G, the last note, that occurs on beat 1 is on AVL1. It should be noted that there are two Gs in the melody of the bar, the second is perhaps to be more emphasised as it marks the change in the register.

As anticipated, the movement from G to E is supported by an increase in data points, reinforcing the orchestra's descending semiquaver pattern as the music approaches the climax. Interestingly, the movement from E to G, which includes some crossover in VL, from orchestra to piano is represented by a slight overall increase in data points. It is worth noting that the passing note, F, is on a significantly higher data point despite its metric placement. This suggests that F is the point of tension in this context and G is the point of release. This 3-prg reappears immediately afterwards but it begins and ends on data points that are larger than the first. It can be pointed out that although F# is used instead of F, suggesting a larger amount of movement. The reiteration of this short idea prompts for more emphasis and interestingly, F and F# are on the same data point and it is only the outer notes that increase slightly.

The 3-cprg and prolongation are supported by a general decrease in data points. Despite the octave jump in G, it is supported by a decrease, indicating that perhaps some stability is being established amongst the fast-rhythmic piano line, that there is a sense of unity in the tonal area of that region. Gb is supported by an increase but this can be due to the change of tonality – a shift from an E minor to an Eb minor area. The 4-prg is supported by an overall increase in data points. What is particularly striking about this is the sharp increase of data points on G, which actually coincides with the beginning of the accentuated bass line in the piano. The subsequent descent to A coincides with the metric placement on the weaker beat of the bar and its prolongation to the next beat. The subsequent increase then aligns with the gradual stepwise ascent (embellished with other decorative tones) in building up the tension.

With the prolongation, Bb and the inner 3-prg D-E-F, overall, the shape of the harmonic movement seems to decrease, suggesting that we have not yet reached the climactic moment of the phrase. The gradual descent from D to F phrases off the counter melody but decrease in the outer voice on Bb, despite the registral changes. The 3-prg, Bb-C-D, and sustained Bb in bars 163-164, is represented by an increase in data points, correlating with an increase in tension. The increase with C aligns with its off-beat placement in the bar, a strong accent on the last group of semiquavers, prompting for more emphasis Bb in bar 164 and the subsequent D can be perceived to be related as one internal phrase as both points are on AVL7. The neighbouring movement that precedes the 3-prg is supported by an increase then a decrease in data points, therefore suggesting that metric placement does not play a role here as both notes are on off beats, C# does contain more tension than Bb as C# does not belong to the implied tonality of the phrase. With the prolongation of D in bars 166–169, marked with an overall decrease in data points, can suggest that we are soon approaching the conclusion of the section. The following descending 3-prg is overall supported by a general increase in data points, indicating that there is a drive, increase in intensity as the music draws to a close in one section, yet it is preparing for the beginning of the transitional passage. The Bb that reoccurs immediately on the next beat of the bar in the piano, is also represented by an increase of larger HM, a sense of emphasis on the beginning of the new section. The larger amount of harmonic movement on C coincides with the first beat of the bar, marking its metrical placement. Above it, there is an unfolding which decreases in data points, aligning with the descending melodic line.

There are nineteen instances of significant movement, eleven of which are unaccounted for, without any correlation to a note on the middleground graph:

1. In bar 144, -8 and +4, A should be added to the middle chart, as this will act as a consonant skip to the preceding F# and creates a stepwise descent to G#. A should be added to both beats as it is sustained for the duration of the bar. Additionally, it shows how the sense of tension is built internally in other layers of voices that are not necessarily the melody.
2. In bar 149, +5, beat 2, G should be added, as mentioned before there are two Gs in the melody of the bar, the second of which marks a registral increase and as a result, more emphasis is required on the note.
3. In bar 155, -4, +5, 2 additional Gs can be added as this reinforces the tonality of the section, beat 2's G is structurally strong as well, it occurs on a crotchet and the first lot appears as an offbeat pattern. As a result, there are four points on the graph that reinforces the G minor tonality.
4. In bar 160–161, -4, +4, as G and A from bar 159 is already present in the middleground chart, it would therefore be logical for Eb and F# to be inserted, this would create a pattern from G to A and Eb to F#. Internally, the significant increase from Eb to F# coincides with the first beat of the bar and emphasises the change back to duple metre.
5. In bar 164, beat 1, C should be added as it then leads into the C# in the following beat. It may perhaps be more appropriate to amend the neighbouring movement label to a 4-cprg as there is a clear ascent as opposed to an emphasis on Bb. Alternatively, it may well be the case that C is the core LN as it is a diatonic tone as opposed to C#.
6. In bar 163, beat 2, +4, D is to be added, a prolongation of D, which is already tied from previous beats, thus depicting an increase in data points, where the second D

depicts an emphasis, heightening tension internally, same note but different data point, a different role within the phrase.

7. In bar 166, beats 2 and 3, +4, -5, an additional inner melody can be created. First off, F# will be on the two beats in bar 166 but as a result of identifying this, G will need to be added on the next bar, which then subsequently leads into A on the second beat of bar 168.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

The middle section of this development has produced a relatively higher result than preceding sections. In fact, the mean gathered here is the largest, the second largest being bars 64–86. This section has been described as the development by Morgan but my interpretation suggests that this section is in fact the middle section of the development, the climax of the section itself. Naturally, this is supported by a relatively large median as well, which supports the large mean. Interestingly, there are two HM that are used quite frequently across these bars, 4 and 6, such a combination has not occurred previously and evidently, it is the combination of the frequent use of these specific numbers that have produced a large mean as a whole.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

The first interesting point, is the use of VL6 in this section, this has not appeared in previous sections of the development. In fact, the last appearance was in bars 64–86. Naturally, the use of such a large VL number is supported by much smaller VL movement like 0 and 1. VL6 appears twice in this section, the first of which occurs on the second beat of bar 145, coinciding with the change to the higher register by the orchestra. This was supported by four common tones, and the transformation does not appear as large. The second use of VL6 appears on the second beat of bar 160, again, aligning with the ascent of register. On the whole, it can once again be seen that smaller VL movement is prevalent in the C^1 section. So regardless of the generally larger HM that is used, the importance of smaller VL movement can be seen. For instance, HM12 is created through the BIP[01245], three "small" VL movement combined with two larger numbers. The retainment of a common tone provides some grounding to the shift of an unrelated chord. It may even be said that HM10, supported by the BIP[235] is more significant than HM12 due to a reduced use of smaller VL where 0 and 1 are not used.

BIP Local Observations (Refer to Volume 2: Appendix 2, Figures 47 and 57–59)
Overall, there is a larger use of HM4 to 7, with no particular BIP that is used more significantly than others. The appearance of HM0 at bar 155 coincides with the tie from the preceding bar and sustains the G minor tonality, maintaining momentum before the scalic passage reappears in the next bar on the piano part. There is an interesting sequence of AVL in bars 160 and 161: 7-7-3-7-7. The use of AVL3 breaks up the pattern of 7, how does this impact the phrase? Might there be a structural significance? AVL3 actually appears on the last beat of the bar, which suggests that the anacrusis provides a sense of stability, a sense of release before propelling onto the next bar. Furthermore, as this movement is primarily in duple time, the presence of a smaller HM gives the duple metre more significance. It is also interesting to highlight that this segment is rhythmically retrograded, aligning this result with the supporting BIP contents. This would be very useful in understanding what goes on between each set of sounds.

Table 90. AVL and BIP content in bars 160–161.

		crotchet		crotchet	
AVL	7	7	3	7	7
BIP	5 2 0	6 1	3 0 0	4 2 1	4 3 0

From Table 90, it can be seen that when examining the individual VL contents, it can be argued that the BIP content on the two crotchets, the second and third ones, can be perceived to be larger than the BIP on the outer 7s. 0 is retained in the outer movement whilst the BIP on crotchet contains minimal movement of a semitone. When observing much more closely into these BIPs, the following can be seen:

Table 91. VL Movement in bars 160–161.

5 2 0	+1 +4 +1	6 1	-3 -6 -1	3 0 0	+1 +2 +1	4 2 1	0 +1 -1	4 3 0
	6		10		4		2	
sq-q-sq		c		c		c		sq-q-sq

It is evident from performing this internal calculation that there is a correlation between rhythm and harmony, where crotchet is given more emphasis due to its larger rhythmic content and the shift to the semiquaver(sq)-quaver(q)-semiquaver pattern (sq), contains far smaller numbers. With the appearance of BIP[124], it can be noted that it occurs at the following points: Bar 161, first beat; bar 165, 2nd beat; and in bar 170, 1st beat. BIP[124] appears on different beats, with varying roles in the structure of the phrase. But perhaps it can be stated that BIP[124] all occurs in the middle of a phrase. In the third instance, this occurs a bar before the transition, the middle of the phrase. In the second instance, it appears as a bridging phrase, connecting the previous ideas from bars 162–164, and driving it to more stable rhythm (orchestra) in bar 166. Similarly, this occurs as an anacrusis/transition to the high point/climax at bar 163. The combination of [124], a semitone, tone and major third builds tension in this instance.

As for the appearance of BIP[015], it can be noted that it occurs at the following points: Bar 142, 2nd beat; bar 172, 1st beat; and in bar 168, on the 2nd beat. All of these BIPs coincide with the middle of the phrase. In the first instance, this occurs at the start of the section, the highest note of the phrase. In the second instance, this occurs on the first beat of the transitional passage, towards the middle/end of the phrase (orchestra) and in the third instance, this occurs between the middle/end of the phrase, driving to the highest note of the section.

Summary

Much like the opening section, there were numerous linear progressions that were not accounted for in the VL reduction and through the AVL data. For this reason, I enriched the VL reduction with more observations on how this ties in with the phrase structure. An interesting feature of this section is that non-chordal tones seem to be key here as the driving factor to indicate “tension”, but again, accounting for other parameters such as dynamics, rhythm and texture are important to confirm this. Furthermore, unlike the opening section, there are more instances here where there are contrasting results between the AVL and VL reduction (e.g. a decrease in AVL where one would predict an increase). The mean AVL from the statistical data also reveal a larger AVL than the previous section as well. Similarly, it is within the VL movement, the subtle decreases, that has interesting relationships to the music. For example, in bars 127–129, there was a decrease by 1 within the VL, which aligns with descending melodic contour and entrance of the orchestra. Furthermore, in bars 142–171, there are more instances of a correlation between AVL and the linear progression, where the movement between each keynote seems to align with notion of stability (e.g. bars 142–

147). Another key point that can be taken from this section is the AVL increase with more instrumentation.

Bars 172 to 208

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figures 48)

There is a 7-prg ascent from A to G# with two sets of AVL increases, A to C# and D to G#. The overall shape aligns with the contour and register of the music, aligning with the increase of tension in the transition, the decrease from G# to D coincides with the last beat of the bar, a passing tone, giving A and E more emphasis. The preceding shift in the register of A is supported by a decrease in data points, a release of tension from the previous phrase. The ascending 5-prg from C# produces interesting results as it supported by a decrease in data points. Although the resolved tone, A, is on a significantly higher number, the smaller HM that precedes this clearly shows how tension and climactic points can be created through smaller movement. As the largest data point is on C#, it reinforces the notion that all the movement from bar 172 is driving to this particular point. The overall movement from bars 172–178 is supported by an increase in harmonic movement, building the intensity and momentum to the return of previous musical materials. The first 7-prg connected to A is also supported by an increase in data points as well.

As bar 178 marks the start of the recapitulation, one can observe an unfolding from D to A, which is supported by a decrease in data points, aligning with the contour of the phrase, the peak to the end of the phrase. Its subsequent prolongation to A in bar 181 is also supported by another decrease, suggesting that the next phrase will begin on a more stable notion. Interestingly, the next unfolding, a descending motion from D to G# is supported by an increase in data points, only slightly but it does contribute to the notion that G# is yearning to reach the next point, to a note that resolves the dissonant/unresolved tone. However, this is then proceeded by an increase to D in bar 184, thus indicating that all the movement prior to D, from G# contains an increase in momentum. Above these unfoldings, there is also a prolongation of A from bar 178–183. This is supported by a decrease in data points, establishing a sense of stability, a return of familiar materials. Subsequently, the unfolding from A to D is supported by an increase, aligning with the next phrase. With the 3-prg, D to B, this is supported by the same amount of data points, AVL6, a relatively large number, suggesting a high amount of tension in the phrase. C, the PN, is supported by a larger number, a point of instability for the non-chordal note. The sustained B, bars 188–189, sustained by different harmonic movement, contains a decrease, which coincides with the end of the phrase. This also contains similar chords. Interestingly, the beginning of bar 189 is represented by a slight increase in data points, coinciding with the first beat of the bar and the start of a new phrase. The neighbour note is also aligned with a smaller descending number, giving the principal notes more emphasis.

Similarly, the next neighbouring movement is supported by data points that privilege the core notes, B and the PN, A# is on a much lower data point, 0. This reinforces the Bm tonality of the phrase. The subsequent movement from B to C is supported by a significant increase, aligning with the change in melodic and thematic materials. However, the consonant skip to A is represented by a decrease in data points, suggesting that the new phrase begins on a more stable chord. Perhaps a more stable harmonic regions too, as it contains sparser instrumentation as well. Interestingly, the next note marked in the middleground, C, is supported by the same data point as A, 4, suggesting that all movement beginning from bar 195 to the new sub idea at bar 200 are all one unit, as a larger phrase. What is particularly striking is that bar 200 marks the start of the high point of the section but it is not directly represented in the graph depicting harmonic tension. Overall, the prolongation denotes a decrease, suggesting an overall sense of stability in this phrase. The actual point of the beginning in this climactic phrase is marked by data point 5, a slight increase from C, thus suggesting that fuller instrumentation may align with more tension. The movement to E, part of the musical idea of the phrase is supported by a decrease, although this aligns with the music's actual contour, it denotes a sense of stability within this phrase.

However, the start of the new phrase, marked by G, is distinguished by an increase of data points, aligning with the orchestra, which reinforces the melody played by the piano. It can be seen that there is an overall increase in this phrase, a steady increase, aligning with the build-up of tension. The next point on the chart, C, is also marked by the same data point as G, reinforcing the notion that the entire phrase from bars 204–208 are connected as one unit, and all the climactic moment occurs within the phrase. As the last note of bar 208 and the first beat of bar 209 are the same chord, bar 209 is marked by a decrease in data points to 0, suggesting a sense of familiarity and stability, marking the beginning of the section.

There are eighteen instances of significant movement and ten moments that are not accounted for:

1. In bar 177, beat 2, G# from the orchestra can be added. It is significant in the sense that it marks the start of the linear descent in the orchestra. G# is then reinforced in the next beat of the piano part, which could possibly indicate that beat 2's G# is the actual beginning of the LN and G# in the piano line on beat 3 reinforces it.
2. In bar 185, beat 2, +6, D should be added as it has an important role in that itself as it marks the last D that is consecutively repeated in a row, with the first note of the three-note descent in that beat.
3. In bar 187, beat 1, there is a –4. Like point number 2, an additional C can be added at this particular point as it is metrically significant. The last C in the orchestra, which is followed by a descent, suggests a sense of stability within the passing tone.
4. In bar 190, beat 1, there is a –6. B is the most likely option as it reinforces the downbeat of the bar, the first beat of A1, suggesting that the off-beat anacrusis is driving to its metrical downbeat.
5. In bar 192, beat 2, there is a –6. C is the most suitable addition to the bar as this denotes the registral shift from C6 to C5, prolongs the C identified from the first beat. There are two roles here, the first of which marks the end of the previous section and the other as a core note in the consequent phrase
6. In bar 193, beat 2, there is a +4. Again, C is most appropriate as it shows that there is tension and a sense of climax within the phrase, which actually just precedes the cadence.
7. In bar 199, beat 2, there is a –4. B can be added to the middleground chart, as this will in turn create a linear progression from A to C, a 3-prg. B coincides on the last beat of the bar, almost like an anacrusis to C.
8. In bars 207 and 208, there are three consecutive significant movements, +5, -8, +4. G# should be added in the two beats of bar 207 as it marks the shift from the white keys – C major sonority to a C augmented triad region. The first G# is from the orchestra. Evidently G# dominates the entire bar. With bar 208, G natural will be inserted into the middleground chart, as this is significant and should be added as it demonstrates the shift back to the G natural sonority, establishing a C major chord.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

A statistical analysis of the retransition leading back to the recapitulation, A and A1 indicates a smaller overall harmonic movement. This is significantly smaller than preceding sections and suggests that the music has reached a point of stability again. The median, 4, reflects the larger value of the mean, 3.82. Interestingly, if the statistical data is segregated into its thematic ideas, transition, A and A1, the results do indeed reflect the tension/release notions. The transition is supported by 5 as the mean and median, a number that closely resembles the preceding sections, a higher amount of tension before the recapitulation. Naturally, when A returns, this is represented by a mean of approximately 3, bearing a close resemblance to the data gathered in the exposition. Although both sets of data revolve around the 3 region and the harmonic movement in A1 is larger than A, it is interesting to point out that the values in the recapitulation begin on a slightly higher number than the exposition, suggesting a sense of emphasis upon the return of the familiar materials. Median and mode remains mostly the same but A1, the recapitulation, the mode is 4 instead of 3, which reflects the large mean

VL Movement (Refer to Volume 2: Appendix 2, Figure 53)
Once again, smaller VL movement is used, much more so than numbers larger than 3. large harmonic movements, ones larger than 6 are created by combinations of smaller VL movement. It is worth highlighting that VL6, the larger VL number only appears in the transitional passage, both appear on the last beat of the bar, as the melody ascends in the phrase. Evidently, the notion of the last beat of the bar being the weakest cannot be applied here as an internal analysis of the VL indicates that more attention should be given to that PCn. Further segmentation of this data into its respective sections reinforces the use of smaller VL movement, particularly with A1. It is interesting to point out that VL3 is used as often as VL1 in the transition section. More use of VL2 in A1 than A, which aligns with the larger mean of the section. And the same can be said about the 0 use of VL4 in A but 6 in A1.

BIP Local Observations (Refer to Volume 2: Appendix 2, Figures 48 and 57–59)
There was a wide variety of BIPs in the transitional passage where each BIP was used only once. All BIPs include the use of VL0 in each transformation, reinforcing the notion that despite the larger harmonic movement and tension in the overall passage, each movement is created and established by minimal movement, providing a sense of grounding. In the recapitulation, A, there is one BIP that occurs more frequently than others: [002]. There are different functions for its appearances: one, the first occurrence is in the middle of a phrase, evoking a subtle sense of stability (this was also preceded by decreases in AVL too); two, the second instance appears twice in a row, is preceded by an increase, and occurs mid to end of the phrase; and three, this instance occurs towards the end of the phrase, preceded by a

decrease. It can perhaps be argued that the use of [002] in this context is a tool to create a sense of stability within the phrase, as it usually follows on from the climax of the phrase. It is also worth noting that the consecutive use of AVL7, both with the same BIP, occurs at the peak of the subphrase, reinforcing the ascending bass line in the piano.

Notably, in A1, there is also the recurring use of VL0 in bar 190 and the first beat of bar 191 contains the repeated use of the same chord. This in a same evokes a sense of stability, after the increase of HM/larger VL numbers in the preceding phrase. This was reinforced by the same rhythmic figure, and proceeded by an increase, supporting the notion of stability. There is also a consecutive use HM4: [000013]; [000112]; and [00022]. This coincides with the end of the phrase, the orchestral reply to the piano. This is interesting as this occurs at the peak of the phrase, preceded by an increase, thus prompting for a closer view into the individual VL movement. The retainment of common tones across each transformation is also a feature, after eliminating these as shown in Table 92, it can be argued that the last of these movements is more significant as it involves the increase of two semitones.

Table 92. Remaining VL within the BIP after removing common tones.

3 1 0	-1 0 +1	2 1 1	0 +1 +1	2 2

This would then mean that whilst on the surface, the AVLs may contain the same amount of movement, it is through the examination of the individual VL that will shed light on the inner tension of the PCn. Another instance of consecutive use of AVL occurs in bars 205-206: [022] [022] [0112]. This occurs right in the middle of the semiquaver pssage, perhaps suggesting a sense of stability before the significant increase to 9. The same BIP for the first two beats suggests a sense of unity where the third change can be described to be less significant, with smaller changes and more use of semitones.

Table 93. AVL3s in bars 203–204.

BIP	2 1 0 0	2 1 0 0	1 1 1 0
Bar	203		204

With the consecutive use of HM3 in bars 203–204 as shown in Table 93, AVL3 acts as a bridge to connect two musical ideas, an antecedent and consequent idea. Bar 203 occurs at the tail end of a phrase whilst bar 204 begins the new phrase. [0111] can be perceived to be slightly smaller as it uses movement of a semitone, creating a sense of stability at the start of the phrase.

Bars 209 to 231

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figures 49)

The 3-prg from G to E across bars 209–211 is represented by an overall increase. The passing note F contains the largest amount of movement in this phrase though, aligning with the notion that passing notes are unstable and yearns to be resolved. E, the subsequent note, is situated on a slightly smaller number, correlating with the previous sentence. G is on data point 0 primarily because it shares the same chord from bar 208. What's immediately striking about the subsequent 4-prg is that E, F and G# are all on the same data point, this contrasts our listening perception as we can actually feel the music driving towards the end of the section. However, if we look at this from the bigger picture, the final note, A, is on a significantly higher data point, from 4 to 10, reinforcing the beginning of a new section, marked by a significantly different chord, notes that can be considered to be larger in tension than the preceding section. The same can be said about the movement that is underneath the soprano line, from E to D. However, unlike bars 209–211, the passing note in this context, G# in bar 216, is depicted by a significantly smaller number as it provides a sense of resolve to the change in sections. Subsequently, the movement from F# is represented by an increase. In the bigger picture, F# is part of a bigger phrase, the beginning of the climactic moment. Overall, the shape of this 3-prg is represented by a decrease, suggesting that the significant moment occurs right at the start of the phrase and there is an overall sense of stability by the end of D#. The same can be said to the inner voice of these notes as well.

There is a consonant skip, F#-A and B-D, depicted by another decrease in data points, this can be attributed to the fact that the small phrase is resolved at this point, from the start of bar 217 to the start of bar 218, a sense of release before driving to the climax, or even, the build-up to the solo. Much like the first 3-prg identified at bar 214, the inner movement from A to G# is depicted by a decrease in data points, however, the movement to F# is supported by an increase from 3 to 6. This could be due to the fact that F# appears a lot sooner than the first instance, which as a result, meant that the movement as a whole, from A to F# increases instead of a decrease. And the second appearance, perhaps more emphasis is given to it and as a result, a higher sense of tension. The same can be stated with the underlying melody D to

B. Following the consonant skip from F# to C#, this is represented by a significant increase from 6 to 1-. This aligns with the ascent in the register, the highest note of the section, as well as a note of a longer duration. The next 5-prg, C#-B-A-G-F# is supported with AVLs 10-7-4-6-13. Overall, there is an increase in data points, so despite C# being the highest point of the section, as F# in bar 224 is also of a longer value, the movement between C# and F# could be perceived as a build up to this climactic point. It is interesting though, to observe what happens internally, from C# to A as it depicts a decrease, suggesting that A has a sense of release of tension. A being on a crotchet, a longer note value, with more common tones from C#. This is then followed by an increase in data points, suggesting that despite the descending melody, there is a greater amount of tension in the build-up to F#.

The prolongation of F# from bar 219–224 is supported by an increase in data points, aligning with the approach of the climactic moment of the solo. The subsequent 6-prg, F#-E-D-C-B-A is supported by AVLs 13-7-3-8-6-3. The last larger phrase of the section is supported by a general decrease in data points aligning with the conclusion of the piano solo. However, it is interesting to observe the fluctuations in harmonic intensity on a localised level. The decrease from F# to D coincides with the end of the first subphrase and subsequently, the increase from D to C coincides with the beginning of the next subphrase. This is then followed by a decrease of data points to reach the end of the section. The same can also be said for F# overarching to G. The movement from the last note of the section, A to B is supported by an increase of data points, aligning with the start of a new section, indicates that perhaps more emphasis should be given to mark this particular point. Overall, it does begin on one data point lower than the start of the B section, perhaps suggesting slightly less tension due to the smaller AVL.

There are nine instances of significant movement in this section, five of which are unaccounted for.

1. In bar 209, beat 2, there is a +5. A would be the most logical option here, even though it falls on the off beat, the A and on the next beat, G, when added in, will actually create an upper neighbouring movement within the descending 3-prg. This will also reveal how notes that are not placed on a down beat can also be highlighted in the middleground chart. Although G did not need to be inserted.
2. In bar 215, beat 1, there is a -10. D and A would be the most appropriate addition for the middleground chart. This reinforces and prolongs D and A from the laat beat of

bar 214. Although it can be argued that perhaps bar 215 contains more metrical weight, the first entry of the idea is on the anacrusis and the significant decrease simply reinforces the presence of the same chord. This would however mean that the movement from D to C# is actually an increase in data points, slightly heightening the tension.

3. In bar 220, beat 2, there is a -6. This significant decrease can be represented by B. This note is metrically displaced, and the first appearance of the passing note is actually in bar 220. This would then mean that on its second appearance at the start of bar 221, this is supported by an increase in data points, giving the first beat more emphasis.
4. In bar 224, beat 2, there is a -8. Much like the instance in bar 220, F# can be added to the final middleground chart, F# occurs on the second half of the beat as opposed to the structural downbeat. As this is also tied to the next bar, F# is ultimately carried through across more than one beats, giving the note more prominence. Furthermore, the significant decrease aligns with the notion that this chord is closely related to the first beat of bar 224. However, this would then mean that the movement from F# to the passing note E, is supported by a slight increase in data points, which actually reinforces the notion that there is a sense of increased tension within the passing note.
5. In bar 225, beat 1, there is a -5. Much like the previous two instances, E would be the most suited for addition for the final middleground chart. E is metrically displaced and would have been situated on the first beat of the bar, this also implies the strong presence of E through this bar, how it is prolonged across two beats. However, this would imply that there is a significant increase in the harmonic tension between the first and second beat, this increase actually correlates with the constant semiquaver pattern, a driving and rhythmic figure and a descending melodic contour, on two layers of voices, not just one, reinforced and supported.

The findings in this section strongly correlate with the results from the appearance of B in the exposition, particularly with the new additions to the middleground chart and the overall shape of the line graphs. The statistical data is also very similar as well. It may also be worth keeping an eye out for repeated BIPs when gathering data on a global level.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

The results from this section are very similar to the first B section from the exposition. The only exception to this is that the mean is just slightly larger in the recapitulation. It is also interesting to point out that the results from this is very similar to the results gathered in the transition section, which then prompts the notion that perhaps B should be better labelled as a form of transition between A and C, a subsidiary theme. Naturally, the results from B are significantly higher than the preceding sections, indicating more tension and instability. The mode still is the same from A^1, creating a subtle sense of continuity and relationship to the preceding section.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)
When comparing this to the first appearance of B, it can be seen that the results are fairly similar, As expected, 0, 1, 2 are used the most. Medium sized numbers such as 3 and 4 are used slightly more in this section than its first appearance. There is a fewer use of larger VL numbers as a whole in this section as well. Almost every transformation is supported by a smaller VL number such as 0, 1, 2. In the case of bar 220, where the smallest VL is 3. The total harmonic movement on that beat is AVL10, coinciding with the peak of the phrase, the piano solo. The next time this anomaly appears is on bar 224, another note of a longer duration, like bar 220 which marks the beginning of a sense of resolution to the piano solo

<u>BIP Local Observations </u>(Refer to Volume 2: Appendix 2, Figures 49 and 57–59)
[012] is played six times in this section:

1. In bar 215, beat 2, in the middle of a phrase, reiterating A before descending on the next beat (middle beat)
2. In bar 216, beat 3, at the end of the phrase reiterating A before a quick descent on semiquavers (last beat)
3. In bar 218, beat 2, in the middle of a phrase, reiterating G# before rising back to A (last beat)
4. In bar 219, beat 1, refer to point 2, twice now that a semiquaver pattern from A has [012].
5. In bar 227, beat 2, reiterating D before descending to C, the middle of a phrase.
6. In bar 231, beat 1, the end of the phrase, it differs to previous appearances (semiquavers), more melodic variety.

It can be seen from all six appearances that BIP[012] appears to be a vehicle to stimulate tension, particularly in the middle of the phrase. In one instance, [012] is used twice in a row, this contributes to the build-up to the peak/high point of the phrase, suggesting the notion that larger harmonic movement does not necessarily correlate with a higher amount of tension. In fact, the use of smaller movement, common tone, semitone and tone, creates a sense of stability, grounding before large leaps. With the exception of bar 231, all the appearances of [012] coincides with the reiteration of the previous note which thus accounts for the common tone relationship. In most cases, [012] is followed by a slight descent in the melody, reinforcing the notion of stability in the phrase itself. Disregarding metre though, it can be observed that [012] occurs as a passing tone, not on a downbeat, perhaps, a larger movement is situated on downbeats in this region.

There are three uses of AVL0 across this section, it can be seen that the retainment of common tones, used earlier on I the solo section, can be used as a compositional device to set up the notion of stability of sense of grounding, a larger harmonic movement generally dominates the end of the phrase. The use of AVL0 at bar 225 is unusual, but it sustains the F# from the preceding beat before propelling onto larger harmonic movement. [023] was also used four times in this section: one, bars 217 and 218, beat 2 into beat 1 of the next bar, consists of an ascending and descending pattern, a consequent part of the larger phrase structure; two, in bar 234, beat 2, part of the larger phrase structure, can be perceived as part of the consequent phrase, or simply an extension of the earlier materials and three; bar 225, beat 1, similar to the findings from bar 224, originated from a tied note, part of the extended phrase. On the whole, it can be seen that [023] marks a point of stability within an unstable region, or an area that contains a large amount of harmonic activity. It is preceded by a larger number each time and disregards all notions of metre and its connotations.

Bars 232 to 260

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figure 50)

There is a neighbouring movement, B-C-B supported with the AVL 4-6-4. The overall movement from B to B depicts an increase in harmonic movement, aligning with the reiteration of the musical figure. The neighbouring note is also supported by a larger data point, 6, reinforcing the notion that a non-chordal tone/passing tone contains a higher amount of tension. With the 5-prg, B-C-D-E-F#, supported by AVLs 5-4-1-6-5, it is interesting to point out firstly that it begins and ends on the same data point, reinforcing the structure, tying these bars as one entire phrase. The initial decrease from B to C coincides with the notion that a sense of stability can initially be felt when setting up the phrase. This is then continued to the next note in the linear progression D, further reinforcing the notion of stability but this is then followed by an increase, a significant one, from 1 to 6 coinciding with the crescendo, indicating that we are about to reach the climactic moment of the phrase. However, there is a slight decrease to F#, marking the end of the phrase.

The 5-prg, D-E-F#-G#-A# is supported with AVLs 5-4-3-5-0. This is interesting to observe that despite the increase in dynamics and forced articulation, there is a decrease in the data points. This suggests that there are in fact more common tones that bind this section together than initially realised. This 5-prg begins on the last note of the previous 5-prg, two consecutive appearances. There is also a decrease in AVL from D to F#, subtly suggesting a sense of stability amongst this turbulent section. However, there is an increase from F# to G#, defying the preconceived notion that there should be a decrease on the second beat of the bar. The significant decrease to D can perhaps suggest that this is not the true climax of the section.

The chromatic shift from A# to A is supported by an increase of data points from 0 to 4 but this actually coincides with the start of a new phrase within the orchestra and also supported by a registral increase as well. The subtle unfolding in the very same bar, from A to C#, across beats 1 to 2, is supported by a significant increase in data points. This suggests that there is a strong drive for the harmonic materials in that bar to push towards the downbeat in bar 243. However, this is followed by a significant decrease from 9 to 4, C to B on the first beat of the bar. This therefore implies that the anticipatory idea, bar 242, contains the most amount of tension, as a way to pre-empt bar 243 and upon the arrival of the beat, it is greeted with a decrease, strongly denoting a sense of stability. C# to D, in bars 242-247, supported by a decrease in data points, aligns with the contour of the melody, also subtly suggests a slight release of the tension at bar 247. However, the prolongation of B within these last few bars before the change of rhythmic materials at bar 247 in the piano is supported by an increase in data points, aligning with the increase of tension/drive towards bar 249.

Whilst on the one hand, there is a slight decrease on the overarching shape, an internal examination of the smaller phrases indicates an increase in tension. The overall contour from B to F, in bars 247 – 249, depict an increase melodically, but this is supported by a decrease on data points, which on an overall sense suggests that point of attack, the initial surprise is actually at bar 247 as opposed to bar 249 where there is an expanded use of the register. Internally however, it can be noted that the G-F-E motion is supported by an increase, 3-6-8. So despite the decrease in the melody, an increase in the harmonic tension can be felt on a more local level. Interestingly, the movement from F to Db in bar 249 is supported by a decrease in data points, denoting that the movement of the highest to the subsequent note contains a stronger notion of stability and that the subsequent sequential rhythmic material will contain more varied harmonic activity.

The 6-prg, Db-Cb-Bb-A-G-F#, is supported with data points 4-5-3-7-3-(2.5). It is interesting to note that the last note of the 6-prg is not directly supported by a data point as the rhythmic segmentation did not account for the rhythmic divisions, in semiquavers. Furthermore, it is also worth highlighting that from the data points, there is an overall decrease from 4 to 3. Whilst this aligns with the contour of the phrase itself, it also suggests a sense of stability, a release of tension prior to the arrival to the end of the section, therefore implying that the largest amount of tension appears prior to this moment. The movement from F# to G is also supported by a slight decrease in data points, reinforcing the notion of stability/finality for the last moment of the phrase. There is a 4-cprg, G-F#-F-Eb with data points, 1-2---1, where F natural is not supported by an AVL. There is a slight decrease to F# which suggests more tension on the passing materials. The chromatic linear progression is overall represented by the same data point, which could suggest that in a sense, some sort of continuity between the last note of the previous phrase into the first note of the next phrase.

With the next 4-cp, Eb-F-Gb-G, this is supported by AVLs 1-4-7-3. Overall this is supported by a slight increase in data points, a slight increase in harmonic tension. But it is more interesting to observe the increase internally from Eb to Gb, from 1 to 7 as this occurs within the phrase, with no decreases marking the end of it. It does however indicate that on a more local level, the cut off marked at bar 255 is at the peak of the highest tension point. There is a chromatic neighbouring movement, G-Gb-G-Gb-G, supported with the AVLs 3-2-1-1-2. Overall, this depicts a decrease, suggesting a subtle sense of relationship between the first and the last point, but the second identified G natural to the third is supported by an increase, aligning with the registral change, G4 to G5. The chromatic neighbouring movement in the first instance represents a decrease in data points, clearly suggesting a sense of familiarity in the harmonic materials, appearances of repeated melodic fragments. The second chromatic neighbouring movement indicated a slight increase which subtly suggests a slight increase in momentum/tension, which is also reinforced by more involvement of the orchestra. There is an overarching movement from bar 254–261, Eb to D, represented by a slight decrease in data points, contrasting our preconceptions about transition sections, but it clearly indicates that larger harmonic movement is not necessary in building momentum. The 7-cp is overall depicted by an increase of data points, varied movements from G to A, which suggests that the chromatic inflection Ab contains a higher amount of tension and diatonic sense prevails, “more stable” than chromaticism. The movement from Bb to D depicts a steady increase, not all notes are supported due to metric segments but clear indicator overall that D is the highest point. The neighbouring movement, D-C#-D, decreases to 0. C# is not supported, clearly indicating a new section, a stronger sense of stability.

Much like earlier sections, there are similarly instances of significant movement that are not correlated with a note on the graph, nineteen instances of significant movement section, and eight of which are unaccounted for:

1. In bar 233, beat 2, there is a decrease of 5. C can be added to the middleground chart as it reinforces the identified neighbouring note in the previous beat. As a result, this would then mean that there is an increase from C to B. On a local level, this increases in tension to the return of the principal note.
2. In bar 234, beat 2, there is a decrease of 5. B can be added again as it will act as a prolongation to the first identified B. In turn this indicates an increase to the passing note, C. But this aligns with the gradual build up in momentum and the passing note contains more tension.
3. In bar 241, beat 2, there is an increase of 5. B can be added, not in the piano reduction but it is the last note of the phrase in bar 241. The higher data point, not eh final moment and it drives to the next musical idea, also creates a neighbouring movement. The increase from A# to B and decreases to A natural, creating a subtle sense of stability.
4. In bars 245 to 246, beats 2 and 1 – 2, there are increases of 4, 5 and a decrease of 7. Three notes can be added, F#-G#-G#, a consonant skip from the previous B to F#, prolonged G#. Overall decrease, similar harmonic contents, a unison note. Also, the first and third notes are metrically displaced, which accounts for its inclusion on the graph. The increase from F# to G# aligns with the arrival of the downbeat.

5. In bar 236, beat 1, there is an increase of 5, C is to be added as it prolongs C in the previous bar, suggesting an increase in tension internally.
6. In bar 259, beat 1, there is a decrease of 5. Ab can be added as this note is reinforced from bar 258, strongly emphasised with the accent and by the full orchestra. The decrease to 0 shows that there are tones in common and similarity in the harmonic content, it could be argued even that this is the true starting point of the 7-cp.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

It can firstly be observed that despite the variance in numbers, the overall contour (fluctuation in numbers) still remains the same, the C section is represented by an overall sense of smaller harmonic movement to its counterparts, A and B. The mean is 3.86, which is very similar in value to the median and mode. Upon further segmentation to its corresponding structural sections, it is particularly interesting to note that the harmonic movement in C is larger than the transition section. This can then imply the fact that larger and significantly contrasting harmonic movement and content is not necessary to stimulate harmonic tension. Other musical parameters clearly come into consideration as well. The mode still remains the same in both segmentation but the median as expected is smaller in the transition section.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

As expected, the use of smaller VL movement such as 0, 1, 2 dominates the section. Larger movement such as 4,5,6 are used less frequently and they only appear in C, not the transition, supporting the results from the statistical analysis. It is also interesting to point out how the common tone recurs consistently in certain bars. For instance, VL0 is used on every beat from bars 232–242 and incidentally, this marks the beginning of the climactic section/new musical idea. So in this case, the lack of VL0 coincides with a new idea. VL0 is also used on every single beat in the transition section, supporting the earlier statement made about the use of smaller numbers to support the transition.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 2, Figures 50 and 57–59)

There are eight BIPs in common between the two sections. AVL 4 to 6 were used most frequently in the first section whilst AVL 4 and 5 were used more in the transition. There is also less large movement in the transition and no series of repeated harmonic movement was present in this section. In bars 252 to 253, the BIPs as seen Table 94, all share 0, even more so on the largest AVL, 5. The most significant VL change would occur between 4-4-5, with the sudden appearance of VL4. Bars 252 marks the end of one sub idea which can denote a release in tension whilst bar 253 with its harmonic contents denote the start of a new idea, a transition and a gradual increase in HM.

Table 94. AVL/BIP Movement in bars 252–253.

BIP	1 0 0 0	1 1 0 0	3 1 0	4 0 0	3 2 0 0
AVL	1	2	4	4	5
Bar	252		253		

With AVL 11, comprising BIP [0344], this occurs in bar 246, beat 2 and it is interesting to note that this BIP is built out of a series of smaller to medium VL numbers. AVL11 also occurs just before the climactic moment and it is situated at the end of the four-bar phrase. There is also a sequence in bars 232-233 with the AVLs, 4-2-6-1-4 and its repetition in bars 234-236 (beat 1), with the AVLs, 5-0-4-1-6. It is interesting to see that there is stagnant numbers in the first appearance of the sequence, 4 to 4 and increasing slightly in the second iteration from 5 to 6. The contour between each set of sounds is the same: descending-ascending-descending-ascending. The change of time signature in bar 233 is also marked by a larger harmonic movement.

It is also interesting to note the role of AVL4 in the C section too:

1. Bar 233, beat 3, AVL4 occurs at the end of the smaller phrase, middle of the bigger phrase
2. Bar 235, beat 1, middle of the phrase connected to the idea in bars 232-233.
3. Bar 239, beat 2, the middle of the phrase into the bigger phrase idea, continued from bar 232, climactic section
4. Bar 242, beat 1, end of the four-bar phrase, connected to bars 243-246, middle of the bigger phrase
5. Bar 243, beat 1, start of the new phrase, part of the continuation at bar 239, middle of a bigger phrase.
6. Bar 244, beat 2, middle of the phrase, connected to the idea in bar 243.
7. Bar 246, beat 2, at the end of the phrase connected to bar 247, middle of the phrase.
8. Bar 249 beat 2, end of the phrase, part of a four-bar unit, continuation.

All eight occurrences share one common theme: they play a role in heightening the tension, all within the middle of the larger phrase. Perhaps they could be perceived as a point of stability as well. As for the transition section, one can observe the following for the use of AVL4:

1. Bar 253, beats 1 and 2, start of the phrase, clear structural indicator.
2. Bar 254, beat 3, start of a new phrase, also a continuation from bar 253.
3. Bar 255, beat 2, register shift, end of the phrase, new subidea/motive
4. Bar 258, beat 1, end of the phrase, part of a larger phrase unit.
5. Bar 259, beat 3, start of a subphrase, part of a larger phrase as well.

The use of AVL4 in this section has varying impacts but its appearance mostly occurs at the start of a phrase, with the only exception in bar 258.

Summary

Much like the earlier sections, bars 172–260 present more instances of linear progressions closely correlating with the AVL data, aligning with the musical activity, as well as more AVL fluctuations and increases in the transition (e.g. 7-prg in bar 172 and the prolongation of F# in bars 219-224). There was an overall increase in HM, and this suggests that there is more intensity in the music and momentum to the return of previous musical materials. There were also more observations relating local to global units of phrases, more indications that an increase or decrease of instrumental layers also attribute to tension, and more instances of significant movement not accounted for. The statistical data revealed a smaller AVL mean as well as the fact that VL movement of less than 3 were used frequently. It can be noted that BIP[002] is used quite frequently and its appearance each time coincides with a more stable moment in the phrase. BIP[012] also appeared to occur whenever there is an increase in the AVL data, potentially suggesting more tension as well. The use of common tones is also a feature in this section. From the beginning of this movement till this point, it can be seen that it is usually on chromatic notes that contain the larger AVLs.

Bars 261 to 299

<u>VL Reduction to AVL Data</u> (Refer to Volume 2: Appendix 2, Figure 51)

The initial 3-prg from D to C indicates an overall increase in harmonic movement, aligning with the quick succession of harmonic changes of the section. The fact that it moves from 0 to 6 so rapidly suggests a significant amount of VL movement within the harmonic movement. There is a 3-prg, C-Bb-A with AVLs 6-2-4. There is an overall general decrease in the harmonic movement, aligning with a momentary release of tension, ending the phrase to an Am chord, a tonal chord as opposed to a dissonant one. The passing note Bb, is on a smaller harmonic movement, reinforcing the notion than passing notes are less significant, this subsequently meant that the movement from Bb to A is an increase, aligning with the first beat of the bar, which has more metrical weight than subsequent beats in the bar. Interestingly, the prolonged A is on the same data point as the A in bar 266, suggesting a connection between the two As.

The consonant skip from A to D is represented by a decrease in data points, from 4 to 1. This is interesting as D marks the reiteration of the materials from bar 261, restated at an octave lower, represented by a smaller number. Firstly, this reinforces the notion that the beginning of each phrase in the cadenza begins on a stable chord/sonority, setting up expectations. Interestingly, the repetition begins on one data point higher than its first appearance. Whilst the materials are restated an octave lower, there is a sense of increased tension, more emphasis on its reappearance. The repetition of D to C is supported by an overall increase in data points, 1-4-4, which begins one data points higher than its first appearance. But Db and C are on the same data point, not a steady increase like the first appearance, which indicates that it is less of a surprise, which explains the smaller number.

The movement D-C-B in bars 261–262 and bars 268–269 are represented by AVLs 0-7-5 and 1-7-5. It is clear that both are very similar numbers and in the second instance, it is one data point higher, suggesting that the reiteration is more emphasised. Unlike the other 3-prg, there is a decrease in the AVL from C to B, perhaps this is due to the accent on C, as well as the fact that this occurs so early on in the phrase, that there is a need to provide more of a sense of stability/resolve, that the climactic moment will not begin so early on. The overall prolongation of C from bars 265–272 is represented by a decrease in data points. This is interesting as it aligns with the registral descent but it can also subtly suggest that the first appearance of these materials is critical in setting up the momentum of the section. Unlike the results of the 3-prg identified at bar 265, there is an overall increase in this occurrence. There was a decrease from C to Bb, like the first one but it can perhaps be argued that the increase on A aligns with the notion that the materials are being extended, varied from the first appearance. Furthermore, this 3-prg is actually part of a slightly longer progression, a 4-prg down to G# in bar 277. This data point is substantially smaller than A and C#, the first note of the 3-prg. This suggests that perhaps a sense of stability can be felt at this moment, the end of a subphrase. With the neighbouring note and prolongation of G#, both data points are the same, the first and third ones on G#, with Fx on a smaller data point despite occurring on the downbeat of the bar. This suggests how metre and metrical weighting is not that significant in this section and horizontal movement is more of a priority, it is evident that Fx is an embellishment.

The unfolding from G# to E has an overall increase and is part of a bigger phrase, driving to the end of the first part of the solo section, an increase of tension, coinciding with the upcoming fluctuation of dynamics. The 4-cp from E to C# is depicted by an overall decrease in data points, release of tension of the phrase, coinciding with the first half of the idea, there is an increase from D to C#, suggesting some emphasis on D. The first note of the *più mosso* is on a data point significantly higher than the start of the cadenza. This suggests that despite arriving on a firm diatonic chord, it is still on a high point of tension, where the orchestra returns, with more of a sense of urgency as the orchestra creeps back in and with a faster tempo. With the 3-cp and prolongation, there is an overall increase in data points, aligning with the build-up, developing the initial music materials. There was a slight decrease in the prolongation, denoting stability and connection. But then it increases to B, which reaffirms the weaker role of the passing note in this context. The consonant movement from B to G depicts a decrease in data points, perhaps to pre-empt the true climactic moment later on, but nonetheless, these two notes are on a larger data point so a sense of statistically larger movement can be seen on a broader level, with more tension in these few bars as opposed to the start of the section. The movement from G to F# has a slight increase in data points, aligning with the climactic point of the phrase/section. Its subsequent reappearance, its prolonged presence is represented by a significant decrease, reaffirming the notion that the previous F# is the highest tension point of the phrase. Interestingly, the arpeggio that follows it is represented by a slight increase in the data points, indicated a slight increase in tension prior to the new phrase at bar 300. The decrease from F# to D correlates with the metric placement, with the second beat of the bar, privileging the outer notes. But the subsequent 3-cp across the span of a bar is represented by a steady/constant decrease 2-1-0, rounding off the phrased section, a release of tension before the arrival of the next section.

There are thirteen instances of significant movement, nine of which are unaccounted for without a note on the middleground VL graph.

1. In bar 267, on beat 2, D is most appropriate for the middleground chart, acting as an anacrusis to D in bar 268. Obviously, the second one is still more significant but the first one needs to be included to account for its prior appearance.
2. In. bar 273, on beat 2, F# would be the most appropriate, providing an inner voice/movement to the outer parts, a strong pull for F# to return to G.
3. In bars 280 and 281, there are three consecutive significant movements, +4, -5 and +4. Three notes are to be added here. G# at the start of bar 280, a consonant skip from the first identified E, which shows that there is an increase in the melody before it decreases, moving down the register. E can be added to the last bear of bar 280, a huge decrease from the first identified E, which suggests a sense of stability/release in tension. Subsequently, Eb can be added immediately on the next data point, as this marks the first actual appearance of Eb. Its prolongation depicts a decrease, aligning with the overall contour of the phrase as it drives towards the end of the section.
4. In bar 283, on beat 2, G# would be the most appropriate. It creates a neighbouring movement between the two As, reaffirming the strong sense of diatonicism in these few bars: a lower number, a passing note idea.
5. In bar 289, on beat 2, B would be the most appropriate for addition, prolongs the first B, a huge decrease which suggests a sense of stability in this phrase, similar tones, on the second beat, which is slightly weaker, a release of tension.
6. In bar 294, on beat 1, B should be added, which then creates a consonant skip. It is important for the middleground, as there is a change of time signature, with a full chord by the orchestra. This reinforces the E minor sonority set up by previous beats and thus, this increase can suggest more tension.
7. In bar 295 on beat 2, D can be added to the middleground, reinforcing the D major sonority, with a partial arpeggio, F#-D-F#. There is a large decrease in AVL to D but the actual root position of the note indicates stability as opposed to its appearance in its first inversion form.

<u>Statistical Analysis</u>

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

In comparison to its preceding section, the mean is similar on the whole and is only slightly larger, a subtle sense of increased tension within the cadenza passage. Naturally, the median supports the uncovered mean, but it is interesting to note that 1 and 4 are two of the most frequently used harmonic movement in this section despite 3 being the mean. Upon further segmentation into its two structural idea, it can be noted that the first half is significantly larger than the second half. This actually correlates to the variety of harmonic movement in these bars, the quick and swift changes between seemingly unrelated key areas and there is a stronger sense of pitch centres in the second half, thus accounting for the smaller harmonic movement. It also suggests that there is a higher amount of tension in the first half of the cadenza than the second half. The median and mode in bars 261–282 are exactly the same as the mean but it is interesting to note that the mode is 1 for the second half (whilst the mean and median are 2). This reinforces the notion that the movement between each set of sounds are connected by semitonal movement as opposed to the use of larger movement.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)
Much like the preceding sections, there is an overwhelmingly large use of smaller movement like 0, 1 and 2 between each chord. In fact, it can be observed that every transformation in the second segment consists of at least one common tone. The use of larger VL movement such as 4 and 5 are strongly supported with the use of 0 (multiple 0s at certain points). Also, the use of larger VL movement in the second segment all occur within the same bar, bar 294, the end of one melodic idea within the section. This also marked the exit of the orchestra as well. Although VL5 is not used in the first section, there is more of a use of 4 and naturally, they are supported with a combination of smaller numbers, in most cases with 0 or 1 but there is one instance where 2 is the smaller VL movement, situated at the start of bar 273, marking the first of the 4+3 grouping.

<u>BIP Local Observations</u> (Refer to Volume 2: Appendix 2, Figures 51 and 57–59)
One striking point to be made with this section is that it is quite large compared to previous sections, but it is interesting to note that there is less variety and more repeated use of certain BIPs. There are four instances of consecutive harmonic movement in this section. Incidentally, these occurrences appear only towards the end of the cadenza. This strongly reinforces the notion that the cadenza goes through a series of different harmonic regions, with no firm tonal centre. With [0011], there is a similar representation in the score, full chord in the right hand, supported by an extra, sometimes dissonant note in the left hand. In bar 281, the following BIPs were used: [0011] [0002] [0011], the last three beats of the bar. With [0002], this can be perceived to be more harmonically stable, Gm chord in second inversion, this is actually supported with the use of more common tones than the other two BIPs. Although this BIP uses 2, a slightly larger VL movement than the other two, it is

compensated with the use of more common tones. The fact that this consecutive use of BIPs occur towards the end of the solo passage can suggest a sense of stability, and it in fact is actually driving towards a firm Am sonority in bar 283. From a metrical perspective, [0002] occurs on the third beat of the bar whilst [0011] appears on the second and fourth beats, with more weight on the middle BIP. Therefore, despite the fact that they contain the same AVL, a closer inspection of the BIP contents reveal that more thought should be given to the VL motion with the BIP.

In bar 284, the following BIPs occur, [011] [011] and [002], AVL2. It is firstly interesting to point out this consecutive harmonic movement is of the same amount as bar 281. The fact that this reoccurs again so quickly after the last appearance could potentially suggest that part two of the solo passage, the jazzy feature begins with more stability. There is more of a sense of key. The first two BIPs are the same whilst the last one contains a shift of a tone with one more common tone. It can be argued that [002] can be perceived to have more structural weight due to this and this is reinforced in the registral shift in the left hand where the lower register is used, a huge shift in the octave movement. [011] in the first two BIPs are relatively similar as the harmonic contents do simply shift by a semitone. In bars 289–291, BIPs [0001] [001] [0001] occurred. The occurrence of consecutive AVL1 across these bars are particularly distinctive as they occur right at the start of the phrase. This therefore suggests the notion that a sense of stability is established at the start of this new phrase. It can be argued that the first and third BIP are more stable than the second. This can actually be justified with other surrounding musical factors. The first BIP, with the absence of the orchestra, this shifts back to a solo idea. The third BIP is metrically significant, as it occurs on the downbeat of the bar, reinforced by an accent, with the shift of the time signature too. This passage is also setting up the climactic moment of the phrase, occurring two bars after bar 291.

In bars 295–297, there is an interesting recurrence of AVL 1,0,1,0 with the BIPs [0001] [0000] [0001] [000], alternative AVLs. The outer chords are the same, D major. This occurs within a sequence-like idea, with the second iteration occurring on bar 297, on smaller harmonic movement, suggesting that its first appearance has more structural weight. The idea that this alternates between [1010] indicates a sense of stability and connection between the two phrases. It is also interesting to note that there is one less 0 used in the second appearance of AVL0. This is a subtle representation of more tension.

Bars 300 to 327

VL Reduction to AVL Data (Refer to Volume 2: Appendix 2, Figure 52)

Table 95. AVL in bars 300–310.

Note	B	C	C#	D	Eb	F	F#	G
AVL	0	1	7	5	7	4	4	5
Bar	300	301	302	303	304	306	308	310

Table 95 above presents the 8-cp in the opening bars of this section. There is clearly an overall increase in the value of data points, which actually indicates that there is an increase in tension as the music reaches the climactic moment of the solo section. This correlates with other surrounding musical parameters such as the increase in dynamics, an ascent in the register and the return of the orchestra. It can however be noted that the data point on G is not the largest in the 8-prg, where C# and Eb contains the larger number, both on AVL7. There are some similarities that can be drawn between the two notes, both occur in the 3/8 bars, a point of transition between the subphrases. The first actually coincides with bridging the neighbouring movement ideas, bars 300–301 with the transition and bar 303. They also both depict an overall ascent in the register, where the second instance coincides with a fragmented idea, a transition between 2/4, 3/8 and 2/4. These two points therefore contain a significant amount of tension due to their structural placement in the music. Furthermore, these two notes are chromatic tones and as they occur at what can be initially established as a diatonic region, there is a natural sense of instability with these notes.

It can be observed that the largest amount of harmonic movement, the significant increase occurs at the start from B to C#. This quickly establishes the idea that tension can be felt early on in the phrase. Following on from earlier statements, there is a decrease in data points from C# to D and an increase from D to Eb. This reaffirms the notion that diatonic sonorities are privileged in this context and they have more stability than the chromatic tones. Interestingly, after Eb, the movement to F and F# is represented by a decrease in data points, despite the crescendo and ascent in the register. This could denote a moment of stability before the climactic moment of the section. Also, F and F# are on the same data point, this suggests that there is some connection between the musical materials from F to F# and this is actually reflected in the music itself as bar 308 is essentially a semitone higher than bar 306. Finally, there is a slight increase from F# to G, from 4 to 5, aligning with the downbeat of the bar, the peak or the highest point of the section. With the subsequent movement, G-Ab-G-

G#-A, across bars 310-313, this was supported with the AVL values 5-7-8---6, where G# was not on a specific DP. Overall, there is an increase to the highest note of the section, indicating the highest point of tension. Interestingly, this tension continues to increase to G, almost like a neighbouring movement, but as G is the last diatonic note of the phrase/section, this indicates that the end of the section contains a significantly high amount of tension. The dissonance and unexpected sonorities before decreasing to a slightly smaller, but still relatively large harmonic movement. The chromatic tone, G# is unsupported by any data point, as it falls on the second half of the beat, but it can be implied that it will fall on a slightly smaller harmonic movement, perhaps 7.

In the coda section, it can firstly be noted that none of the notes within the unfolding are located on set/firm data points, with the only exception being at bar 325, the final chord of the section, just at the end of the cadence, a longer chord is applied here. The prolongation of A, part 1 from bars 313–318, decreases from 6 to 1, a significant decrease, demonstrates the emphasis that is necessary on the first appearance as it reinforces the return of the introductory materials. The decrease to 1 by bar 318 can suggest stability after the contrasting chords in the preceding section. From this particular data point to the end, there is a slight increase in data points, suggesting an increase of tension to the end of the movement. This in fact aligns with the increase of dynamics as well as the change in rhythmic materials. But overall, the movement from A to A, bars 313 to the end, is denoted by a general decrease in data points, aligning with a decrease in tension, a sense of resolution.

With the subsequent series of unfoldings, the following observations can be made:

1. G to C, descending movement – data points decreases slightly
2. C to A, ascending movement – data points increases slightly
3. A to A, descending movement – data point increases significantly
4. C to A, descending movement – data point decreases significantly.

The only unfolding in the set that does not correlate with pre-conceived notions, the movement decreases but the data point increases, especially with the second last unfolding, just before the climactic moment at bar 324, which builds up the intensity and it is actually sustained till the final unfolding enters.

There are ten instances of significant movement in this final section, with only two instances accounted for, four of the remaining eight however occurs during the unfolding, which will need to be treated carefully:

1. In bar 310, there is a –4 on beat 2. G should be added to the middleground chart. Although it falls on the second half of the beat, the right hand dominates the melody in this section, which helps support and reinforce G on the first beat. The decrease would then mean that there is a sense of slightly stability at the start of the climactic moment.
2. In bars 314–315, there is a +6 and –4. Two As can be added to these points as this will then reinforce and support the first A identified at the start of bar 313. The slight increase of the second A indicates a larger amount of tension on the upbeat to bar 315, a stronger pull/more emphasis on the second beat. This is then resolved by a large decrease on the third A, demonstrating a sense of release of tension on the downbeat of the bar.
3. In bar 317, there was a decrease of 6. AN additional A can be added to this data point, as this reinforces the A sonority as well as indicating a release in tension before the opening materials are repeated again. On the overall scope, this reinforces the decline or decrease in harmonic movement on the approach to bar 318.
4. The next two unaccounted data points can be supported with the addition of A. The A minor sonority is sustained throughout the entire coda but it is particularly more evident in the reiteration at bar 318 as A is reinforced on the first beat of every bar. This would then illustrate how the amount of harmonic tension, essentially an increase till bar 322, can be reflected in the prolongation as well as the unfolding. So it is not entirely necessary for the foreground melodies, sounds that are more obvious to our ears to reflect tension, harmonies that contain common tones can also depict and represent tension.
5. With the last two unaccounted data points, D is the most appropriate choice for addition, using the same line with the added As, creates a dominant/subdominant chord relation to the pitch centre, these two Ds will evidently be connected to the final A in bar 327 and as these two Ds are prolonged across the two bars, it demonstrates or depicts an increase in data points, contrasting the descending harmonic movement in the unfolding. So there are two competing moments of tension here, one increase while the other decreases, it actually demonstrates that there is a sense of resolve in the unfolding, a stepwise descent to the tonic but the upper voices maintain a high

amount of tension, maintaining the sonority, climactic feel before the final declaration of the chord in bar 325.

Statistical Analysis

Mean, median, mode (Refer to Volume 2: Appendix 2, Figure 53)

What is immediately striking from the overall mean in this section is that it is significantly larger than the cadenza, this is quite unusual as one would associate a smaller amount of movement with the conclusion of the work. However, this parallels to the results obtained at the beginning of the movement: 4.15 to 4.6. As this is slightly smaller than the beginning, it can still be argued that some release can be seen at the end of the first movement, it may even be the case that a larger harmonic movement at the end symbolises continuity to the next movement. In fact, if the two segments are further divided into its solo and coda sections, it is even more interesting to note that the mean is just slightly larger in the coda. However, in comparison to the preceding segments, the solo sections depict 4-2-4 (mean), depicting the notion that the outer phrases contain the most amount of tension. When comparing the contents of the median and mode in the subsections though, it can be observed that the median is slightly larger in the first part. The contents in the second are more consistent, 3 but 1 is most commonly used as the mode in the first part.

VL Movement (Refer to Volume 2: Appendix 2, Figure 56)

As anticipated, the most commonly used VL numbers are 0, 1, 2 again. It can be noted that the use of VL6 is notably absent in this last section, differing slightly from the beginning, suggesting the notion as well as reinforcing the use of smaller VL movement towards the end of the movement. This is similarly echoed in the segmentation into its two respective sections. Interestingly, VL4 in the first half appears consecutively across bars 303 and 304, the peak of the phrase of bar 300. This is subsequently followed by VL5 on the next beat, subtly reinforcing the idea that tension can be felt through the individual VL movement in each chord. With the exception of the first beat of bar 313, it is interesting to point out that almost every transformation in the coda is supported with at least one common tone, not only will this then demonstrate continuity but it binds the entire section together as one larger unit, subtly providing a sense of stability, despite the overall larger harmonic movement.

BIP Local Observations (Refer to Volume 2: Appendix 2, Figures 52 and 57–59)

There are two instances of consecutive harmonic movement in this final segment of the movement. As shown in Table 96, the first occurs between bars 300–301, used immediately after the first beat of the section and the second occurs closer to the end of the section, this could suggest/evoke a sense of stability towards the end of the movement.

Table 96. BIP in Bars 300–301.

BIP	[0001]	[0001]	[0001]	[0001]
Bar	300	301		

The start of the last part of the solo section is marked by a series of chords that move by a semitone and connected by at least two common tones. The use of such a small harmonic movement at the start of the phrase can suggest a sense of stability, and it can be felt before it significantly increases to 7 in the second beat of bar 301. It can even be argued that it is pre-empted by BIP[001] as it comprises of 1 less 0, a subtle representation that larger harmonic is to come. It can also be noted that the pitch contents of these chords simply pivot between a Bm and D7 chord as well. These AVL1 movement is also preceded by AVL0 (so 0-1...... -7), depicting a steady increase in harmonic movement. The large harmonic movement that follows this is sustained till bar 305. This indicates that there is a correlation between larger harmonic movement to an increase of tension in this context and the peak of the climax consists of moderately sized harmonic movement as opposed to larger ones.

With the recurring use of AVL8, the following BIP and its movement can be seen in Tables 97 and 98:

Table 97. BIP in bars 322–323.

BIP	[001223]	[000134]	[000134]
Bar	322		323

Table 98. VL Movement between [00122] and [000134].

[001223]		[000134]
3 2 2 1 0 0	+1 +1 -1 -1	4 3 1 0 0 0

There are two different sets of BIP, with the second and third pairs being the same. This shows a sense of continuity across the two bars. The transformation between AVL8, with its inner movement between each VL numbers could suggest that [000134] is more significant, due to the presence of VL4. Although the VL movement do cancel out and there is an equal amount of movement between chords and it is reinforced by the presence of an extra 0, other musical factors like rhythm strongly suggests that there is more emphasis on beat 2 of bar 232 leading into bar 323, just one beat before the cadential moment of the coda. The large amount of harmonic movement right before the end of the piece suggests a high amount of tension leading to the final cadence.

There is a gradual decrease of harmonic movement through AVLs 5-3-2-1 and BIPs [000023], [000012], [000011] and [0000001] across bars 318–320. This coincides with the start of a new phrase, with more stability being established at the start, this is clearly denoted by the steady decrease in data points and more use of common tones. It can be noted that the initial decrease initially correlates with the melodic contour but the ascent is supported by a decrease in the data points, where not every ascent in the register will be supported by an increase of harmonic movement.

Summary

From bars 261 till the end, similar observations were made between the AVL data and the VL analysis. It is interesting to highlight that the beginning of each phrase in the cadenza begins on a "stable" chord/sonority, on a smaller AVL value. Whilst there were moments in the music where the AVL data did not align with the VL reduction and the music, there were more similarities and more moments where the music and VL reduction aligns with the AVL data and the notion of tension/release in this movement than the Hindemith case study. There were however more instances of unaccounted significant movement in this music that required closer analysis. VL movement of 0, 1, 2 were used more frequently in the cadenza, much like earlier sections with more repeated use of existing BIP. There was also a general decrease of DP meaning that there were more common tones, aligning with the end of the movement, a sense of resolution. What is particularly interesting is that this section contained a larger AVL mean from the statistical analysis, perhaps suggesting that this movement is to lead onto the second movement.

BIP Global Observations
This section highlights recurring BIP and AVL features in its segmentations within its formal structure. The following table, which can also be found in Volume 2: Appendix 2, Figure 55, presents the global view of VL movement:

Table 99. Global VL Data within its Formal Organisation.

	Introduction	Exposition	Development	Recapitulation	Cadenza	Coda	Total
Bars	1 – 32 (32)	33 – 115 (83)	116 – 177 (62)	178 – 260 (83)	261 – 312 (52)	313 – 327 (15)	
VL							
0	64	241	206	263	194	97	1065
1	64	137	102	124	120	25	672
2	49	120	95	119	88	22	493
3	12	50	61	53	18	8	202
4	8	34	32	26	9	3	102
5	9	9	18	10	4	1	51
6	3	2	4	5	0	0	14

BIP Local Observations
Table 100. Local VL Data within its Formal Organisation.

	Intro (32)			Exp. (83)			Dvp. (62)			Recap. (83)					Cad. (52)			Coda (15)
	x	x^1	a	a^1	b	c + trans	b^1	c^1	trans	a	a^1	b	c	trans.	y	y^1	y^2	x^2
Bar	1-14 (14)	15-32 (18)	33-43 (11)	44-63 (19)	64-86 (23)	87-115 (29)	116-141 (25)	142-171 (29)	172-177 (6)	178-188 (11)	189-208 (20)	209-231 (23)	232-252 (21)	253-260 (8)	261-282 (22)	283-299 (17)	300-312 (13)	313-327 (15)
VL																		
0	28	38	39	75	48	79	80	102	24	41	75	49	52	46	66	82	46	97
1	22	42	16	27	37	57	33	62	7	15	29	29	33	18	66	31	23	25
2	23	26	10	29	37	44	33	51	11	9	28	39	27	16	55	16	17	22
3	5	7	8	8	17	17	32	22	7	10	10	18	8	7	7	6	5	8
4	4	4	0	7	13	14	11	20	1	0	5	14	6	1	4	1	4	3
5	4	5	0	1	4	4	6	10	2	2	2	2	4	0	0	1	3	1
6	1	2	1	0	1	0	0	2	2	0	0	2	3	0	0	0	0	0

BIP Global Observations

From this table, it can be noted that on the whole, there are more occurences of smaller VL movement is used, which is reflected especially in VL0, 1, 2. The use of larger VL movement such as 5 and 6 are much less preferred and clearly used in conjunction with smaller numbers to denote a sense of stability. In all six sections, VL0 is the most commonly used VL number, reinforcing the importance of the core of neo-Riemannian inspired operations, retaining common tones between chords amongst other significantly larger harmonic movement. Despite the core sections containing the same number of bars, it is especially interesting to observe the more frequent use of 0 in the recap. VL 1, 2, and 4 occurs less frequently in the recap but VL 3, 5, and 6 appears more often in the recapitulation. It can therefore be suggested that with the more frequent use of larger VL movement, smaller VL movement such as 0 is necessary to support this sharp change, denoting a sense of stability. Whilst on the one hand, the large amount of VL0 would suggest that the recap is slightly more stable, the presence of larger VL movement indicates otherwise. It is interesting to note that despite the significant tonal changes in the cadenza, there is a large amount of common-tone movement and no use of VL 6. This thus suggests and reinforces the notion that significant key changes can be created by smaller VL (and overall AVL) movement.

As the thematic contents for the introduction and coda are relatively similar, it is useful to compare the results. Despite the introduction containing double the number of bars to the coda, VL0 is used much more in the coda. In all, this can therefore suggest that there is a sense of resolution at the end of the movement, with large use of VL0, reduced frequency of larger VL numbers such as 3 to 6. It can perhaps be argued that larger VL contents appear at the start as a way to create tension. As anticipated, the largest amount of VL movement that can be considered as a moderate size to larger ones occur in the development section. However, it can also be seen that this is supported by much smaller VL numbers to support the large VL movement. When examining the core section, it is blatantly obvious that the development has the most use of larger VL movement but it is interesting to note that the shift to the use of larger VL movement in the development resulted in lesser use of smaller VL movement in the development. It seems that the core point or use of larger VL movement has to include the use of smaller VL movement, like 0.

BIP Local Observations

Table 100 presents the data from local levels. (This table can also be found in Volume 2: Appendix 2, Figure 56. From the table, it can firstly be noted that between the two sections at the very beginning, it can firstly be highlighted that despite more presence of 0 in x1, there is more use of larger VL, 1 to 6, as opposed to the first. This supports the general notion that x1 builds upon the harmonic tension established in the opening. When comparing the two “a” sections in the exposition and recapitulation, it is worth noting that the VL data from 0 to 4 all contain the same amount of movement, VL0, 1, 2 4, consists of increases, 3 remains stagnant. However, there is no use of VL6 in the recap. This thus suggests the more common use of smaller VL movement upon the return of familiar materials. With the last appearance of x in the coda, it can immediately be noted that there is an increased use of 0 and much lesser use of larger VL numbers. This is also reflected in other smaller VL numbers too, like 1 and 2. Therefore, a subtle representation of stability and a release of tension can be seen at the end of the movement. In the two “b” sections, it is interesting to point out that they both share very similar VL data. It can be noted that there is fewer use of larger VL movement, 5 and 6 in the recap, a subtle representation of less harmonic tension on its reappearance. When comparing it to its variant, b1, there is an overwhelmingly larger use of smaller VL movement and less so of larger VL numbers. This in all represents a notion of stability for the beginning of the development section. VL5 however is used the most in b1 than the outer b sections. Although the two clear cut transitional materials contain a similar number of bars, the second appearance of the transition can be perceived to be more stable due to the use of smaller VL numbers, more frequently used. There was no use of VL5 and 6 in the second transition too. C1 in the development section can be perceived as one that contains much more tension than its first appearance. This is due to the more frequent appearance of larger VL numbers such as 4, 5, 6. However, this is supported by smaller VL numbers, with very frequent use of VL0. When comparing all three appearances of the c section, they all contain very similar VL data, from most to least frequent use of VL movement. And unexpectedly, the use of individual VL numbers larger than 3 are widely used from c till the end of the transition. Through the examination of individual VL movement data in the cadenza, it can be observed that y1 contains the most amount of stability due to the large use of 0. This is reinforced by fewer use of larger harmonic movement as well. As y2 contains the least number of bars, it is natural for the VL numbers to be substantially smaller but a parallel can be drawn between y and y2 as the largest amount of harmonic movement can be seen in the outer sections. Lastly, it should be highlighted just from looking at the overall VL movement from the transition to the end that there is minimal use of larger VL movement, an overwhelming use of smaller VL movement can be seen, which actually correlates with the overall structure of the movement, more common tones and smaller movement towards the end.

Global View of AVL

Table 101. Global View: Statistical Data within its formal organisation.

	Introduction	Exposition (A)	Development (B)	Recapitulation (A1)	Cadenza	Coda
Bars	1 – 32 (32)	33 – 115 (83)	116 – 177 (62)	178 – 260 (83)	261 – 312 (52)	313 – 327 (15)
Mean	4.63215	3.9989	4.962	3.80792	3.5766	4.19
Median	4	4.0625	4.666	4	3.333	3
Mode	3	3.375	4.16065	3.6	2	3
Total	295	726	718	790	406	113

Local View of AVL

Table 102. Local View: Statistical Data within its formal organisation.

	Intro (32)		Exposition (A) (83)				Development (B) (62)			Recapitulation (A1) (83)					Cadenza (52)			Coda (15)
	x	x1	a	a1	b	c + trans.	b1	c1	trans.	a	a1	b	c	trans.	y	y1	y2	x2
Bars	1-14 (14)	15-32 (18)	33-43 (11)	44-63 (19)	64-86 (23)	87-115 (29)	116-141 (25)	142-171 (29)	172-177 (6)	178-188 (11)	189-208 (20)	209-231 (23)	232-252 (21)	253-260 (8)	261-282 (22)	283-299 (17)	300-312 (13)	313-327 (15)
Mean	4.7778	4.4865	3.1429	3.5366	5	4.3163	4.6087	5.2112	5.066	3.3182	3.5365	5.0625	3.8615	3.2609	4.18	2.43	4.12	4.19
Median	4	4	3	4	5	4.5	4	5	5	3	4	5	4	4	4	2	4	3
Mode	3	3	2	3	4	4.5	3.5	4,6	4	2	4	4	4	4	4	1	1	3
Total	129	166	66	145	240	275	272	370	76	73	145	243	251	78	213	90	103	113

Global View of AVL

Table 101 presents the statistical data of the AVL in its key sections. This can also be found in Volume 2: Appendix 2, Figure 53. From this table, unsurprisingly, the statistical data gathered from the development is the largest in the entire movement. This section will evidently contain unexpected sonorities, sharp changes and unrelated harmonies and this is reflected in all three subcategories, median and mode. It is particularly interesting to observe that the three largest mean data values are situated in the introduction, development and coda. This can have a significant role in our perception of tension and release, as it can be suggested from these results that these sections hold slightly more tension than its inner sections. The exposition contains stability, same with the recapitulation and cadenza. As a result, the arc of the movement can be likened to a typical story (beginning sets up plot and characters, middle sections reveal problems and obstacles, followed by the climax and the ending). The "A" materials contain very similar results to the recapitulation, with both sections consist of the same number of bars. The mean can be seen to be larger in the exposition, possibly indicating that the exposition has slightly more AVL tension. The median reflects this as well, 4.0625 decreases to 4. Interestingly, the mode is larger in the recapitulation than the exposition, reflecting that larger harmonic movement is perhaps more apparent in the recapitulation but they do not necessarily occur consecutively and are instead spread out. This is again reflected in the grand total of these sections, where the total of the recapitulation is larger than the exposition.

On the whole, it can be noted that the same materials appear in the introduction and the coda with similar results. The median in the introduction is slightly larger than the coda, potentially denoting a release of tension at the end of the movement. Naturally, this would mean that the median identified in the exposition would be larger than the coda, 4 > 3. Interestingly, both sections contain the same mode, 3. This could be the main part of the statistical data, same result, that binds the two sections together. Evidently, as the number of bars in the coda is half of the introduction, the total number will be substantially smaller. The increase in the overall results perhaps suggests that the reappearance of the opening materials is significant and more tension can be felt as a result, as it maintains the almost similar result in the median as well. Naturally, the mode is much smaller in the cadenza than the coda, smaller harmonic movement is clearly preferred in the cadenza. Despite the shift/change in musical style and character, the results from this section is the smallest of the entire movement. Perhaps due to its jazzy nature, meaning there is more parsimonious movement between each chord? This is quite bizarre, despite the constant harmonic shifts. This could be a subtle representation that the piece is coming to an end. The result from the median reflects the mean, which is actually a more accurate result as the mean is just an average, and the median locates the middle number.

Local View of AVL

Much like the global view, Table 102, which can also be found in Volume 2: Appendix 2, Figure 54, presents data in localised sections. From the data, it can be noted that there was very similar data in both sections, x and x1, which is reflected across the mean, median and mode. But it should be pointed out that the mean is smaller in the second instance. This could suggest that the biggest element of surprise is at the start, a larger harmonic movement to set up the tension and intensity of the movement. When corelating the results in the introduction with the results in the coda, it is interesting to point that the data is smaller than both sections in the introduction. This thus depicts an overall decrease in the harmonic tension of the music. The mode is still the same but the median reflects the smaller mean,3 as opposed to 4s in the introduction. Unlike the introduction, the repeated materials, a1, is supported by a higher set of data points than a, more harmonic tension in the exposition (which is reinforced by a larger harmonic movement than b). The different roles and significance of a and a1 in the exposition and recapitulation can be described with repeated materials. When comparing this to its reappearance at the recap, the results are fairly similar, a1 > a but a in the recapitulation is larger than the introduction, which suggests a renewed emphasis on the core materials. The median and mode remains the same in a for both but the mode is larger in a1 of the recapitulation. Much like the exposition, it can be observed that the reappearance of b in the recapitulation is supported by a slightly larger mean, but with the same median and mode in both exposition and recapitulation. This reinforces the reappearance of familiar materials, correlating with a greater amount of tension. Unlike the exposition, where the c and transitional materials is supported by an increase in data points, its reappearance in the recapitulation is correlated with gradual decreases in the data points. It can be seen though, that there is a close proximity between the numbers in the exposition and development and the results link, acting as a form of transition. The decrease in the recapitulation however, could suggest that there is a sense of false illusion that we have reached the end, yet a larger mean in the cadenza indicates otherwise. With the core "b" idea, it is immediately interesting to highlight that the variant, b1, is slightly smaller across all three statistical results. This could be due to several reasons. B1 in the development appears structurally at the start of the section, whilst b occurs as the third subsection in the exposition and recapitulation. As b1 appears first, it is plausible that the smaller overall harmonic contents aids in setting up the tension of the new section. This is then followed by an increase in harmonic movement, coinciding with the middle part of the section, that a higher amount of tension is to be expected from the climax. Interestingly, the last subsection of the development is supported by a relatively large harmonic movement, one that is rather close in value to c1. This thus suggests that the transitional section sustains the large amount of tension from c1 and aids in driving the music back to the recapitulation. In all three appearances, the transitions contain significantly different harmonic contents, this might perhaps be due to its different functions. The last of which is significantly smaller but this could perhaps be perceived as a brief moment of stability before the cadenza. Despite the contrasting key centres in the cadenza, it is interesting to point out that the first and third sections are relatively similar in their results. This could potentially suggest that the segmentation of these sections can be likened to a neighbouring movement elaboration, y1 is simply embellishment. Y1 is supported by a much smaller set of results to its outer ones. It should also be highlighted that the mode in y2 is significantly smaller than the mean, almost suggesting a notion of stability despite the overall larger mean. Unlike the global view which depicted a decrease in the mean, this local perspective suggests that there is actually an increase in harmonic tension at the end of the movement. This could also suggest a structural emphasis on the coda itself, the reappearance of familiar materials and that y2 acts as a form of transition back to the coda. So although the mean is the smallest of the x materials, there is a dual function when examining the context of its appearance. In the broader scheme of things, it can perhaps be argued that y ultimately leads back to x2 due to the similar mean content as well as a subtle decrease in the median and mode contents. Whilst the subsections in the development represent the archetypal start-climax-end statistical data, the middle section of the cadenza is supported by a significantly smaller number than its counterparts. This can be strongly attributed to other surrounding parameters, change of rhythm and tonality perhaps, reintroduction of the orchestra. There is the same mode on y2, which shows similarity and frequent use of smaller harmonic movement.

BCxVL Data

Bars 1–33 (Refer to Volume 2: Appendix 2, Figures 60–61)

In HyM level 3 for bars 1–14, the longer phrase coincides with an additional beat class layer. The absence of one beat class layer towards the end of the section coincides with the end of the opening materials. Longer beat classes, larger than 4, occurs predominantly after the opening bars, the first phrase. With the movement [31][13], this is one particular feature that occurs quite frequently in the opening bars and at times they appear simultaneously across different beat class levels

It can be seen towards the end of this segment that there is a strong correlation between longer bc and harmonic movement. In the last phrase, two factors have to be taken into consideration, the repeated use of bc4 in bc level 4 and the simultaneous use of bc8. The harmonic movement clearly indicates a steady increase from 2 to 7. It can perhaps be argued that despite the presence of stagnant/steady rhythmic values, it is a vehicle for building tension. This is supported by the slightly more varied bc values in the middle of the increase of the harmonic movement, between 3 and 6, with bc[313]. In comparison, the presence of two bc8 closer to the start of the movement is supported by a slight decrease in harmonic movement, denoting stability. This is also supported by the use of bc13 in bc level 1. Curiously, the gradual addition of other bc layers did not indicate an increase in tension. It is then interesting to note the correlation between level 3 and 2 at this particular moment. In L3, [13] occurs three times, supported by a decrease in harmonic movement. Similarly, in level 2, although [13] occurs four times, the first three times, like level 3, is represented by a decrease in harmonic movement. This thus suggests a subtle connection between consecutive use of rhythmic materials and harmonic movement. There is incongruence between the hypermeasures and the shaping of the soprano line, particularly in HyM L3. This suggests that an analytical view, particularly a Schenkerian perspective, is not entirely accurate and rhythmic elements will need to be considered. There is also a segment towards the end of the section where bc4 is echoed across three different bc layers and in this scenario, this is supported by almost the same amount of harmonic movement, denoting a subtle sense of stability. The end of the opening idea/start of the new phrase is also greeted with a decrease in harmonic movement as well as a longer rhythm, supported by two bc levels, not just one.

As for bars 15–32, it is interesting to note how the HyM levels have developed from their first appearance: 4 ½ increases to 6 1/2 , 8 to 7 ½ and 1 ½ to 4. The overall consensus that the thematic materials are developed further here. Further transitional materials can also be seen. The expansion of the last phrase is supported by an increase in bc layers as well. [13][31] are recurring features of the section, bars 1-15 included. They take turns to appear across different bc levels. Its role varies across different segments – which level, supporting key notes, as this will then indicate why there is an increase or decrease in the harmonic movement. It is also interesting to observe where all four bc layers appear at once, particularly towards the beginning of the section, this coincides with a slight increase in harmonic movement, which actually reaffirms the accented articulation on the note itself. The larger rhythmic values, in its corresponding beat classes, is supported by larger harmonic movement in most cases, reinforcing its importance, with more emphasis. The change in the rhythmic pattern, from [13] to [14] is supported by an overall increase in harmonic movement. However, this was not the case in the other section as it correlates with a decrease in harmonic movement. Perhaps this has to do with "where" in the bc level it occurs. The first occurs in level 1, the main melodic line, whilst the second occurs in level 4, the bass line. So perhaps the role of the rhythmic feature is heavily dependent on its register. What is immediately striking in the section with the 4-prg is that the last three notes of this descending line consist of the same harmonic movement and beat classes (across three levels). This suggests that the properties of these three notes have more in common than initially realised. It also reinforces the notion that the same amount of tension is maintained despite the descending melodic contour and this is supported by identical/recurring rhythmic figures. Interestingly, the additional bc layer, L3 in conjunction with L4 is supported by a decrease in harmonic movement as well, much like the results gathered in the first chart, bars 1-15. Additionally, this is nested within the prolonged G#, denoting a sense of closure to the introduction and perhaps slightly more stability,

Bars 33–58 (Refer to Volume 2: Appendix 2, Figures 62–63)

The recurring use of bc[22] across all bc levels is also most frequently used, which contrasts the introduction's core bc feature [13][31]. It might be the case that bc[22] can be seen as more regular and stable whilst [13][31] simply contains irregular grouping. In this section, there is very little use of larger beat classes. The two times it did occur actually coincides with larger harmonic movement, thus suggesting that more emphasis is required at those particular moments. There is a slight incongruence between the soprano line and HyM. It can however, be noted that the metrical divisions in the HyM can be likened to the antecedent-consequent idea but the results from the VL analysis looks beyond archetypal divisions, drawing out the horizontal connections. The repeated rhythmic fragments in HyM level 2 are the same across the piano and orchestral lines. It is also interesting to note that although there is a general decrease on its first appearance, the second maintains the same harmonic movement. Similarly in the orchestral section, the only appearance of bc4 is supported by an increase in the harmonic movement. With HyM level 3, on the grouping of 5, this particular moment features the use of bc1 across multiple bc levels and this is supported with a larger harmonic movement of 7, aligning with the notion and supporting the fact that smaller rhythmic values hold a higher amount of tension and the shift from the pattern (use of bc2) suggests an anomaly, more tension.

We can also observe that the opening ten bars are subdivided into four (almost) equal smaller phrases, and this can suggest an A-C relationship in its localised levels. With the relationship between bc2 to its harmonic movement, the results varied depending on the density of the particular moment, what the surrounding levels consist of and its contents, reaffirming the notion that bc class analysis and its relationship to its harmonic movement is context specific. What is also immediately striking from these few bars is that a break or shift from the recurring bc2 figures is greeted by an increase in harmonic movement, this is indicated by a bracketed arrow towards the end of the diagram in Figure 63. This thus suggests that a shorter rhythmic value, in this context, in the bass line, contains more tension. However, its shorter appearance, a couple of bars earlier is depicted with a decrease in harmonic movement. This demonstrates that bc[1(4)] is more significant and it can also be noted that bc[1(2)] occurs on the off beat. Interestingly, [1(10)] is also supported by a slight increase in harmonic movement, which suggests that more [1] has a direct correlation to larger harmonic movement. HyM level 2 bears the most resemblance to the results gathered in the soprano line, more in accordance with the smaller phrase units. In contrast, only the first portion of the HyM level 3 is similar to the soprano line. This could potentially suggest that the vertical features of the music plays an equally vital role with the horizontal, melodic features. There are multiples of 1 recurring in this section, where bc[22], [112] are preferred, with less appearances of irregular rhythm. The piano and orchestra do take turns to execute the rhythmic features. At times, they do occur simultaneously, as tutti, otherwise, a clear hierarchy can be established (L1 as melody etc). It is especially interesting to observe at this particular moment where more than one bc later contains the same rhythmic components. Bc[112] is supported by a steady bc[22] and this was supported by HM0 on both appearances. This could potentially establish a correlation between a stable moment in the music to repeated identical harmonic movement.

The first appearance of a triplet also occurs in this section, on the off-beat, supported by a larger harmonic movement but with a fuller set of layers. It is also interesting to highlight how the use of tremolos coincide with the use of larger bc, bc[12] the largest in this section. A rhythmic observation can be made towards the end of the section, particularly with the gradual layering of bc1 over the phrases. As seen in the analytical chart, the first appearance of this was only in L1, then on its second appearance, it occurs in line 2 as well, but not in its entirety. Its third appearance is also exactly like L1. It is then interesting to observe that despite the use of smaller bc, the first two groups are depicted with an overall decrease in harmonic movement and a slight increase in the third. This reinforces the notion that it is not entirely necessary for faster rhythm to be associated with a larger harmonic movement. Additionally, if one were to observe the individual movement between each harmonic movement, the movement is subtle and not overly excessive. The smaller harmonic movement later on can also be attributed to the tremolos in the orchestra, repeated sonorities, most likely on the same note. Much like standard music notation, it is also worth noting that triplet are depicted with brackets above the bc value and its corresponding numbers. Tremolos are also represented by a closed bracket with a wavy arrow.

Bars 59–74 (Refer to Volume 2: Appendix 2, Figures 64)

There appears to be a pattern of HyM groups of 5 at a higher level, which clearly does not conform to the classical structure as one would expect regular bars in lots of four. It was also trickier to subdivide passages with consecutive use of bc1, which normally spans over a longer number of bars and can function on its own in the higher hierarchies. The bc1 in conjunction with bc[1(3)] is a unique feature of this section as well. At the end of the first grouping of HyM3, interestingly, at this particular moment there are several layers which contain the same bc and coincides with the end of the hypermeasure. All seems to sustain the same harmonic movement. It would appear that the presence of bc2 in the orchestra can perhaps attribute to the stagnant/same harmonic movement. The use of [1(3)] alternating with bc1 in L2 of the middle section of HyM L3 in the piano segmentation coincides with an overall increase in the harmonic movement. This is also supported by multiple bc layers in the orchestra playing consecutive bc1 patterns. The change or break in this bc pattern to bc2 is then marked with the largest harmonic movement of the section, 7. Therefore, there is an interesting relationship between rhythm and harmonic contents. In this particular case, the increase in harmonic tension is attributed to repeated use of bc1 across numerous bc layers and a unique play off between the two levels in the piano: bc1 with bc [1(3)]. There is a gradual change from regular to irregular grouping of bc1: [1(4)] to [1(3)]. Although it is evident that each appearance of the harmonic movement occurs on every crotchet or every bc [1(4)], bc2 will be used as the base beat as it heavily depends on the time signature. The change of time signature does not affect the bc values. There are more regular and consistent rhythmic features that appear in the solo section, a pulse can be detected more so here than in preceding phrases. From a theoretical standpoint, it is worth highlighting that consecutive multiples of bc are simply represented by [x(y)], where x stands for the bc value and y stands for the number of times that it occurs consecutively.

<u>Bars 75–92 </u>(Refer to Volume 2: Appendix 2, Figures 65)
There is an increase occurrence of bc1, particularly in the piano. For convenience, some of them have been written in short hand. There is no congruence at the highest HyM grouping. It can perhaps be stated that this is the first section so far in the entire movement where the phrase or hypermeasure groupings (in accordance to its rhythmic values) have a direct relationship to its VL results, bringing a closer relationship between rhythmic and melodic elements.

It is particularly interesting to note that within the second grouping of HyM L2, on the bass note G, that whenever multiple bc layers contain the same bc value, it correlates with an increase in the harmonic movement, which suggests that there is a certain significance at these particular moments. BC L1 and L3 are identical towards the end of the 6-prg, one of the few occurrences where it is the same in this section. This suggests that more emphasis is required, which correlates with the increase in harmonic movement too. Towards the end of the third group in HyM L2 (HyM L2 [3]), there is another instance where quaver equates to a crotchet, 2 = 4, which then explains the increased frequency of harmonic movement at that particular moment. Subsequently, it is interesting to highlight that the two occurrences of longer bc coincides with an increase of harmonic movement, from 5 to 9. This thus suggests that there is to be some emphasis in the notes in the other layers. This actually coincides with the shift to longer beat values, from 2 to 4. Towards the end of HyM 2, in the second last grouping, it can be notes that the presence of consecutive bc1 does not necessarily denote a higher amount of harmonic movement. On the contrary, this combination with bc4 in the lowest layer actually assists in establishing some stability, 9 to 4, then subsequently followed by a series of similar numbers.

Bars 93–107 (Refer to Volume 2: Appendix 2, Figure 66)
In this section, there is one new rhythmic feature, hemidemisemiquavers, which are depicted as 0.5. Decimals are preferred over the use of fractions. Although I could have pulled the entire scale back to 1 for a hemidemisemiquaver, this feature rarely occurs in the movement. It can be noted that the longest passage of bc4 occurs towards the middle of this section, coinciding with less profound changes in the harmonic movement. This is also supported by a series of bc2. It is also interesting to highlight that the first note of the section, depicted by a larger harmonic movement, is supported by longer rhythmic values across all three lines in the instrumentation, suggesting that emphasis is required. The larger pairing of phrases in the first grouping of HyM L3 can represent an antecedent and consequent idea. The repeated harmonic movement AVL3 in the opening of this section is supported by a more stable rhythmic figure, echoed in the piano, line 3 with bc4 and off beat bc2 in the orchestra, as well as bc2 in line 3, that has contributed to the sense of stability leading up to this. Towards the end of the first HyM L3 grouping, there is a slight incongruence between the rhythmic phrasing and linearity. The melodic contour depicts a more continuity, extending into the next marked section. Within the second HyM L3 grouping, it can be noted that the smaller segments within it contain similar materials. Particularly in moments where the melodic line contains smaller rhythmic value, bc1, which is almost always supported with bc2 in the orchestra. The orchestra in this section appears to play more of a supporting role, which emphasises the rhythmic figures in the piano section. The longest span of melodic motion is supported by shorter rhythmic values with a full complement of the orchestra. The largest harmonic movement can be seen here, with repeated bc[1(4)] prior to this and emphasis from the orchestra, on bc level 1 and 3, at the beginning, just one beat prior to it. Towards the end of this section, there is a steady increase in the use of bc1, beginning firstly in the lower levels and it works up towards the melodic line in the piano. It can also be noted that the phrase marking is in congruence with the melodic contour particularly towards the end of the section too.

Summary

The beat class data alongside the AVL data and VL reduction has, like the Hindemith study, revealed many instances where the bc data both align and do not align with the AVL and VL analysis. What is interesting in this movement is the presence of numerous layers and HyM and the incongruence against the VL analysis. It suggests that a VL analysis, that is inspired by Schenkerian principles, is not sufficient and that rhythmic elements play a vital role to better understand post-tonal repertoire. In the opening bars, changes in rhythmic patterns such as bc[13] to bc[14] can denote an increase in HM. As the music developed, there was a recurring use of bc[22] in bars 33–58 , suggesting a sense of regularity. The metrical divisions in this section can be also likened to antecedent-consequent ideas. It is important to note that there is more data in this section which demonstrates that faster rhythm does not need to be associated to a larger set of HM. More regular rhythmic features can subsequently be seen in the solo section in bars 59–74 with bc[0.5], hemideiquavers introduced in bars 93 – 107 as well. On the whole, there was more congruence with melodic contour by the end of bar 107.

<u>Bars 108–125</u> (Refer to Volume 2: Appendix 2, Figure 66)
The use of bc[1(4)] trickles down to the different bc levels, a very prominent feature especially towards the end of this subsection. Each bc line clearly has different roles to play, some as secondary, some clearly marked as primary. Faster rhythms are prioritised as melodic materials in most phrases. Towards the middle of the second grouping in HyM L2, the harmonic movement is repeated consecutively and this is supported with the consecutive use of bc2 across all three bc levels. BC2 in this context represents a sense of stability, stagnant and provides a sense of pulse. Interestingly, with all HyM levels in this section, they all align neatly with the melodic features. The first couple of bars are actually part of the bigger picture, from the previous section. Within the third grouping of HyM L2, there are moments when the orchestra doubles the rhythm in the piano and in this context, it coincides with medium to larger amounts of harmonic movement.

<u>Bars 126–145</u> (Refer to Volume 2: Appendix 2, Figure 67)
Within the HyM levels, it can be noted that levels 2 and 3 are in congruence with the treble and bass lines. There is a direct relationship between rhythmic and melodic-harmonic elements here. When the bc comes in for the first time in the orchestra, it can be noted that this short bc1 figure correlates with an increase in harmonic tension, which is supported with the entrance/presence of the orchestra. The bc2 that does not appear consecutively in this section is echoed in three bc levels, which can help in accounting for the overall larger AVL8 in this short phrase. In the following phrase, there is a series of repeated bc figure, bc112 in

this section combined with a running bc2 in the lowest level, which attributes to the “steady” set of numbers in the harmonic movement. However, the increase to AVL8 correlates with a significant change in rhythm, from shorter to longer rhythm: 1-2 to 6. Towards the middle of the section, we can also note that AVL7 within the 6-prg is supported by unison rhythmic figure in the piano bc. The subsequent bc1 passage begins on the lower levels here, in line 3, which runs throughout the next few phrases (HyM L1) and supported by L1 and 2 in the piano section. The new section after this begins from this point, and clearly features the use of bc1 in the piano. Towards the end of this section, there are irregular bc values, “odd” numbers are supported with more regular bc values, 4 and 2, to provide more stability. Interestingly, the harmonic movement that immediately follows these irregular movements is one of the largest harmonic movement of the section - a shift from irregularity to regularity – a renewed emphasis on the note? The last few phrases identified in this section are also part of the larger phrase structure.

<u>Bars 146–161</u> (Refer to Volume 2: Appendix 2, Figure 68)
Bc1 and bc[1(4)] are recurring features in the melodic lines of the piano, which could potentially suggest a dual role, where it is melodic as well as a vehicle to stimulate tension. Within the second second grouping in HyM L3, there are multiple layers in the orchestra that play the same rhythm, with bc1, a renewed emphasis, and actually, a larger harmonic movement can be traced throughout this section. This very same section can stand alone as its own section too, as it contrasts previous and proceeding materials or it can be attached onto the previous section as a form of continuation. It can perhaps be argued that the incongruence between the HyM and treble-bass lines can be resolved with the following statement: the HyM on a larger scale is actually 5+6, a much larger phrase unit. The simultaneous rhythmic pattern across the three lines in the orchestra correlates with an overall increase in harmonic movement, 4 to 7 as well as the appearance of a 3-prg, E to G, anacrusis melodic materials? The first appearance of a substantially longer in the orchestra actually correlates with a larger harmonic movement but interestingly, the second appearance of a longer rhythm (bc8) appears in two lines instead and is supported by a smaller harmonic movement. This therefore suggests that in this particular section, there is a direct relationship between longer to shorter rhythms and increased to decreased tensions. The change in grouping from 8 to 6 towards the end of this section is supported with a series of more stable harmonic movement. The dual function, actually forms part of a larger unit, from the proceeding bars. There is also

another instance of simultaneous use of the same bc in the orchestra, which correlates with a larger use of harmonic movement.

<u>Bars 162–170</u> (Refer to Volume 2: Appendix 2, Figure 69)
HyM L2 has a closer correlation to the treble-bass lines than the higher levels, with more interesections. The rhythmic materials clearly suggest a new idea, but the melodic contents suggest a longer linear progression. There is a recurring use of bc[1(4)] throughout these few bars in the piano section, which is supported consistently by bc4 in the orchestra. However, at one point, prior to the end of this section, it changes to bc2, supported by L1 in the orchestra too. This coincides with an increase in harmonic movement, thus suggesting that a change in rhythmic activity in this context correlates with a heightened sense of tension. There is a notable rhythmic feature bc[6 2] and bc[4 4]. These appear twice but with very different results, where the first one depicts a decrease whilst the second depicts an increase. This can be explained via the slightly different rhythmic values, the use of bc[1(4)], breaking the bc2 pattern, which emphasises the bc[1(4)] figure, with more stability. There is fewer use of bc[2 11] here as well, either as bc[1(4)] or bc[22]. The appearance of irregular rhythmic in the lowest voice of the piano, towards the end of this section, whilst being supported by stagnant bc4 in the orchestra, which attributes to the slight increase in harmonic movement. However, this does not apply to the other appearance of bc5. As this coincides with the change in rhythmic activity in the orchestra, it can perhaps be stated that faster rhythms help to “stabilise” the irregular rhythmic activity, which in turn helps in explaining the decrease in the harmonic movement.

Summary
Bars 108–170 present several notable features and further instances of congruence and direct relationship with the VL reduction. Bc[1(4)] was a key prominent feature in bars 108–125, with shifts from irregular to regular rhythm towards the end of 145, where the rhythms moved from irregular bc values to values of 4 and 2. From bars 146, there were recurring features of bc[1] and bc[1(4)], which contain a dual role to stimulate tension as well as a change in grouping towards end of 161 from bc8 to bc6. Subsequently, from bars 162–170, there is notably more recurring use of bc[1(4)] in the piano as well as an interesting rhythmic feature, bc[6 2] and bc[4 4], which appeared twice but with different data, one that correlates with a decrease in the AVL and another with an increase in the AVL.

Bars 171–186 (Refer to Volume 2: Appendix 2, Figure 70)
The retransition to recapitulation was dominated mainly by regular rhythms. Bc[1(4)] is a constant feature in the transition which is echoed throughout multiple lines of rhythm. Bc[2] is a feature in the recapitulation, as seen previously in the exposition. The recurring presence of bc4 in the opening of this section aligns with the relatively similar harmonic content but the shift to more use of bc1 aligned with sharper or distinct changes in the harmonic movement. Bc1 in this context plays a role in stimulating tension and instability. There are also more moments here than in preceding sections where multiple lines contain the same rhythm: bc[1(4)]. This actually correlates with an overall increase in harmonic tension, from 1 to 8, marking the return of the opening materials, the recapitulation. The repeated use of bc[1(4)] also aligns with the two step progressions, creating a sense of continuity, bc[1(4)]. The two instances where bc[11] is repeated by bc L1 in the piano is represented by a decrease in harmonic movement, 8 to 3, 2 to 0. Firstly, this suggests that its first appearance is far more significant due to the larger harmonic content. It also suggests that bc1 in this context denotes instability and a heightened sense of tension and a change to a slightly larger rhythmic value suggests stability. The identified HyM towards the end of this section is part of a larger phrase, where the first three bars are essentially an antecedent phrase.

Bars 187–203 (Refer to Volume 2: Appendix 2, Figure 71)
There are two instances of longer rhythm, bc12 and bc16, which coincide with the varied harmonic movement. This generally suggests a decrease in HM but bc16 coincides with an increase, which suggests that from a structural point of view, that there is a closer correlation to structure than rhythm for this section. It can also be highlighted that the first part of this section, the bc is in congruence with the treble and bass lines. The additional section that is not attached to its preceding and proceeding phrases. It might be worthwhile to perhaps consider if additional notes can be inserted to the soprano line. Perhaps a descending 3-prg, from A to F is nested inside a larger 3-prg. It can therefore be suggested that the HyM is to assist in filling in the gaps, to identify more notes that are crucial for a middleground chart.

There is also a correlation between the repeated use of bc1 and an increase in harmonic tension. Incidentally, the greatest increase actually occurs when L1 of the 0 also doubles the bc1 pattern. This reinforced bc1, which meant that there was an increase amount of tension and it is also the only time when L1 of 0 contains a faster rhythm. Towards the middle of the second grouping of HyM L3, the increase from 3 to 7 in the data points actually coincides with the change to shorter rhythm. The only appearance of the triplet in this section coincides with an increase in harmonic movement. There is an overall increase in the harmonic movement in the middle of this section, especially when L3 of the orchestra enters, with additional beat class layers that contains rhythmic features from previous bars. And interestingly, the change in the same L3 from 2 to 4 coincides with a slight decrease in the harmonic movement.

Bars 204–222 (Refer to Volume 2: Appendix 2, Figure 72)
The grouping of beat classes is exactly the same as its first appearance in the introduction. The HyM are congruent with the results gathered from the treble and bass reductions. With the first phrase, under the first grouping of 5 in HyM L3, it can be noted that the repeated AVL4 correlates with the rhythmic figures that have occurred previously, suggesting that there is a consistent rhythmic figure present in this movement. Towards the end of this phrase, it can be seen that despite the appearance of bc1 across two levels of beat classes, the overall AVL remains quite stagnant. This can perhaps be attributed to the recurring use of bc2 in the orchestra. Right at the start of the next phrase, within the grouping of 5 ½ in HyM L3, the previously mentioned statement regarded recurring rhythmic figures and repeated AVL movement also applies here, to the consecutive use of AVL5 as well. Subsequently, the increase in AVL from 0 to 5 coincides with the repeated use of bc1 across all four bc levels, in both piano and orchestra.

Towards the end of the second grouping (5 ½ of HyM L3), the increase of AVL4 to 10 coincides with the orchestra's absence, with more emphasis given to the piano solo. This coincides with the appearance of bc2 in the orchestra, shifting from bc1 to 2. At the start of the next HyM L3 grouping, it can be noted that the decrease from 10 to 0 coincides with the use of bc2 on two levels as opposed to the one level. Additionally, the overall decrease in the harmonic movement from 10 to 6 within the 3-prg coincides with longer bc values, from 2/1 to 4, rounding off the phrase. In the transition to the next HyM L3 grouping, it can be seen that the decrease of harmonic movement coincides with a longer bc, bc6 on two levels. Subsequently, the steady increase in harmonic movement, 4-6-8, coincides with an increased use of bc1, stagnant in L3, but it becomes more prominent in the other two levels. This is also supported with two key notes in the soprano line.

Bars 223–238 (Refer to Volume 2: Appendix 2, Figure 73)

The HyM levels, particularly on a higher level, L3, correlates with the soprano and bass reductions. HyM L2, especially from the second half of this section, has a close relationship to the melodic features. However, where there is a segmentation or grouping of 4 ½, this cuts into the 6-prg, suggesting that perhaps further division can be made within the 6-prg. There are distinct rhythmical features, which can be seen between the two segments in this section, where the orchestra's entrance bridges the two sections, with additional layering and thicker texture. The falling 3-prg within with first part of the section correlates with a decrease in harmonic movement as well as a transition from faster rhythm to slightly longer, regular rhythmic grouping, particularly with bc levels 2 and 3. L1 however, suggests a shift from longer and at times, irregular bc values to repeated bc2 patterns. More stability can therefore be seen at this point. Subsequently, the materials that follow this may even suggest that the presence of the orchestra, with its entry, contributed to the decrease in harmonic movement, moving towards more stability. Towards the end of this section, when multiple bc lines contain the same bc values, this correlates with a slight increase in harmonic movement to the next section, and reinforced by multiple notes in the soprano line too. Within the second group of 7 of HyM L3, it can be noticed that the L1 pattern was repeated twice but we only see an increase in harmonic movement in the second appearance and this can be attributed to an additional bc layer in the orchestra too.

Bars 239–260 (Refer to Volume 2: Appendix 2, Figure 74)

The higher HyM levels in this section are mostly congruent with the results from the soprano line. However, one noticeable area where there is incongruence, cutting in the 4-cprg, and the rhythmic elements take precedence in this section. Additionally, there is an interesting bc feature, bc[0.5 (6)] that reoccurs. Even though the smallest rhythmic value should be assigned 1, as this feature only occurs very rarely in the movement, 0.5 would be the best alternative. Within the first grouping of HyM L3, there is a different inner grouping here in contrast to its first appearance at the start of the music. Why? Perhaps this is due to the longer antecedent-like phrase and the consequent-like materials stand alone. Otherwise, alternatively, it could be attached onto the previous seven bars, 7+3. Within the first sub grouping within the group of 5 in HyM L3, it can be seen that there is a short section where two lines contain the same bc features, reflected with a decrease in harmonic movement, perhaps as a way to reinforce stability. The long passage of bc1 in L1 of the same passage is also echoed briefly in L2, from bc1 to bc2, and supported in L3, correlates with an increase in harmonic movement.

With the appearance of AVL7, there is a change in bc value to 3 and with an additional bc layer – two factors that attribute to its increase. Within the next section, 4+2 in HyM L3, despite the presence of longer rhythmic values, there is an increase in harmonic movement. This can be attributed to the irregular appearance of bc1, as groups of 3. Towards the end of this grouping, there was a momentary absence of the orchestra, an increased presence of bc1 in the piano that has resulted with the increase in harmonic movement, particularly in L3. Subsequently, the rhythmic features, through bc1, display another moment where additional bc layers have resulted in an increase of harmonic movement. Towards the end of this section, there is a decrease to 0, which coincides with a reduction in rhythmic layers.

Summary

On the whole, the retransition to recapitulation consists of primarily regular rhythms, more instances of metrical congruence and further comments about specific bc and its corresponding AVL data. From bars 187–203, it is interesting to point out that there is a correlation between repeated use of bc[1] to the increase in harmonic tension. Towards the end of the phrase, there was a change from bc[2] to bc[4], from shorter to longer rhythms. From bar 204, marking the reprise, it was noted that the grouping of bc is the same as the introduction, with HyM congruent with results gathered from treble and bass reductions.
In the HyM on the higher levels of Bars 223–238, there was notably more congruence and meaningful relationship with soprano and bass reductions. The change in bc also aligns with AVL movement as well. Similarly, in bars 239-260, the higher HyM levels can be seen to be congruent with soprano line. Towards the end of bar 260, there was a different use of bc[1] where it was used in groups of 3, aligning with an increase in HM. It can be noted that there was a reduction in rhythmic layers by the end of the section.

<u>Bars 261–294</u> (Refer to Volume 2: Appendix 2, Figure 75)

This section covers bars 261–294. The last two HyM in L3 correlates with the treble and bass lines but not on L2. This could perhaps be due to the fact that rhythmic features do not align with the 3-cp, A-A#-B. There are also many incongruent moments in the first part of this chart. There is also varied harmonic movement in the first section but we can observe that there is an overall increase of tension in HyM L3 6664, coinciding with the repeated use of bc1 in the piano line. At the start of the next grouping of 6 in HyM L3, the first entrance of the orchestra after the solo section, is supported by an AVL that is neither big or small, thereby creating an emphasis on this particular moment. Towards the middle of this section, the reinforced musical figure in the orchestra also correlates with an initial increase of harmonic movement but also decreases slightly as it tapers out. At the beginning of the last grouping of HyM L3 in this section, the significant decrease in the data points at this particular moment correlates with two successive use of bc2. This rhythmic feature contributes to this emphasis/change of the harmonic movement. The orchestra's reinforcement of particular moments from the piano solo correlates with the identified phrase structure in the treble line, where all are bound by the same amount of harmonic tension.

Bars 295–317 (Refer to Volume 2: Appendix 2, Figure 76)
HyM L3 in this section can be grouped even further, 6+7, and the group of 5 can be grouped with the previous section. There is a clear difference in the rhythmic features, where the group 4 ½ of HyM L3 contains a sextuplet of [1(6)] and supported with the full complement of the orchestra. Within HyM L3, the groups of 5 and 7 also contain some use of the orchestra whilst the group of 6 only features the piano. Within the first grouping of 5 within HyM L3, the presence of bc4 in the orchestra assists in the release of tension, marking the end of one subsection. It can also be noted that with the next two groupings of HyM L3, bc2 alternates on L1 and 3. The rhythmic elements are fairly constant here, where tension is driven by harmony and perhaps through the use of repeated rhythmic figures, bc2. There is also incongruence between HyM and the treble and bass lines, with long ranged progression in the treble reduction, and the bc groupings suggest that further segmentation does occur between two subphrases. Towards the end of the grouping of 7 in HyM L3, it can be noted that the orchestra reinforces the piano solo. This also coincides with an increase in harmonic movement in the leadup to a significant change in rhythmic activity. Towards the end of this section, with the group of 4 ½ within HyM L3, it can be noted that bc[4 3 1] supports the irregular rhythmic features - sextuplet of [1(6)] and triplet grouping of [444]. This perhaps occurred in this way because bc [4 3 1] is repeated on multiple levels in the orchestra. There are also moments where bc4 is reinforced, this is greeted with a prior decrease in movement. The only exception is towards the end of this phrase, an increase, driving to the downbeat of the next phrase.

Bars 318–327 (Refer to Volume 2: Appendix 2, Figure 77)
HyM L3 can be grouped into a bigger unit here, 6+4, to fully complete the consequent phrase, including the prolongation of the tonic chord. There are clear rhythmic features in each of the larger groupings, where the group of 6 within HyM L3 contains a sextuplet

grouping of [1(6)] and triplet grouping of [444] whilst the group of 4 (from HyM L3) contains bc[8], triplet grouping of [222] and [16]. There is one consistent rhythmic feature, bc4, which initially appears in bc(0) in L4 then doubled by L1 a bar later. This is heard through all the way till the final three bars. The rhythmic features within the smaller groups from the group of 6 in HyM L3, determined the phrases here, clear pattern, melodic features that identified long-ranged linear progression, stretching over the bar lines. It is also interesting to observe the rhythmic harmonic features within each group of HyM 2, the numbers grow each time, where the second is lesser than the first, especially from its first to the third appearance. The transition to the grouping of 4 (HyM L3) contains an absence of bc L4, which attributes to the increase of tension, bringing the triplet group bc[222] to the forefront. Subsequently, it can be noted that the use of irregular rhythmic features correlates with an increase in harmonic movement, thereby suggesting more tension towards the end of the movement. The use of bc16 also correlates with a decrease of harmonic movement, a release of tension. It can also be proposed that this entire section can be a HyM 10 on L3, which would actually align with the broader treble and bass reduction and structure.

Summary

Unlike earlier sections, there were both incongruence and congruence in the rhythmic and VL relationships. Bar 261 commenced with incongruence where the rhythmic features do not align with the VL features but this changed by bar 295, where more regular rhythmic elements are present, with “tension” driven by both AVL and use of repeated figures bc[2]. More congruence can be seen by the end of bar 327. Much like the AVL and VL observations, whilst it is insightful to perform a bc analysis and examine its consequent HyM levels and more meaningful relationships can be seen between rhythm and VL features, other parameters such as texture and dynamics should be considered in future investigations.

Concluding Remarks

Much like the Hindemith Sonata, the various analytical charts – comprising a VL Reduction, VL Labour, bcxVL charts and statistical data – have revealed that there is much that can be said between the AVL data to the VL Reduction and perceiving musical tension. The individual VL movement along with its combined sum, the AVL has helped in filling in the gaps of a VL Reduction, highlighting moments that are harmonically significant in the music. Along with this, the bcxVL charts reveal that there is a close interrelationship with its harmonic and melodic counterparts and the observations reinforces the contents of the music.

These charts on the whole has helped to solidify one's understanding of where phrase and sectional closures are, the climactic moments and how these align with the music's formal features.

Chapter 5

Towards the Future of Music Theory: Plurality, Theoretical Hybridity and Post-Modernist Ideals

This research has been carried out with the key objective to demonstrate the potential implications of hybridity for music theory: a hybrid analytical method is developed to tackle the ambiguities posed in neoclassical repertoire, music that specifically contains tonal elements whilst being intertwined with post-tonal harmonic features.

The notion of hybridity as a broad concept has both positive and negative connotations in its post-modern applications beyond the realms of music. The extent of each entity or element retaining its individualistic features when combined with other entities/elements is challenging but there are more positive than negative outcomes. Applying such a concept to music theory has shown the potential in taking this approach. This however is heavily dependent on the choice of repertoire being studied, and this raises the following questions: To what extent would this work and/or body of repertoire necessitate a hybridised or mixed economical approach? What is the purpose of using more than one musical theory? What further analytical insights does it reveal?

The application of the hybrid method along with a careful selection of repertoire, covering works by Hindemith, Stravinsky, Ravel, Enescu, Martinu and Vaughan Williams, has revealed detailed insights about the music that would not be recognised with individual methods. The results of this study by using this hybrid method has provided an enriched set of data: a VL graph that charts critical melodic and harmonic features as well as its fundamental structure, that encompasses an expanded tonal palate (transcending the tonal realm); VL labour to better account for the music's harmonic idiom; and a beat-class-voice-leading analysis to shed light on the relationship between rhythm and phrase groupings. This will create a multi-faceted analysis of the works, with consideration to multiple musical features. A hybrid theoretical method is by no means applicable to all musical repertory, but for a carefully chosen body of repertoire, such as neoclassical music, this will be of great use for the analyst, to understand the underpinnings of these compositions.

As shown in the methodology and in the case studies, the implications of the VL labour analysis and its corresponding graphical representations have suggested a correlation between theoretical and perceived tension in post-tonal music. The brief empirical study in Chapter 2 examined listener judgements of musical tension for selected segments from three selected neoclassical works: the first movement from Hindemith's Second Piano Sonata, *Mouvement de Menuet* from Ravel's *Sonatine*, and the first movement from Stravinsky's *Concerto for Piano and Wind Instruments*. The focal point of this study was to investigate an unexplored aspect of tension: the perception of harmonies in music that embody both tonal and post-tonal features, how listeners would perceive tension without reference to a tonal centre.[273] The methodology employed is novel, drawing upon the AVL, an element from a hybrid theoretical model, by calculating the individual VL movement between each segmented vertical sonority, PCn. This therefore provided a renewed perspective on how tension is reflected in listeners' musical perceptions from this repertoire.

As this experiment focuses purely on one parameter – harmony – in an attempt to measure how we perceive post-tonal tension, future studies can be explored and expanded to several directions. It is clear from established studies that other parameters such as rhythmic and metric influences need to be accounted for when analysing our perception from tension. One possibility could be through Volk's computational model, "Inner Metric Analysis," and combining the model with the voice-leading calculational approach set out in this study.[274] The method used to segment the harmonies (AVL) in this study also has its various flaws and limitations. In most studies carried out into the perception of harmony, the number of notes in

[273] The experiment required participants to: firstly, listen to an extract consisting of a series of pitch collections; and secondly, listen to a smaller clip from the extract, consisting of two PCns and rate how tense the progression was from the first to the second PCn, using a rating scale (1 to 5). From carrying out this study, the results revealed that the AVL cannot be the sole factor in determining tension in post-tonal harmonies and other secondary, or for a better word, psychoacoustical and as well as the chords' physical factors reveal more insights. These factors include measuring the chords' roughness, mean pitch, range (e.g. shift from higher to lower registers may result with a small MTR), number of notes (e.g. shift from a larger to smaller number of pitches in a PCn) and its pitch organisation in terms of tonal stability (relating back to Krumhansl and Kessler's 24 key profiles). The results of examining these additional variables through a correlation and regression analysis revealed that the two main factors to better account for listeners' perceptions to the stimuli set are chord size and tonal stability.

[274] This quantitative method assigns each note a "metric weight," which is based on the "superposition of specific pulses evoked by the onsets of all notes." By using this computational approach, this method will reveal crucial information about the music's metric structure both on a local and global level. (Anja Volk, "Persistence and change: Local and global components of metre induction using inner metric analysis," *Journal of Mathematics and Music* 2.2 (2008): 99–115; Anja Volk, "The study of syncopation using inner metric analysis: Linking theoretical and experimental analysis of metre in music." *Journal of New Music Research* 37.4 (2008): 259-273.

a given chord are all standardised, and this was not the case in this study. Post-tonal harmonies when segmented, can result with varying number of notes in a chord, some may simply contain a single unison note and others may contain more than the "norm" (4-, 5- note pitch collection). The number of notes in a pitch collection has no doubt had an impact on how listeners would rate its tension, participants tended to give a lower rating to a progression that consists of a larger to smaller pitch collection. Additionally, register should be carefully considered for in future studies, along with rhythm and meter, as the registral height of the harmonies can have an impact on how listeners rate its intensity.[275]

The method of this experiment can be adapted in future studies to utilise continuous measurements instead of discrete measurements. As discussed by Britten and Duke, continuous measurements may be a more beneficial measurement tool to better understand participants' changing perceptions *during* the listening experience.[276] It will also be useful to investigate if there is a difference between musicians' and non-musicians' perception of these post-tonal harmonies, particularly if prior musical training influences listeners.[277] As only one instrumental timbre was used for the empirical study, future studies could [278][279][280] The stimuli set for future perception experiments can also be expanded to include other works by different composers, but of the same time period, to explore the relationship between these composers' harmonic idiom to listeners' perception. Another possibility is to extend the AVL

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[275] Discussions surrounding the relationship between register to musical tension can be seen in Granot and Eitan's study (Roni Granot and Zohar Eitan, "Musical tension and the interaction of dynamic auditory parameters," *Music Perception* 28.3 (2011): 219-24.)

[276] Ruth Brittin and Robert Duke, "Continuous versus summative evaluations of musical intensity: A comparison of two methods for measuring overall effect," *Journal of Research in Music Education* 45.2 (1997): 245–258.

[277] A recent study by Arthurs, Beeston and Timmers reveal that listeners' ratings of consonance and stability "were influenced by the degree of musical training" as well as the knowledge of "tonal hierarchy" (Yuko Arthurs, Amy Beeston and Renee Timmers, "Perception of isolated chords: Examining frequency of occurrence, instrumental timbre, acoustic descriptors and musical training," *Psychology of Music* 46.5 (2017): 662–681.)

[278] It has been reported by Paraskeva and McAdams that chords played on a piano are perceived to be more tense that its orchestral equivalent and a study by Silvey also presents the same findings (Stella Paraskeva and Stephen McAdams, "Influence of timbre, presence/absence of tonal hierarchy and musical training on the perception of musical tension and relaxation schemas," *Proceedings of the 1997 International Computer Music Conference* (1997): 438-441; Brian Silvey, "The effects of orchestration on musicians' and nonmusicians' perception of musical tension," *RIME 9*.1 (2011): 1–9).

[279] For example, chords that are played on stringed instruments have been reported to invoke more melancholy, nostalgia and sadness than a keyboard instrument (Imre Lahdelma and Tuomas Eerola, "Single chords convey distinct emotional qualities to both naïve and expert listeners," *Psychology of Music* 44.1 (2016): 37–54.)

[280] An example of spectral analysis can be seen in McAdams, Douglas, & Vempala's "Perception and Modeling of Affective Qualities of Musical Instrument Sounds across Pitch Registers" (Stephen McAdams, Chelsea Douglas and Naresh Vempala, "Perception and modeling of affective qualities of musical instrument sounds across pitch registers," *Frontiers in Psychology* 8 (2017): 1–19.)

method, comparing the perception of the PCns to its original stimuli, from the music, bringing in the examination of other parameters.

Furthermore, as the experiment focused on harmony to measure tension, this can be extended to include other parameters to further support this notion. BaileyShea and Monahan for instance consider a new method for describing musical energetics (relating to musical tension as perceptions of musical movement or force) that is not dependent on tonality.[281] Their study employs concepts of *generalized gravity* (according to which upward motion gives the impression of providing more energy than downward motion) and *registral mass variance* (according to which musical events in lower registers can be perceived as heavier or denser than events in higher registers), concepts which can further enhance the examination of works without a clear tonal center, such as neoclassical and post-tonal music.

Correlating tension ratings to physical and psychoacoustical features is perhaps the next step one should take in theorising post-tonal harmonic tension, as accounting for the AVL simply does not suffice in such repertoire. In creating an abstract model, there will be potential implications for music analysis, as this could ultimately furnish a tool to assist in explaining formal functions such as closure in post-tonal music.[282] Although additional follow-up experiments would undoubtedly reinforce the findings, the analysis and observations from this study demonstrate a new perspective on perceiving tension that belong neither to the tonal nor post-tonal realm. The experiment in Chapter 2 has shed light on the complexity of these harmonies and the various external factors that affect listeners' perception. Further examination into post-tonal tension perception will in the bigger picture assist in our understanding of the interrelationships between performance practices, refining theoretical and perceived interpretations and musical structures.

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[281] Matthew BaileyShea and Seth Monahan, "'Von anderem Planeten?' Gesture, embodiment, and virtual environments in the orbit of (a)tonality," in *Music, analysis and the body: experiments, explorations, and embodiments*, edited by Nicholas Reyland & Rebecca Thumpston, Vol. 6 (Leuven, Belgium: Peeters, 2018), 31–50.

[282] Although tonal formal functions have been extensively explored and theorised, the application of these theories to post-tonal repertoire remains problematic (William Caplin, *Classical form: A theory of formal functions for the instrumental music of Haydn, Mozart, and Beethoven* (Oxford: Oxford University Press, 1998); William Caplin, "What are Formal Functions?" in *Musical Form, Forms and Formenlehre*, edited by Pieter Bergé (Leuven, Belgium: Leuven University Press, 2009) 21–39; William Caplin, *Analyzing classical form: An approach for the classroom* (Oxford: Oxford University Press, 2013).

As for performance, the implications of hybridity for this discipline can arguably help to establish a dialogue between music analysis and performers. One way to respond to the ongoing debate and the widening gap between performance and analysis,[283] is to apply the hybridised theoretical model. Further investigation can reveal that the model's application is correlated with an analysis of recordings, which will generate insights that would be of great use for a performer.[284] For instance, in the case of the first movement of Hindemith's Piano Sonata No. 2, the analysis of two professional recordings – Glenn Gould and Sviatoslav Richter – can be used to uncover similarities and differences between an initial interpretation and an informed reading of the work. It can be predicted that the results from the three different analytical charts (VL reduction, VL/AVL graph, BCxVL graph) will reveal the correlation between middleground layers and phrase design, and between rhythmic features and other musical parameters.

As a brief example using the Hindemith Piano Sonata, within the minim segmentation one can firstly observe that there is a significant movement at bar 8, without the support of any note. As this particular moment is not reflected initially from the analysis, it is in fact from the realisations by performers that one can notice the lack of finer details, information that have been overlooked by analysts. As such, upon considerations of the performers' realisations, C should be added to the voice-leading reduction chart. One can observe that this particular note is part of a 2-bar figure, so it can be suggested that instead of viewing it as a phrase in itself, it is actually part of a larger phrase unit - where bars 7 and 8 is antecedent to its consequent response in bars 9 and 10. This can especially be heard in Richter's interpretation where he draws out and accentuates the localised phrases. There is evidently a clearer sense of the horizontal movement and one will be able to have a better grasp of the bigger picture. This is also attributed by the shift in dynamics to piano and the slight change in rhythmic pattern in the LH figure, all of which actually helps in creating a sense of urgency to build up towards the climactic moment and driving it to the end of the first thematic idea of the movement. However, this is not reflected as clearly in Gould's realisation as he characterises the LH figure, articulating the notes differently, rather than adhering to the

[283] Nicholas Cook, "Analysing Performance and Performing Analysis", in *Rethinking Music*, edited by Nicholas Cook and Mark Everist, Oxford: Oxford University Press (1997), pp. 239-261; Wallace Berry, *Musical Structure and Performance* (New Haven: Yale University Press, 1989).
[284] Daniel Barolsky and Edward Klorman, "Performance and Analysis Today: New Horizons", *Music Theory Online* (2016): 22/2: 1-4; Dean Sutcliffe, *The Keyboard Sonatas of Domenico Scarlatti and Eighteenth-Century Musical Style* (Cambridge: Cambridge University Press, 2016); Annie Yih, "Connecting Analysis and Performance: A Case Study for Developing An Effective Approach," *Gamut* 6/1 (2013): 277-308.

legato markings. Unlike Richter, Gould has taken on a more sensitive and "expressive" approach to convey the climactic moment, and as a result, evoking a sense of closure and finality to these opening bars.

In sum, the detailed examination of different musical parameters simultaneously reveal that this hybridised model enables a comprehensive structural narrative for each piece. This thus fills in existing theories' lacunae by revealing a more detailed explanation of the harmonic content, an enriched middleground chart, and the ways in which other musical parameters articulate them. As a result, this has the potential to inform analytical approaches to performance practice as well as musical perception – in shaping a performer's interpretation and how one would approach specific melodic figures (e.g. phrasing, emphasis) and the significance of the large increases and decreases in the harmonic movement from the line graphs. A thorough examination from these "competing" perspectives can assist in revealing useful insights both for the analyst and performer, in an attempt to strike a balance between a subjective and objective understanding of the music. The performative implications can include the understanding of where high and low moments of the phrases are, and where notes should be given more emphasis. On the whole, this can facilitate a closer relationship between theory and performance analysis of twentieth-century music.

Future directions for music theory can perhaps lie in the prospects of theoretical hybridity, as a means to bridge and work with other disciplines such as empirical musicology and performance studies, and to explore how the simultaneous and/or combined application of more than one analytical approach can better illuminate certain corpora of music. From a theoretical perspective, there are much broader implications and analytical benefits with hybrid musical approaches and its application to neo-classical music. As the harmonic language in this period of music can encompass both tonal and post-tonal qualities and there is no existing body of theory that can fully explain the music's features, a hybrid approach is therefore necessary. A hybrid approach that encompasses a method to account for tonal qualities, a method to account for post-tonal qualities, a method to better illustrate the close interrelationship between rhythm and harmony to the notion of tension and release is necessary in order to fully address the various musical features in neoclassical repertoire. Its analytical benefits also include giving more prominence to rhythmic analysis, beat-class set theory, and tying this with other musical parameters, in order to create more inclusive analyses. Furthermore, this study can help in redefining formal functions in post-tonal repertoire. The notion that formal functions comprises the understanding of phrase, idea, repetition, sequences and sections for classical repertory can be further enhanced through a deeper understanding of ancillary parameters such as motive, melody. harmony and rhythm.

Although this study has primarily focussed on the two case studies – Hindemith and Stravinsky – and therefore on Stravinskian neoclassicism and Germanic neoclassicism, alongside smaller case studies from different nations, future studies can focus on applying a hybrid approach to music in a geographically specific way, such as focussing on countries such as Germany, Russia, America, France and Spain, or with a focus on specific years leading up to neoclassicism, or with a focus on piano music or to specific instrumental, chamber or orchestral works. Theoretical hybridity is therefore crucial to the progress of music theory, especially in cases where it is flummoxed by repertoire that cannot be fully explored by a singular method. In the bigger picture, theoretical hybridity can potentially be the tool that analysts and theorists need in order to build bridges with performance and create a closer relationship with musical perception.

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