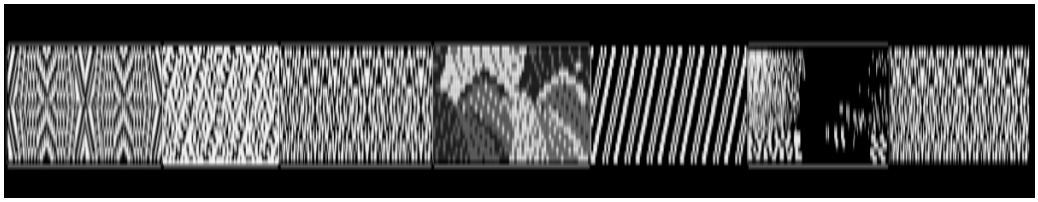
Mapping Textile Patterns into Sonic Experience



Commentary accompanying the Portfolio of Compositions

Submitted for the degree of Doctor of Philosophy by Composition

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2015

ABSTRACT

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Portfolio Contents:

	Composition	Year	Scoring	Duration
1.	*Textile_3*	2012	for four percussionists	0h09'23"
2.	*Habotai*	2012	for string quartet and piano	0h11'50"
3.	*Moorchana*	2013	for oboe, bass clarinet B-flat, violin, viola, violoncello and percussion	0h12'43"
4.	*Textile_4*	2013	for solo piano and live electronics, or four acoustic pianos	0h15'55"
5.	*Nigamagamini*	2014	for solo bass flute and live or pre-recorded electronics	0h09'20"
6.	*Sandhi Prakash*	2014	for string chamber orchestra	0h09'55"
7.	*Textile_5*	2014	for symphony orchestra	0h30'08"

This portfolio contains seven works for a variety of ensembles and explores a number of distinct approaches of mapping textile patterns into musical parameters, incorporating various compositional techniques, such as *microtonality*, *minimalism*, *serialism*, and *stochastic composition*. The commentary examines the aesthetic links between the compositions through the exploration of the interaction of visuals and sonic art, analysing in detail the analogous features between them. It is not the intention of this commentary to inform the reader how to compose music that is derived from textile patterns. Instead, this commentary is to be viewed as a personal creative method, describing the concepts and techniques employed in the music. The commentary is divided into two parts. The first part aims to outline the general methods involved in the construction of textile patterns, focusing on possible relations with various musical parameters. The second part presents these ideas as realised in the practical setting of my compositional work, drawing on the diverse strands of my artistic practice.

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CONTENT OF ACCOMPANYING CD'S

CD 1:

1.	*Textile_3*	(2012)	for four percussionists	0h09'23"
2.	*Habotai*	(2012)	for string quartet and piano	0h11'50"
3.	*Textile_4*	(2013)	for solo piano and live electronics, or four acoustic pianos	0h15'55"
4.	*Nigamagamini*	(2014)	for solo bass flute and live or pre-recorded electronics	0h09'20"
5.	*Sandhi Prakash*	(2014)	for string chamber orchestra	0h09'55"

CD 2:

1.	*Textile_5*	(2014)	for symphony orchestra	0h30'08"

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STATEMENT OF COPYRGHT

ACKNOWLEDGEMENTS

This thesis presents the results of doctoral research conducted at the Department of Music at Durham University over the three year period 2012-2015.

I would like to express my gratitude to my supervisor, Dr. Sam Hayden for providing support and advice, for sharing his insights into musical thinking and guiding me through this project. I would also like to thank Professor Richard Rijnvos for his general availability and helpfulness.

My sincere appreciation goes to my English teacher Clare Carr for providing additional hours for meetings, encouragement and motivation.

I offer my sincere thanks to the following colleagues and friends, who have been particularly helpful and provided emotional support through all the ups and downs that accompanied three years of intense study: Anton Lukoszevieze, Christopher Fox, Marius Jokubaitis, Stephen Timothy Chase, Nicky Hall, Shelly Knotts, Chad Langford, Joris de Henau, John Goodenough, George Kennaway, Shaun Blezard, Simon Ward, Patrick Zuk, Karen Nichol, Joyce Dent, Martin Allison, Stephen Nielsen, and Maria Kouvarou.

The completion of this PhD was made possible by the generous support of the Arts & Humanities Research Council (AHRC), who has funded the composer's study at the Department of Music, University of Durham.

Last and not least, I would like to express my sincere gratitude to my mother, for her constant support throughout my academic studies.

Dedicated

to my daughter Grėtė Jokūbaitytė

1. INTRODUCTION

This commentary explores a methodology that relies on the application of creative techniques related to the field of textile fabrication. I examine the connections between contrasting woven textile patterns and various musical parameters. The research focuses on developing my artistic voice following a trajectory that includes establishing conceptual and methodological tools in order to examine essential aesthetic principles shared between two distinct artistic domains.

I graduated from Kaunas Technology University in 2001 with Bachelor and Master's degrees in textile design and engineering, and I have a comprehensive knowledge of textile fabrics. Studying at the Kaunas Technology University was an important opportunity for me not only to learn how to construct textile fabrics, but also to gain experience of the technological processes involved, each of which impact the physical properties of the finished textile patterns.

My first attempts to create work based on the translation of textile patterns into musical structures date back to my composition studies at the Lithuanian Academy of Music and Theatre. The present PhD commentary is a further development of my compositional background, in particular of works composed between 2001 and 2008, including works exclusively from my Bachelor and Master's degree years. During this period I undertook compositional research on the transformation of textile patterns into various musical parameters, specifically developing contrasting structures of rhythm and pitch through works such as *Panchami* (2006) for string quartet and electronics, *Textile_1* (2006) for mixed choir, and *Scintilla* (2008), scored for symphony orchestra. The latter piece explores a specific textile pattern generating a repetitive pattern of harmony and rhythm.

During my composition studies at the Lithuanian Academy of Music and Theatre, the exploration of possible mapping processes was still at the stage where I nurtured my personal credo in searching for analogies between visuals and sound, without taking anything deeper into account. After a break of several years, whilst making a living as a freelance composer, I was encouraged to return to my previous

research topic and continue working on textile patterns. The opportunity to undertake PhD studies at Durham University provided a natural starting point in order to engage this research in a methodologically rigorous way. This PhD commentary can therefore be seen not only as the document of a personal creative journey – a journey which encompassed the exploration of textile-to-sound parameter mappings from simple to highly complex textile patterns – but also as a demonstration that this approach to music composition can create work of a high aesthetic value.

The aim of the research project is to develop techniques for using textile patterning for sound regulation, thereby establishing a coherent, personal idiom by combining textile and sound. My fascination for the combination of textile design, sound structures, and music-making processes has raised the following main research questions that will be subsequently explored:

(1) What is relevant between the derivation of the primary weave / the overall textile pattern and a particular composition?

(2) Which analogous features of the overall structure of a textile fabric can impact the music composition?

(3) How can the primary weave and its elements be mapped into the various musical parameters?

(4) How could the particular textile design convey its 'emotion' in the music?

The first chapter describes the general properties of textile fabrics, such as the structure and fundamental design of textile fabrics, including the definition of common textile terms that are used throughout the commentary. In addition, it explores previous research projects and literature based on textile patterns. Apart from the influence of textiles the selection of pieces within the portfolio contain a wide variety of musical point of reference. My main influences have been the work of Morton Feldman, John Cage, Bryn Harrison, Tom Johnson, Steve Reich and Terry Riley, all of whom are referenced directly and indirectly.

The second chapter focuses on the exploration of parameter mappings into sonic experience exploring analogous parameters between textiles and music. The method of the mapping process relates to a variety of established compositional

techniques, including *microtonality*, *serialism, minimalism*, and *stochastic composition*, each of which are linked to a particular composition. The conclusion examines to what extent these mapping processes have been successful and discusses outcomes that can be drawn from these compositional experiences.

1.1 RESEARCH CONTEXT

In this chapter, I will explore the connection between music and the design of textile fabrics in different cultures, and how in the last decade, an increasing number of distinctive audiovisual art installations have employed textile fabrics as a source of inspiration. I will explain how weaving technology and processes shaped my creative ideas in order to use textile patterns as a guide for compositions.

Weaving is one of the oldest crafts, which began in prehistoric times; the first linen cloth was made in Mesopotamia in around 6500 B.C.[1] The history of weaving is largely a history of women's work. Anthropological research has concluded that it was invariably women who produced most of the textile in the ancient world.[2] In many languages, including English, the verb *to weave* defines not just the making of textiles, but work in any creative art.[3] As a metaphor for creation, the concept of weaving is embedded in different languages and mythologies all over the world. Many different cultures used weaving as a functional process as well as an art form.

Weaving expresses the identity of the weaver, community, and country through esoteric designs that encode the vision of the world. According to Kathryn Sullivan Kruger the cloth conveys a meaning, and in some societies cloth itself not only becomes a metaphor for language, but also retains its culture's religious or spiritual beliefs.[4] The specific variations in aesthetic, colour and style of a weave help to distinguish behaviors within a culture, and represent one of the principal activities around which a culture organized its economic and social structure, also allowing for the shaping of cultural identity.

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[1] Rachelle Rogers, *Creative Crafts Desk Handbook* (New York: Parker Publishing, 1980), p. 91.
[2] Ibid., p. 22.
[3] Ibid., p. 29.
[4] Kathryn Sullivan Kruger, 'Weaving the Word: The Metaphorics of Weaving and Female Textual Production', (Ph.D. thesis, University of Miami, 1994), p. 15.

It is not surprising that throughout history many artists and researchers have highlighted the connection of weaving with different art disciplines. For example, Gottfried Semper, an architect and art critic, has emphasized the influence of weave technique and materiality on art, architecture and other crafts. He declares that weaving was a starting point from which all handcraft, art and architecture originated.[5] The journalist Ptolemy Mann argues that the relationship between architecture and weaving is not only literal and symbolic, but that they share similar work methodologies in such a way that the process of weaving a piece of a cloth is a metaphor for the process of constructing and inhabiting a building through the idea of layering.[6] American composers Paul Lansky and Malcolm Goldstein characterized the word *texture* as 'the characteristic disposition or connection of threads in a woven fabric'.[7]

I would like to look at earlier research that focuses on the exploration of related traits of textile fabrics in conjunction with sonic parameters in different cultures. According to Professor Manolete Mora from the University of New South Wales, the fundamental principles of the weaving designs of the T'boli people of the Southern Philippines are analogous with the concepts underlying the instrumental composition *Utom*.[8] Mora argues that there are three compositional elements that are basic to both weaving and instrumental music, the main design, ornamentation, and 'ground' (see Figure 1.1).

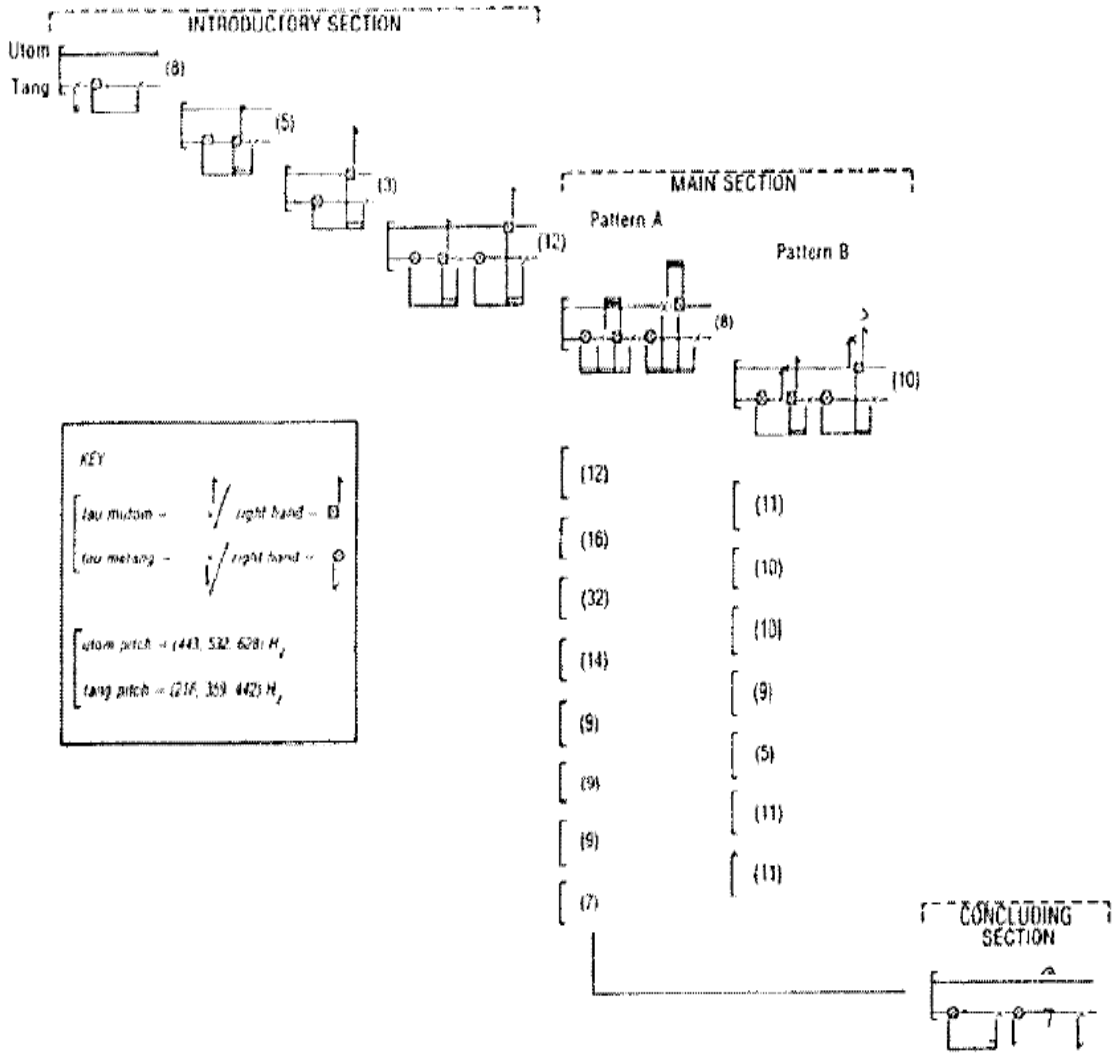
Figure 1.1: The three compositional elements in weaving and music.[9]

	Main Design		Ornamentation		Ground
Instrumental Composition	***utom***$_1$	:	***k'loonen***	:	***tang***
Weaving Design	***ogowen***	:	***k'loonen***	:	***lemen***

[5] Aaron Marcus, ed., *Design, User Experience, and Usability: Theories, Methods, Tools and Practice* (Berlin, Heidelberg: Springer Verlag, 2011), p. 665.
[6] Ptolemy Mann, 'Structurally Sound – Exposing the foundations of Architecture and Weaving' http://www.ptolemymann.com/assets/structurally_sound_exposing_the_foundations.pdf (last accessed 26 January 2016).
[7] Paul Lansky and Malcolm Golstein, 'Texture' in John Vinton, ed. *Dictionary of Contemporary Music* (New York: E. P. Dutton, 1974).
[8] Manolete Mora, 'Tune and Textile: Interrelatedness in the Music and Weaving Arts of the T'boli', *UP Diliman Journals*, 9, 2 (2012), p. 3.
[9] Ibid., p. 12.

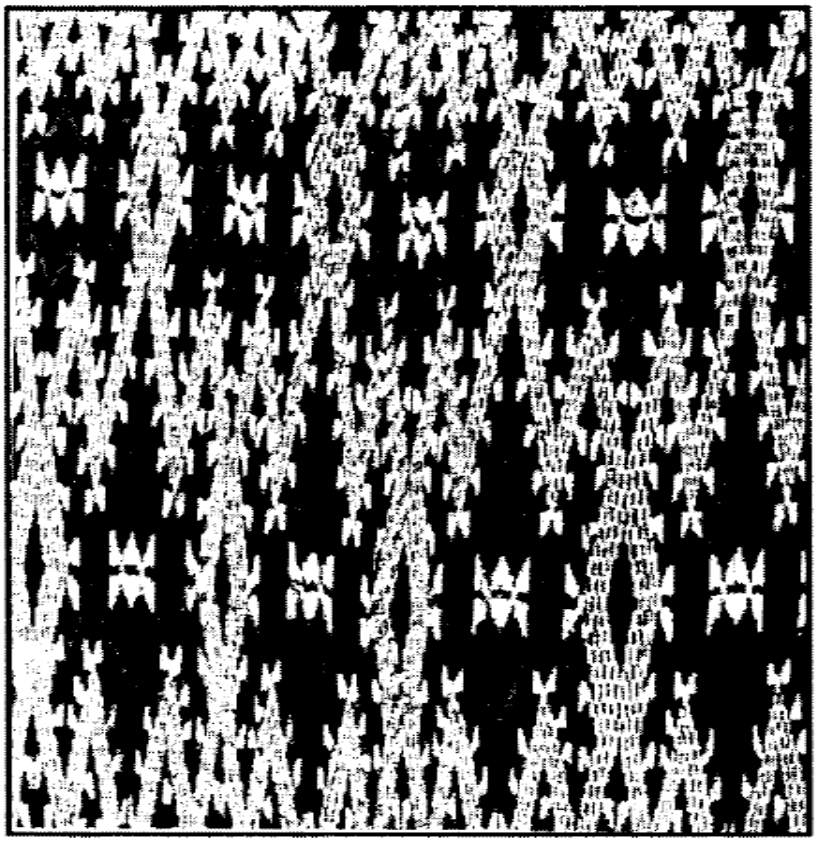
Mora demonstrates that these connections can be found in *K'lutang seko* performance, which is performed by two women each using a pair of wooden mallets. One performer plays the *Utom* (main design), and the other performs the *Tang* (ground) in a closely coordinated, interlocking manner. The 'counterchange', as Mora describes it, between Utom and Tang occurs as a result of unstable figure-ground relations, as the attention of the eye and ear in the visual and aural domains, respectively, shift back and forth between figure and ground and the two elements are 'woven' together (see Figure 1.2 and Figure 1.3).

Figure 1.2: A musical transcription of a fragment from a Seko performance.[10]



[10] Ibid., p. 23.

Figure 1.3: An example of figure (white ornaments) / ground (black color) counterchange in T'boli textile design.[11]



Andrea M. Heckman in her book *Woven Stories: Andean Textiles and Rituals* explores the use of a piece of woven fabric as visual communication in ritual praying and dancing in Andean culture.[12] She argues that weaving through the structure of woven fabrics are symbols and visual metaphors representing meaningful relationships with nature, animals, and the environment. For example, the design and layout of Andean textiles, especially tunics, which contained the horizontal and vertical registers of stripes and bands, display aspects of order, symmetry, and colour reflecting broader Andean concepts of beauty and aesthetics. Moreover, the colour scheme of tunics had a specific coded meaning in Andean culture, for example, red, yellow, deep purple and black colours are associated with the sacrificial and ritual ceremonies of the Sun cult, while the combination of red and blue colours were associated with Inca nobility and royalty (see Figure 1.4).

[11] Ibid., p. 24.
[12] Andrea M. Heckman, *Woven Stories: Andean Textiles and Rituals* (Albuquerque: University of New Mexico Press, 2003), p. 47.

Figure 1.4: (a) An Andean wedding tunic, (b) red-blue men's tunic.[13]

(a) (b)

Textile designer and psychologist Ann Collierhe argues that the weaving process not only expresses the cultural and artistic values of a society,[14] but also lends itself to an investigation of cognitive analysis, and emphasizes the integration of textiles and psychology as a self-healing meditation.[15] Emerging from this background, the exploration of non-Western cultures has made a huge impact on my work, especially through investigating of the Indian melodic mode, the *raga*. The conception of the raga as a musical pattern demonstrating "the expression of a single idea or emotion - rasa"[16] gave me the idea to examine possible links between patterns in both textiles and sound. Aspects such as structure, repetition, proportion, balance (between order and disorder),[17] irregularity, and asymmetry occur in visual terms analogous to music, relying on a foundation of structural sources.[18]

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[13] Elena Phipps, Johanna Hecht, and Cristina E. Martin, *The Colonial Andes: Tapestries and Silverwork, 1530-1830* (New York: Yale University Press, 2004), p. 138.
[14] Helen Banes and Sally Banes, *Fiber & Bead Jewelry: Beautiful Designs to Make & Wear* (New York: Sterling Publishing Company, Inc., 2002), pp. 27-28.
[15] Ann Collier, *Using Textile Arts and Handcrafts in Therapy with Women: Weaving Lives Back Together* (London: Ann Futterman Collier, 2012), pp. 13-35.
[16] Raj Kuma, *Essays on Indian Music* (New Delhi: Discovery Publishing House, 2003), p. 113.
[17] Andrea M. Heckman, *Woven Stories: Andean Textiles and Rituals* (Albuquerque: University of New Mexico Press, 2003), p. 2.
[18] Gabriel Pareyón, *On Musical Self-similarity: Intersemiosis as Synecdoche and Analogy* (Yliopistopaino: The International Semiotic Institute, 2011), p. 129.

The most significant and enduring musical influence during my investigations has been *Coptic Light*, a work for symphony orchestra by the American composer Morton Feldman from 1985. Feldman's aesthetic response to early Coptic textiles, which he had seen in the Louvre, inspired my own research in this area.[19] *Coptic Light* exemplifies his interest in the distinctive treatment of repetition as metaphor for pattern in the visual arts, and effecting subtle change to create musical edifices of increasingly astonishing length.[20] As Feldman says:

> Transferring this thought to another realm, I asked myself what aspects of music since Monteverdi might determine its atmosphere if heard two thousand years from now. For me, the analogy would be one of the instrumental imagery of Western Music. These were some of the metaphors that occupied my thoughts while composing *Coptic Light*.[21]

The repetitions in Feldman's piece are rarely exact, using inflections in rhythm, register, and timbre to create a subtle transformation of timbre and harmony over the duration of the piece as a whole. Having said that, Feldman's transformation process relies on a more intuitive/creative approach when transforming textile pattern into sound, whilst my intention is to explore the latent possibilities engendered in more *direct* mappings, in order to find particular characteristics that determine the language of the process.

The project *Soundweaving*[22] by textile design student Zsanett Szirmay and composer Balint Tarkany-Kovac was inspired by punch cards, which are used in Jacquard weaving textile design. The project is based on mapping Hungarian textile patterns into sound using laser cut punch cards, which match different textile weaves. The cross-stitch pattern of holes on the tape becomes a score converting cross-stitched patterns into melodies to be played on a music box (see Figure 1.5).

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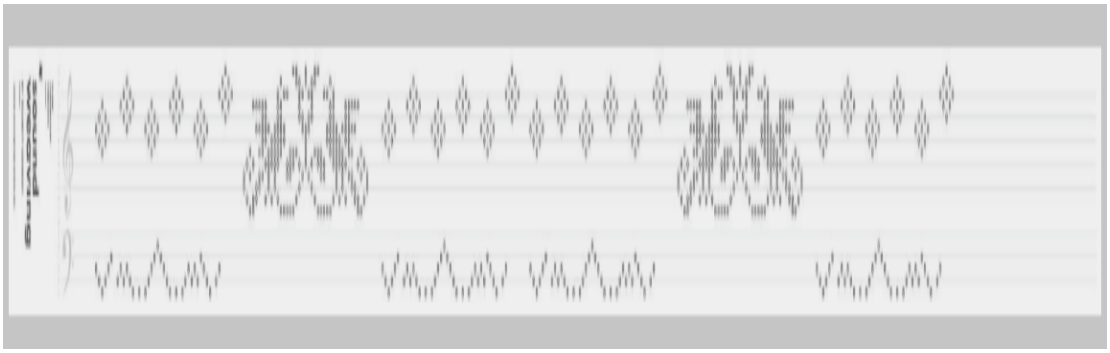
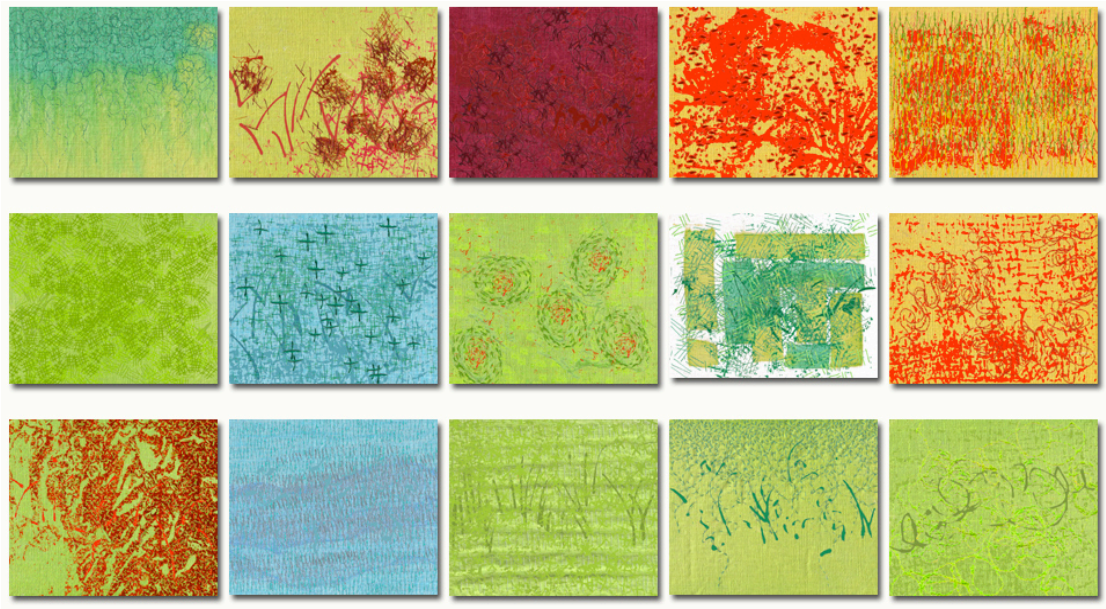
[19] Bunita Marcus, *The square Knot – A Memoir*, ed. by Sean Kissane (Dublin: Irish Museum of Modern Art, 2010), p. 201.
[20] Dora A. Hanninen, 'Feldman, Analysis, Experience', *Twentieth Century Music* 1, 2 (2004), 225-251 (p. 229).
[21] Morton Feldman, Coptic Light, in Morton Feldman, Give My Regards to Eighth Street in *Collected Writings of Morton Feldman*, ed. by B.H. Friedman, (Cambridge: Exact Change, 2000), p. 201.
[22] http://www.psfk.com/2015/02/soundweaving-zsanett-szirmay-artists-embroidery-music.html (last accessed 04 April 2015).

Figure 1.5: The Hungarian textile pattern, in which the pattern in the rhombus is the lower part of the melody. [23]



Fifteen Images[24] (*Le Jardin Pluvieux*) scored for keyboard and 'active' notation by Nigel Morgan investigates both aural and visual reception through the digital animation of textile images and their interaction during live performance. The fifteen physical textile objects are derived from a single image – a sketch of a garden after a night of heavy rain, segmented by a fifteen-panel window, which are transformed into LED scoreboard in order to accompany a performance (see Figure 1.6).

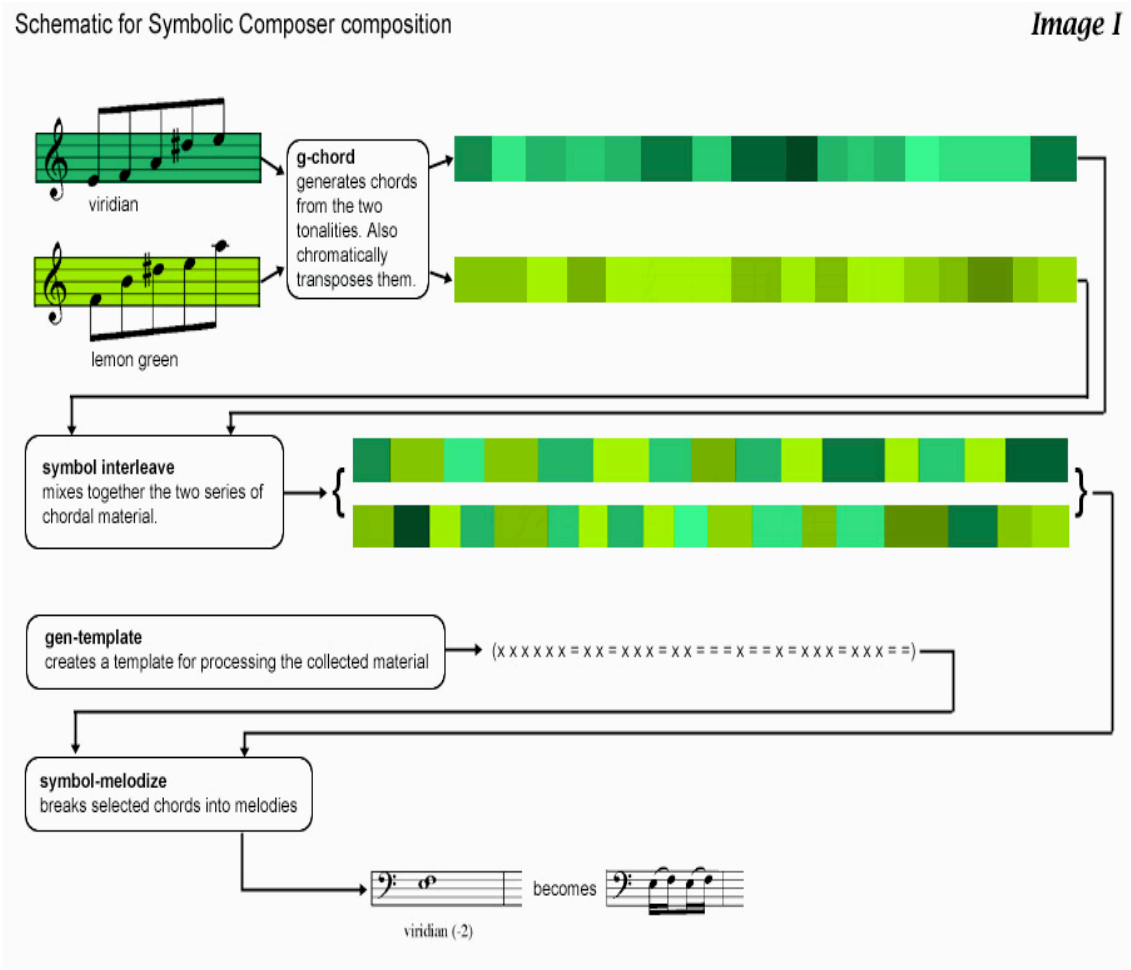
Figure 1.6: An overview of Fifteen Images.[25]



[23] Ibid.
[24] Nigel Morgan and others, 'Music and Textiles Interact', *Craft Research*, 1, 1 (2010), 39-61.
[25] http://nigel-morgan.co.uk/index.php?name=News&sid=227&file=article&pageid=2 (last accessed 23 March 2016).

The organisation of the music is based on the distribution of the garden's colours into fifteen images providing the music's distinct scalic and harmonic vocabulary; the mix of colour was mapped to the density of pitch register and for articulation and expressive effects (see Figure 1.7).

Figure 1.7: An example of Image I from Fifteen Images.[26]

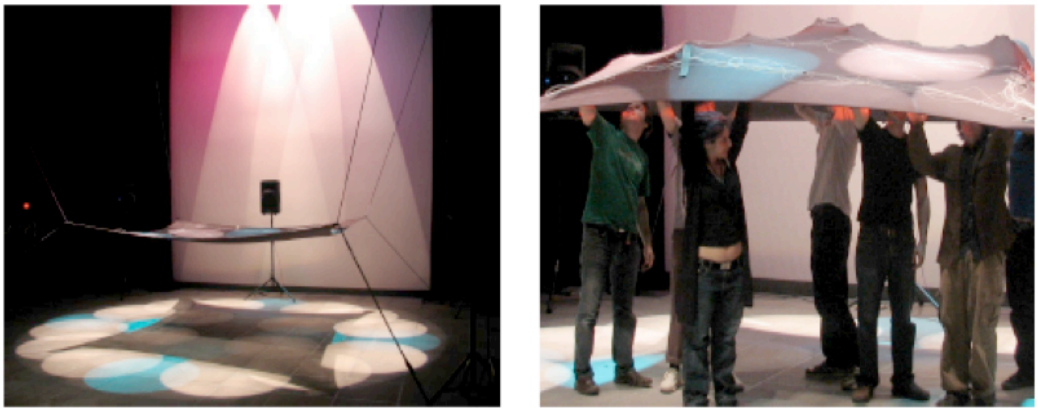


David Birnbaum et al[27] explored a methodology for data extraction and sound production, which derives from using textile cloth to stimulate "improvised play" rather than rigid interaction metaphors based on preexisting cognitive models. The aim of the research was to create a stretched elastic cloth with an integrated sensor array 'blanket' that maps cloth behavior into audio parameters throughout three functions, such as total activity, sensor velocity and activity 'spike'. Depending upon

[26] Ibid.
[27] David Birnbaum and others, 'Mapping and Dimensionality of a Cloth-based Sound Instrument', in *Proceedings of the 4th Sound and Music Computing Conference* (SMC'07), Lefkada, Greece, July 2007.

how the sensor array is sampled, contours in the signal correlating to gesture are mapped to sound synthesis parameters (see Figure 1.8).

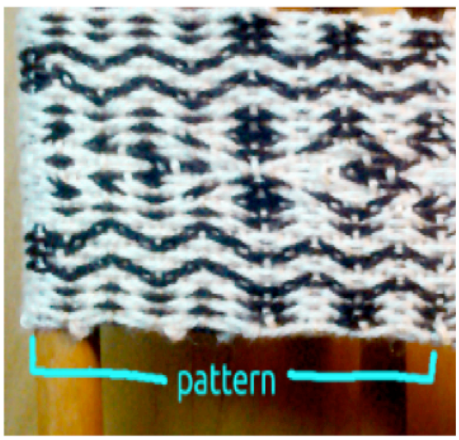
Figure 1.8: (a) The interface at rest and (b) during interaction.[28]



(a) (b)

Furthermore, recent scholarly research in the project *Weaving Codes - Coding Weaves*, led by an AHRC funded team at Leeds University under Alex McLean and Dave Griffiths, investigates textile patterns developing a computer language using live coding to describe the construction of weaves.[29] By connecting live coding with weaving they explore how any woven pattern can be seen as a digital record of movement performed by the weaver (see Figure 1.9).

Figure 1.9: (a) The weaving pattern and (b) its code equivalent.[30]



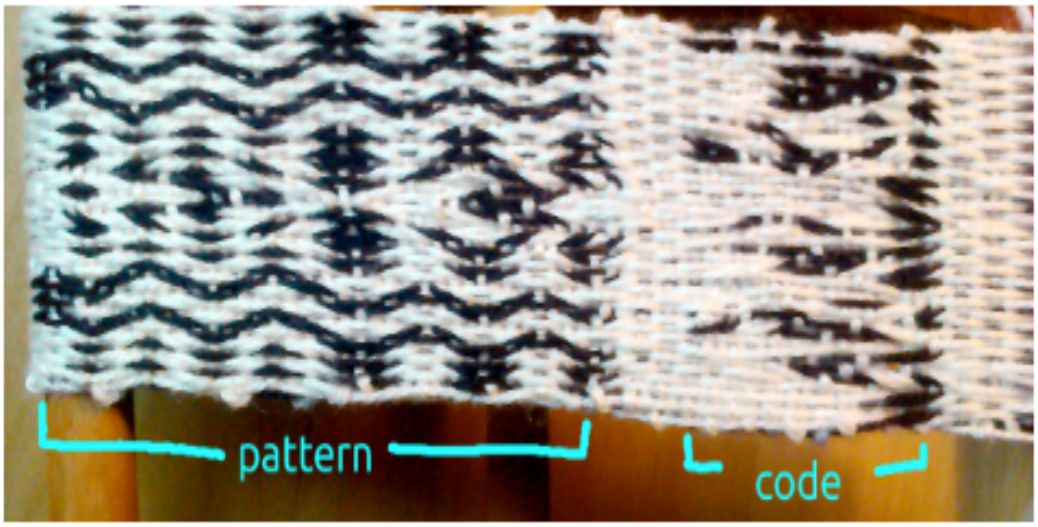

```
(twist 3 4 5 14 15 16)
(weave-forward 3)
(twist 4 15)
(weave-forward 1)
(twist 4 8 11 15)

(repeat 2
 (weave-back 4)
 (twist 8 11)
 (weave-forward 2)
 (twist 9 10)
 (weave-forward 2)
 (twist 9 10)
 (weave-back 2)
 (twist 9 10)
 (weave-back 2)
 (twist 8 11)
 (weave-forward 4))
```

(a) (b)

[28] Ibid.
[29] http://kairotic.org/about/ (last accessed 02 February 2015).
[30] Ibid., (last accessed 02 February 2015).

The final weave, is based on live coding using exactly the same information as the original pattern but this time producing a messy pattern. The coding of the textile pattern demonstrates that the weave itself contains a higher density of information or a higher rate of entropy, and is therefore closer to randomness than the pattern (see Figure 1.10).

Figure 1.10: The original pattern and its executable code equivalent. [31]



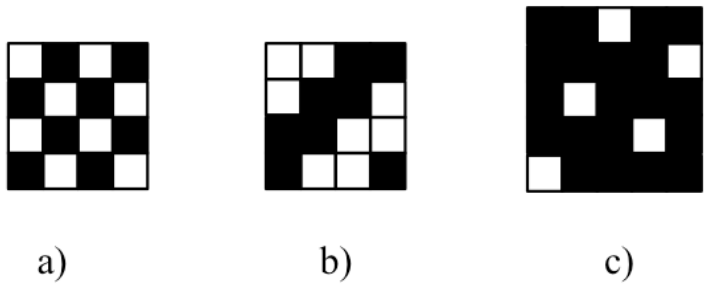
All of the abovementioned examples illustrate the great potential for new compositional and production techniques to be found in the exploration of the interrelatedness between the craft of textile fabrics and sonic art. As it can be seen, weaving is perceived not only as a creative art process, but also reflects the identity of a number of cultures through symbolic meaning, colour, pattern, shape, and utilisation of their respective technologies.

In the commentary that follows, I explore the relationship between my musical ideas and the structures of textile fabric patterns (wefts/warps) and their associated symbolic meanings. Due to the endless amount of possibilities to create a textile pattern,[32] I will concentrate on weaving patterns, which are based on three fundamental weaves: plain weave, twill weave, and satin weave. Each of these weaves generate distinctive fabric textures, all formed by shifting a sequence of

[31] Ibid., (last accessed 02 February 2015).
[32] Sabit Adanur, *Handbook of Weaving* (Florida: CRC Press, 2000), p. 1.

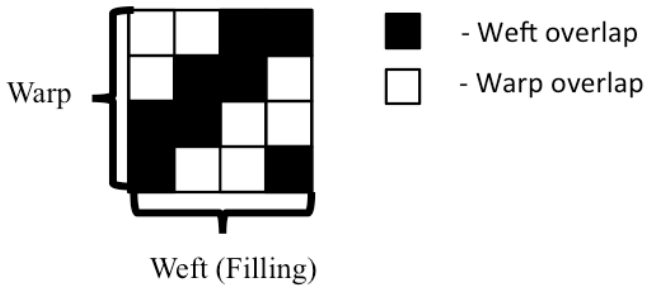
repeats, thus obtaining the particular line(s) characteristic for a certain type of weave (see Figure 1.11). These simple weaves form the basis for the interlacement of most of the complex compound weaves.

Figure 1.11: (a) Plain weave, (b) Twill weave, and (c) Satin weave.



The textiles are considered structured material, in that a textile object can be perceived as an entity, or as an abstraction of its internal structure.[33] The structure of a woven fabric consists of two sets of yarns, referred to as warp and weft, [34] represented by a *canvas method* [35] on a square paper diagram (weave design paper). Each vertical space indicates a warp thread, and each horizontal space represents a weft thread. A black square marks the overlap of the weft thread, which is placed above the corresponding warp, while a blank square illustrates the overlap of the warp, which floats above the weft (see Figure 1.12).

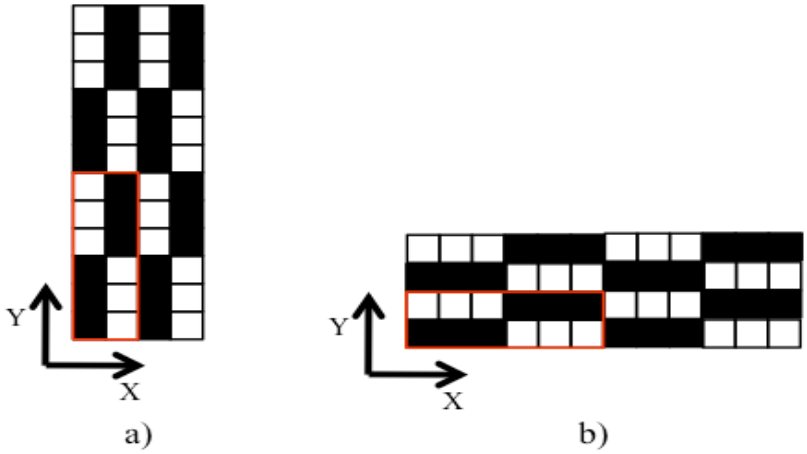
Figure 1.12: Point paper diagram of the basic elements of a woven design (weave diagram).



[33] Andrew C. Long, *Design and Manufacture of Textile Composites* (Cambridge: Woodhead Publishing Limited, 2005), p. 1.
[34] Prabir K. Banerjee, *Principles of Fabric Formation* (Florida: CRC Press, 2015), p. 9.
[35] Walter S. Sondhelm, *Handbook of Technical Textiles* (Cambridge: Woodhead Publishing Limited, 2000), p. 64.

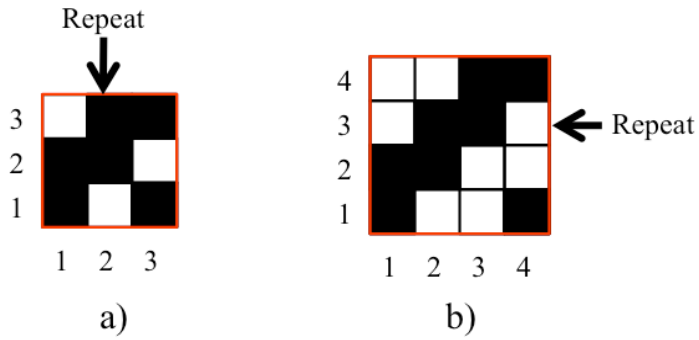
The structure of the textile fabric can be orientated by the x or y axis, which affects the structure and density of the final fabric.[36] Figure 1.13 illustrates the placement of the same pattern in two directions: x and y.

Figure 1.13: (a) The textile fabric formation in y-axis, and (b) the textile fabric formation in x-axis.



The identification of any woven structure relies on the minimum number of warps and wefts, known as the 'repeat', which is a quantitative expression of any given weaves. The repeat size is the sum of the warp and weft floats, which depend on the nature of the weave (see Figure 1.14).

Figure 1.14: (a) The repeat of plain weave (3x3), (b) the repeat of twill weave (4x4).



By far the most exclusive feature of my research, the one that distinguishes it from similar approaches, is the exploration of *compound woven* textile patterns

[36] Sabit Adanur, *Handbook of Weaving* (Florida: CRC Press, 2000), pp. 28-29.

deriving from *primary weaves*; i.e., patterns that I generated myself 'from scratch' during the various pre-compositional processes. The construction of compound weaves requires knowledge and experience as, interestingly, the woven effect cannot be predicted prior to the weaving process.

Each commentary chapter consists of a general overview of the construction and the physical properties of woven textile fabrics, that briefly outline several commonly used methods and processes which define the structure of woven fabrics, followed by a more thorough analysis of the design process, which are linked to a specific musical composition, highlighting the relationship between weave pattern and music. In addition I relate my aim to combine this compositional approach with the influence upon my work of the patterning found in Indian classical music and the associated aesthetic of *rasa* or 'essence'.

1.2.RESEARCH METHODOLOGY

1.2.1 MAPPING PATTERN INTO MUSIC

Translating the numerical output of specific textile weaves into musical events relies on a mathematical operation known as *mapping*. However, mapping implies a one-to-one correspondence between input (the textile weave) and output (the resulting sound) in two ways: simple or complex. A simple mapping tends to be immediately understood, for example, a row of equally spaced lines across a weave pattern could be mapped into music as a pulse. A complex mapping involves more complicated matrices or algorithms, where the mapping from the visual pattern is not such an immediately direct one-to-one translation into sound.[37] Both ways of mapping can be used for translating textile fabric into sound, reflecting particular approaches and aesthetics. Additionally, a mapping method merges the relationship with textile weave and music through an *intersemiotic*[38] approach, in that the comparison of musical components with those from other artistic disciplines reinforces the distinctive aesthetic of the music. In this chapter I would like to explore how visual art, mathematics, and science inspired composers to map non-musical data into the

[37] Roger T. Dean, *The Oxford Handbook of Computer Music* (Oxford: Oxford University Press, 2009), p. 199.
[38] Gabriel Pareyón, *On Musical Self-similarity: Intersemiosis as Synecdoche and Analogy* (Yliopistopaino: The International Semiotic Institute, 2011), p. 102.

musical stream, and how the process of mapping can reflect differing aesthetics and techniques of composition. Finally, I will summarize how the methods of mapping I discuss link to my own creative mapping technique.

Of all the techniques that have determined the direction of Western composition over the course of the twentieth century it is serialism that has had the most significant impact in terms of establishing the potential for mapping abstract ideas into compositional technique. Arnold Schoenberg's inauguration of the dodecaphonic or 12-note method of composition, around 1923 introduced a set of algorithmic procedures to manipulate an ordered series of all twelve notes of the chromatic scale in order to provide a unifying basis for a composition's melody, harmony, structural progressions, and variations.[39] This method as it was developed by Schoenberg and his followers, consists of four main procedures to be observed in order to create variations with the twelve-note series, such as transformation of a note row by inversion, retrograde and retrograde-inversion.[40] Although the rules of this method are a self-imposed compositional constraint, the composer has much freedom to select materials, rules of derivation, methods of ordering and relating parameters to one another, which allows for diverse kinds of music, not only between the music of different composers, but even within the music of one composer.[41] After the Second World War, Schoenberg's method was criticised by Messiaen, Boulez, Stockhausen, and Babbitt, who claimed that Schoenberg did not go far enough. They argued that the rules and compositional procedures of the twelve-note method did not define syntax or determine style, and that Schoenberg was essentially still using traditional styles relevant to tonal music but irrelevant to his new method of handling pitch.[42] These composers pushed Schoenberg's ideas in a more rigorous direction that would become known as 'serialism' into domains beyond pitch selection, by subjecting the parameters of duration, dynamics, and articulation to row sequences and transformation procedures.

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[39] Gareth Loy, *Musimathics: The Mathematical Foundations of Music* (Cambridge: MIT Press Books, 2006), p. 331.
[40] Leonard B. Meyer, *Music, the Arts, and Ideas: Patterns and Predictions in Twentieth-Century* (London: The University of Chicago Press, 2010), p. 314.
[41] Ibid., p. 240.
[42] Milton Babbitt, 'Twelve-Tone Rhythmic Structure and the Electronic Medium', *Perspectives of New Music*, 1, 1 (1962), 49 – 79, (pp. 78-79).

The example of Schoenberg and his successors in advocating these abstract compositional procedures has appealed to a number of artists from other fields. Serialism can be compared with Abstract Expressionism in the visual arts, in that both composers and painters drew on the idea of deducing all the elements of a form from a common thematic source.[43] The serial principle of composition in painting can be observed in the paintings *Fugue in Red* (1921), *Static and Dynamic Graduations* (1923), and *Blooming Garden* of a Swiss-born painter, printmaker Paul Klee.[44] Furthermore, Klee saw analogies between music and visual art, such as in the transient nature of musical performance and the time-based processes of painting, or in the expressive power of colour as being akin to that of musical sonority.[45] Another painter, Wassily Kandinsky was inspired, in part by Schoenberg's example, by the idea that to paint a composition was equivalent to composing music, to create a configuration of colours, lines, and forms something that would be "structurally self-sustaining and incomparably expressive".[46] According to Klaus Kropfinger, the act of transforming "the expression of feeling" through "reason", enables one to control the balance of artistic creation and process in the composition in a way that comes close to Schoenberg's position in his *Theory of Harmony*.[47]

The abstract film directors, The Whitney brothers, John Whitney Sr. and James Whitney were influenced by Schoenberg's twelve-tone system of music composition. In the abstract film *Arabesque* (1975), in a similar fashion to Schoenberg reducing music to the serial row, the Whitney brothers reduced the image "down to its most fundamental state—essentially a point of light, which could then be ordered like a tone row", which was programmed by the contemporary visual music computer animator Larry Cuba.[48]

Just as Boulez had criticised Schoenberg for not fulfilling the potential of his

[43] Yuri Kholopov and Valeria Tsenova, *Edison Denisov* (Singapore: Harwood Academic Publishers, 1995), p. 161.
[44] Ibid., p.161.
[45] http://www.theartstory.org/artist-klee-paul.htm (last accessed 28 February 2016).
[46] Wassily Kandinsky, *Concerning the Spiritual in Art,* in *Concerning the Spiritual in Art,* trans. by M.T.H. Sandler (New York: Dover Publications, 1977), p. 32.
[47] Konrad Boehmer, ed., *Schoenberg and Kandinsky: An Historic Encounter* (Amsterdam: Harwood Academic Publishers, 1997), p. 27.
[48] Brougher Kerry, ed., and others, *Visual Music Synaesthesia in Art and Music Since 1900* (New York: Thames & Hudson, 2005), p. 125.

new techniques, so several composers such as Iannis Xenakis criticised the claim that serialism offered a rational or mathematical foundation for organising music.[49] Xenakis argued that the organisation of serialist music was not perceptable to the listener; his solution was to use mathematical ideas in his music in what he saw as a more relevant way, specifically through mapping ideas from his work as an architect onto his ideas about musical composition.

Xenakis, who was to become known as a pioneer of 'stochastic music' was influenced by his work in the field of architecture, in particular by the design concept of his mentor, Le Corbusier. The mathematical basis for Xenakis's inter-disciplinary practice featuring the transference of a generative technique from one discipline to another is articulated in his treatise *Formalized Music* (1971):

> My musical, architectural, and visual works are the chips of this mosaic. It is like a net whose variable lattices capture fugitive virtualities and entwine them in a multitude of ways… But the profound lesson of such a table of coherences is that any theory or solution given on one level can be assigned to the solution of problems on another level.[50]

Xenakis was also fascinated by several branches of mathematics, which he applied in his compositions, for example, probability theory and aleatory distribution of points on a plane in *Diamorphoses* (1957-58), Gaussian distribution in *ST/10*, *Atrès* (1956-62), Markov chains in *Analogiques* (1958-59), game theory in *Duel* (1959) and *Stratégie* (1962), and group theory in *Nomos Alpha* (1965-66).

Xenakis developed his architectural ideas by articulating them in space, while in music he arranged his ideas in time. He approached both music and architecture from a scientific and mathematical perspective, especially through a consideration of complex proportional relations. He was interested in the similarity of their underlying structural principles.[51] However, Xenakis has lifted the ancient Pythagorean idea of numerical proportions as a structural bond between music and architecture to a more general level:

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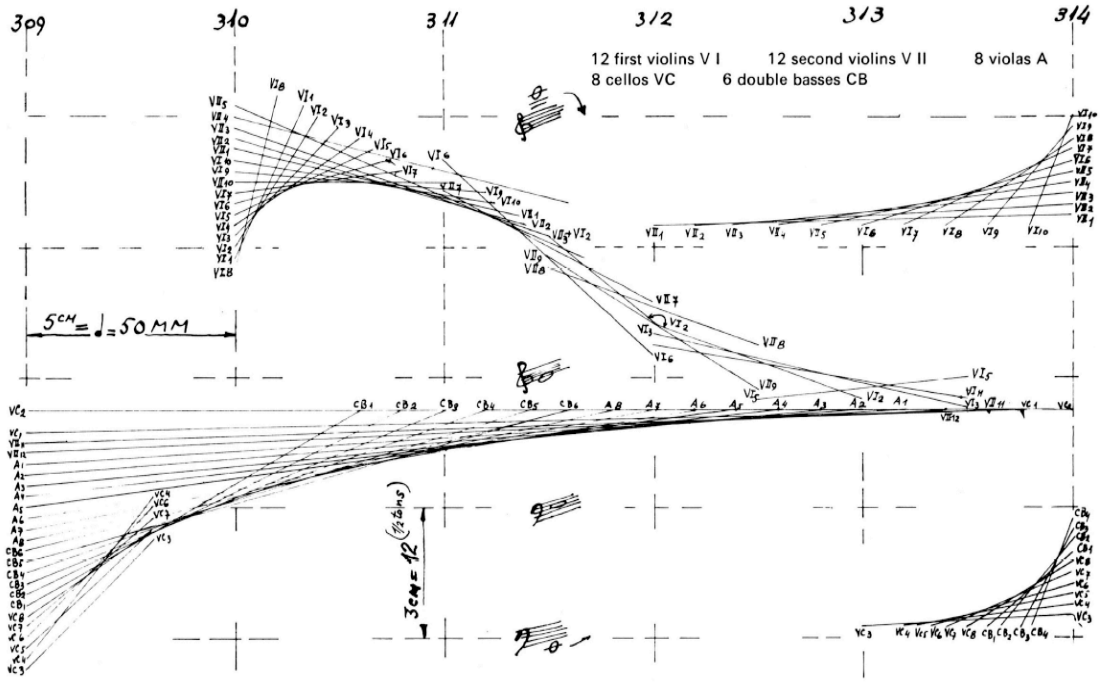
[49] Paul Griffiths, *Modern Music: The avant-garde since 1945* (London: Dent, 1981), p. 110.
[50] Iannis Xenakis, *Formalized music: Thought and Mathematics in Music*, ed. by Sharon Kanach (New York: Pendragon Press, 1992), p. viii.
[51] Le Corbusier, *Modulor 2*, trans. by Peter de Francia and Anna Bostock (London: Faber and Faber, 1954), p. 326.

I think it is possible to feel mathematics. Let's take a very simple example, the problem of proportion. When you have two intervals of time, a long and a short one, you may proportion them so that the long one maybe be double that of the short one. The proportion is something that you can feel. You have to feel proportions in music, architecture, in art wherever you use them or manipulate them.[52]

The correlation between music and architecture is clearly articulated in his composition *Metastaseis* (1955), which was his first piece for orchestra. Xenakis adapted the architectural drawing technique of working on a ruled surface to compose music, where the horizontal axis represents time and the vertical axis represents pitch. The famous sketch drawing of the Coda (measures 309-314) features the projection, in a plane, of a hyperbolic paraboloid. Later he used the same principle in his design suggestions to Le Corbusier for the architecture of the Philips Pavilion in Brussels for the World Trade Fair of 1958. Xenakis applied the use of string *glissandi* in order to obtain sonic spaces of continuous evolution, which he saw as equivalent to ruled surfaces in architectural design (see Figure 1.15 and Figure 1.16).

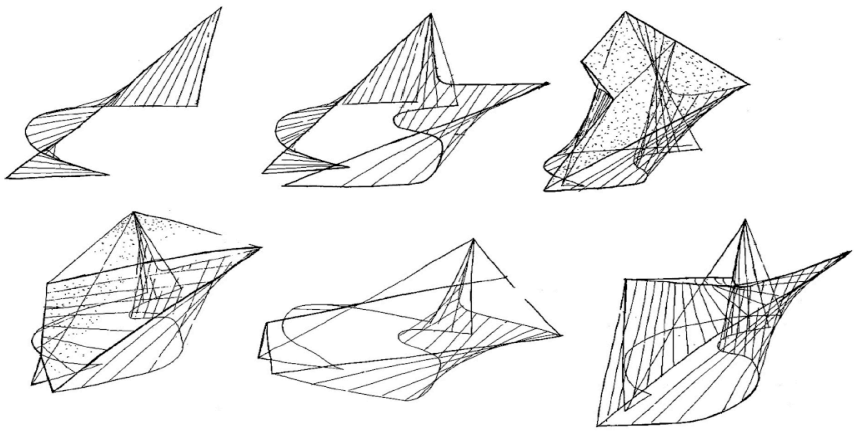
Figure 1.15: Graphical representation of the glissandi pitches in Metastaseis demonstrating the correlation between the string slide formations in musical pitch.[53]



[52] Michael Zaplitny and Iannis Xenakis, 'Conversation with Iannis Xenakis', *Perspectives of New Music*, 14, 1 (1975), p. 91.

[53] Kirsty Beiharz, 'Designing Sounds and Spaces: Interdisciplinary Rules & Proportions in Generative Stochastic Music and Architecture' http://www.creativityandcognition.com/cc_conferences/cc03Design/papers/11BeilharzDTRS6.pdf (last accessed 21 February 2016).

Figure 1.16: Different stages in the development of the first design of the Philips Pavilion.[54]



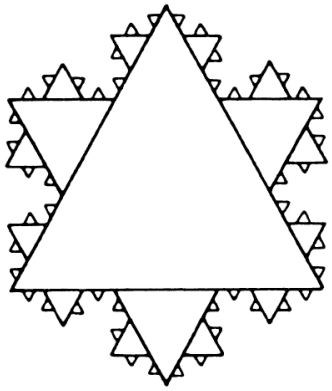
According to Sven Sterken, the similarity between the plans of the Philips Pavilion and the graphical score of *Metastasis* can be considered as two different hypostases of the same idea, namely a continuous transition between two discrete states. In acoustic space this condition is articulated in the development from unison to clustered sounds while in architecture it is expressed by merging the horizontal level surface and the vertical wall plane.[55]

Following Xenakis's example, many composers have turned to algorithmic approaches to composition. Broadly speaking, four categories of algorithms have been favoured by composers looking to explore complex mapping procedures: Stochastic processes (Markov chains, probability functions), Interactive algorithms (chaos theory, fractals), Rule-based algorithms (L-systems), and Genetic algorithms.[56] Of these ideas I would like to briefly explore the concept of *Fractal Geometry*, which has conquered an important space in both the visual arts and music. In 1975 Mathematician and IBM researcher Benoit Mandelbrot in his book *Les Objets Fractals* first introduced the idea of Fractal Geometry.[57] Fractals are generally self-similar patterns and independent of scale so that no matter how close you observe a

[54] Ibid.
[55] Sven Sterken, 'Music as an Art of Space: Interactions between Music and Architecture in the Work of Iannis Xenakis' in *Essays on the Intersection of Music and Architecture* , ed. by Mikesch W. Muecke, and Miriam S. Zach (Ames: Culicidae Architectural Press, 2007), p. 32.
[56] William J. Stewart, ed., *Numerical Solution of Markov Chains* (New York: Marcell Dekker, Inc.,1991), p. 544.
[57] Benoit B. Mandelbrot, *The Fractal Geometry of Nature* (New York: W. H. Freeman Co, 1982), p. 21.

part of a fractal pattern you can find it replicated in a similar way at a larger or smaller scale. In addition, fractal images are generated by means of relatively simple calculi, repeated again and again, using recursively on each step the results of the previous step. Fractals have been used to compose music algorithmically in order to create melodic variations, or sound modelling/synthesis, based largely on the concept of self-similarity, as well as on iterated functions.[58] The American composer Charles Dodge in his electroacoustic composition *Profile* (1983) elaborated an interpretation of the self-similarity concept in the way it is present in one of the most famous fractal objects, the Koch curve (Koch snowflake). It is one of a class of fractals called space-filling curves (see Figure 1.17).

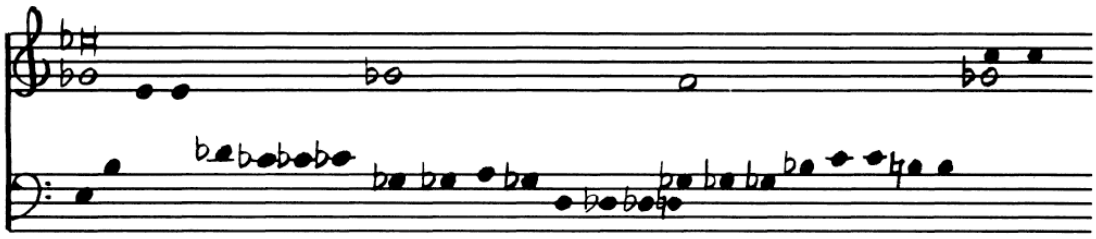
Figure 1.17: The first four generations of the Koch snowflake.[59]



The algorithm for creating *Profile* uses a 1/*f* noise algorithm to generate the musical details – pitch, timing, and amplitude – of each of the three lines comprising the texture of the piece. The structure of *Profile* could be described as recursively *time-filling* in the same way that the Koch snowflake is recursively space-filling. According to Dodge, this approach to the use of fractal geometry is very diverse and his musical analogy touches on but a small, simpler corner of its possible applications.[60] The composition is based on a principle of self-similar structuring in which a set of base notes is used to create a subset of higher and shorter notes, which in turn serve to generate a third set of higher and shorter notes (see Figure 1.18).

[58] Zhicai Zhong, ed., *Proceedings of the International Conference on Information Engineering and Applications* (Springer Science & Business Media, 2012), p. 309.
[59] Charles Dodge, 'Profile: A Musical Fractal' *Computer Music Journal*, 12, 3 (1988), 10-14, (p.11).
[60] Ibid., 10-14.

Figure 1.18: Pitches of all three lines at beginning of the piece Profile.[61]



Dodge argues that the use of fractal geometry has much unexplored potential remaining as a source for inspiration especially for his computer-aided composition: "I was so excited by the results [of the composition *Profile*] that I have used similar algorithms to create a numbers of works".[62]

The American minimalist composer, and former student of Morton Feldman, Tom Johnson has been inspired by simple mathematical procedures, such as tiling or tessellation, patterns of numbers, combinations, formulas and symmetries. According to Johnson, these procedures provide a means of avoiding subjective decisions and permitting objective logical deductions in order to avoid the idea of music as self-expression or as autobiography.[63] In his works, he seeks something more objective, something that doesn't try to manipulate the emotions of the listener. For example, his work *Narayana's Cows* (1989) scored for an unspecified ensemble and a narrator is based on a formula devised by the 14th century Indian mathematician Narayana, who posed this problem: "A cow produces one calf every year. Beginning in its fourth year, each calf produces one calf at the beginning of each year. How many cows and calves are there altogether after 17 years?"[64] In his piece, Johnson assigned the cows to quarter notes, the calves to eight notes, and each generation is represented by a new and lower note of a scale. At the end of the piece (which does not follow all the way to the end solution of the mathematical problem) there are a total of 872 cows. Figure 1.19 presents the musical example for three years.

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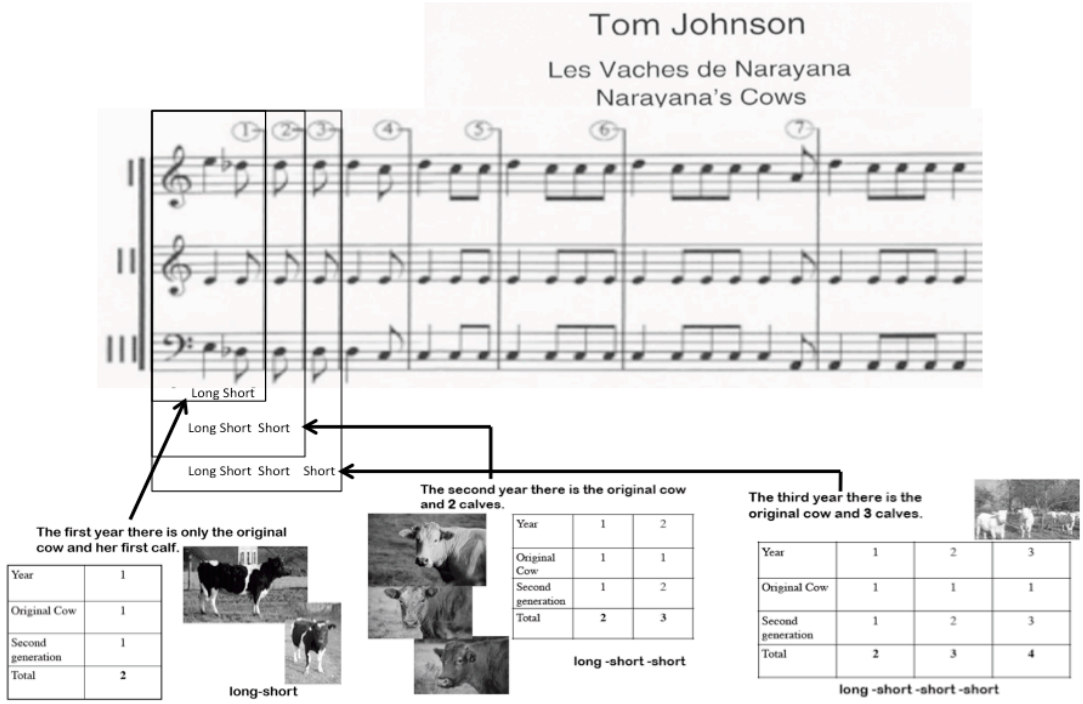
[61] Ibid., p. 13.
[62] Ibid., p. 10.
[63] Tom Johnson, Explaining my Music: Keywords' Music Works # 74, (1999) http://www.editions75.com/Articles/Explaining%20my%20Music_Keywords.pdf (last accessed 16 January 2016).
[64] http://kalvos.org/johness1.html (last accessed 3 February 2016).

Figure 1.19: Narayana's Cows by Tom Johnson.[65]



Year	1
Original Cow	1
Second generation	1
Total	2

Year	1	2
Original Cow	1	1
Second generation	1	2
Total	2	3

Year	1	2	3
Original Cow	1	1	1
Second generation	1	2	3
Total	2	3	4

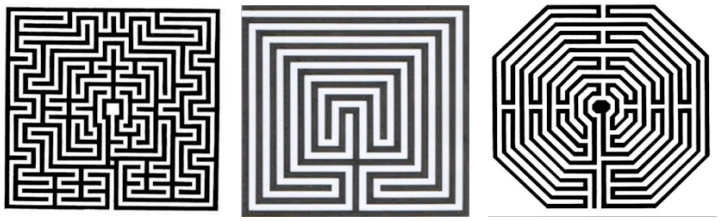
There are more works, written by Johnson, which I would like to mention, such as *Rational Melodies* (1983) which is constructed with rational patterns following rigorous rules; *Automatic music* (1996) for six percussionists is generated according to a sequence using a finite number of symbols or letters, and the collection *Tilework: 14 Pieces for 14 Solo Instruments* (2003) which is based on the geometrical problem of filling a space with one or more geometric shapes, in this instance rhythmic figures. All these examples give a brief idea of how his composing is not so much about composing new things, but simply interpreting things that already exist elsewhere.[66]

Many compositions by Johnson's former pupil, the Brazilian-Dutch composer Luiz Henrique Yudo, are inspired by visual art, especially by abstract geometric paintings. For example, a series of *Labyrinth pieces* were composed in the period 2005-2009, such as *Amaze! (2005), The Maze of Saint-Omer* (2006), *The Maze of*

[65] https://webusers.imjprg.fr/~michel.waldschmidt/articles/pdf/IslamabadRabbitsCowsDaVinciVI.pdf (last accessed 27 January 2016).
[66] Tom Johnson, Explaining my Music: Keywords' Music Works # 74, (1999) http://www.editions75.com/Articles/Explaining%20my%20Music_Keywords.pdf (last accessed 16 January 2016).

Knossos (2007), and *The Maze of Saint-Quentin* (2009). These works are based on different labyrinths and were composed for free instrumentation playing undefined sounds (see Figure 1.20).

Figure 1.20: (a) The Maze of Saint-Omer, (b) The Maze of Knossos, and (c) The Maze of Saint-Quentin.[67]



The score of each composition functions more as a guide than as a rule, which can provide surprising results with each performance. For example, *Amaze!* (2005) is written for any 4 instruments and a real-time cd-rom score in which coloured dots move around a labyrinth. In one realisation of the score, for four organs, premièred at Orgelpark, Amsterdam in 2011, the performers read vertical movements of the dots as affecting changes in pitch, and horizontal movements as indicating a continuation of the same pitch. *The Maze of Saint-Omer* (2006) is based on the structure of the real thirteenth-century labyrinth found at Saint-Omer, in northern France. The instrumentation is open, and the musicians are each given two lines to play. These lines can be any two chosen sounds, which can either remain the same or change ad libitum throughout the performance. Yudo's 'open' approach to mapping geometric designs into sound where the performers determine the final details of a piece means that he can focus almost exclusively and more objectively on making sure that the patterned structure is expressed.

The British composer Bryn Harrison, much like Morton Feldman has been interested in modern abstract painting and how ideas from the visual arts may

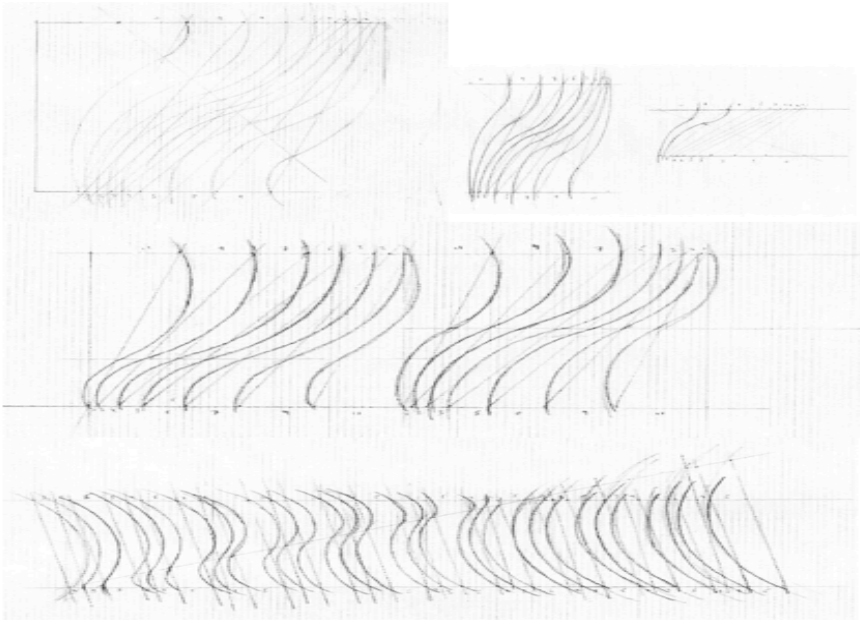
[67] Yudo, L. H., *The Maze of Saint-Omer, The Maze of Knossos, The Maze of Saint-Quentin* (Amsterdam: Yudo Music Editions).

influence the music he writes. He has shown a particular interest in the works of the British painters Bridget Riley, Mike Walker, and James Hugonin, as well as the American artists Brice Marden and Agnes Martin. As Harrison states:

> I have come to see my music as the continuation of one or just a few ideas and of setting up frames of material that can exist as musical objects. I feel that I am always looking at the same thing from lots of different angles and yet, at the same time, as time progresses, I am aware of a very gradual shift into new areas.[68]

Six Symmetries[69] (2004), scored for large ensemble was inspired by Riley's curve-drawing techniques, which illustrate how two distinct procedures, one concerning rhythm and the other concerning tone or colouration, might be combined together. In order to utilize the essence of the technique rather than replicate the proportions of the curves in the paintings directly, Bryn Harrison spent several months learning how to draw the curves, and in the process discovered how these might be adapted effectively towards a musical rather than a visual end (see Figure 1.21).

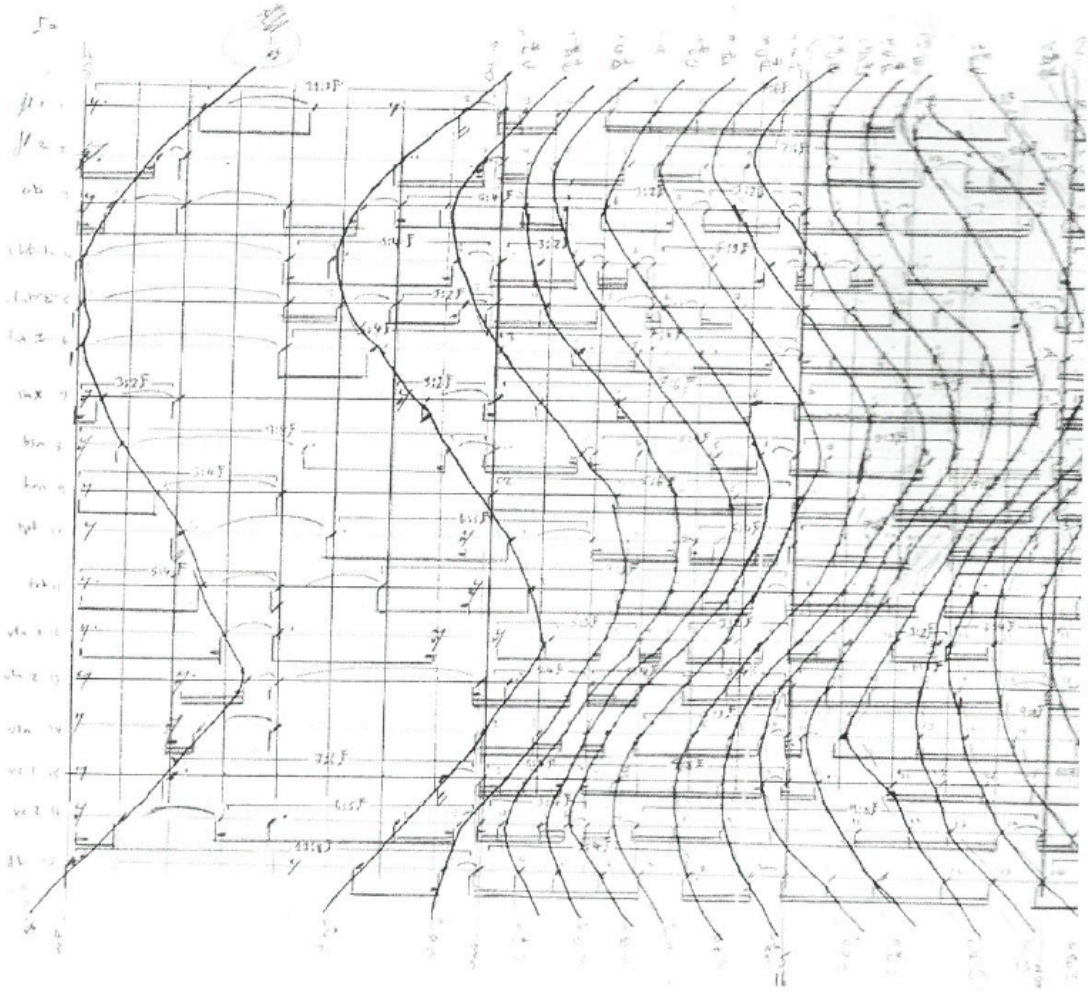
Figure 1.21: The diagrams representing some of Bryn Harrison initial attempts to draw the curves. [70]



[68] http://www.james-saunders.com/interview-with-bryn-harrison/ (last accessed 29 January, 2016).
[69] Bryn Harrison, *Six Symmetries*, (Ph.D. thesis, University of Huddersfield, 2007), http://www.brynharrison.com/BrynHarrisonThesis.pdf (last accessed 24 January 2016).
[70] Ibid.

In order to convey in musical terms the same sense of transition and oscillation, Harrison created a series of rhythmic canons and coupled these to pitch cycles, running these backwards or permutating the rhythmic sequences to create the variations in the piece (see Figure 1.22).

Figure 1.22: The outline for the rhythmic structure of the opening of Six Symmetries by Bryn Harrison.[71]



Moreover, the vertical contours that were used to create the tightly-regulated canons are presented in a looser way in order to provide wave-like patterns running down the page. Although the listener may not be able to visualize the precise shape of these patterns the effect of an oscillating wave is immediately discernible to a listener. According to Harrison, his compositions deal with a reductive approach to musical language through limiting himself to just a few essential techniques and musical processes.

[71] Ibid.

Similarly to Xenakis, Harrison, Yudo, and Johnson, my methodology of mapping evolves from the conceptual relation between geometric patterns and music based on the transfer of a model from the predefined structures of textile design, to a more sensual and practical approach to sound and space. I am also interested in the exploration of analogical parameters between visuals and music, where the mapping process reveals connections through my personal experience and knowledge, formulating the essential principles and aesthetic of the musical compositions.

Harrison has commented that the mapping of non-musical data into musical language not only calls into question the overall relationship between process and intuition, but is also reliant upon certain self-imposed restrictions.[72] The activity of weaving, most obviously demonstrated in knitting can be observed as a special logical process that follows certain protocols as if decoding a piece of text, and thereby seemingly making it more of a methodical than an overtly creative activity.[73] In this case, creativity lies in the decision-making phase prior to beginning each weave pattern, in choosing colour variations, different qualities of yarn or the combination of different techniques. My aim of mapping is to present a process, which could not only follow the structure of textile patterns, but would also serve as a guide by limiting my compositional choices.

My approach to exploring patterns in an intuitive way differs from Feldman's in that he allowed himself to break away from a given system at any moment to reorder and manipulate a different set of materials. In my case, I define intuition as the aim to accomplish a balance of logical and flexible structures during the mapping process, referring to the specification and determination of specific parameters such as dynamics, instrumentation, timbre, harmony, or the choice of a specific scale from an Indian raga, which are then all laid down in a system defined by the structure of the textile fabric. My intuitive approach does not seek to manipulate, but to find a specific choice or solution, which determines my attempt to balance a personal and an impersonal way of working in my pieces.

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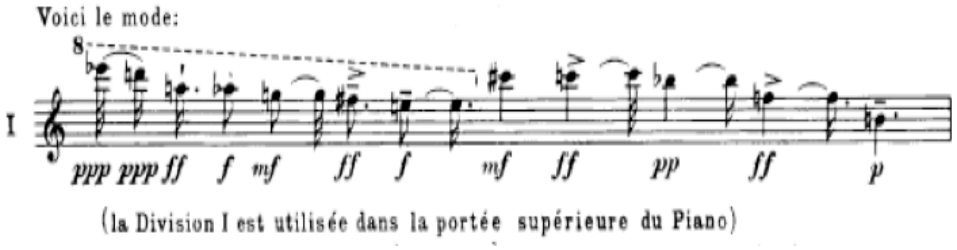
[72] Bryn Harrison, 'Cyclical Structures and the Organisation of Time' (Ph.D. thesis, University of Huddersfield, 2007), p. 86.
[73] Konstantia Koulidou and Enrique Encinas, 'Knittstruments: Melodies of weaving, All Makers Now?', *Conference Journal*, 1, (2014), 73-78, (p. 74).

In order to demonstrate the conceptual framework of the transition process from textile patterns into musical parameters, I aim to provide a brief overview of the design of weaves that shaped my compositional method. In doing so, I not only emphasize those components that are unique within my research, but also highlight key connections related to compositional methods, which I will illustrate with a number of examples.

1.2.2 DESIGN AND MAPPING OF THE PRIMARY WEAVE

My methodology of mapping textiles into sound is related to the parametric approaches of serialism and algorithmic composition as discussed above, in that I focus on the systematisation of all musical elements, which are strictly formalised on a structural level. For example, *Structures Ia* (1951) by Pierre Boulez, written for two pianos, explores the possibilities of total serialism by using the first twelve-tone row of "la Division" from Messiaen's *Mode de valeurs et d'intensités* (see Figure 1.23).

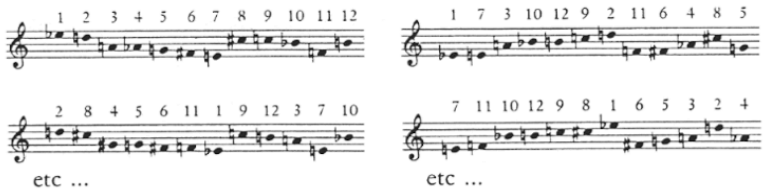
Figure 1.23: The twelve tone series of Messiaen's Mode de valeurs et d'intensités.[74]



Ligeti's analysis of *Structures Ia* highlights that almost every aspect of the piece is predetermined, with Boulez employing a method of serial ordering of the twelve transpositions of the row as a means of deriving rhythmic durations.[75] Boulez used two 12x12 matrices in order to organize serial threads defined by twelve pitches. Matrix A was filled in by transposing the original row, beginning on each note in turn, while Matrix B was created by determining the inversion of the original row and its transpositions (see Figure 1.24).[76]

[74] Olivier, Messiaen, *Mode de valeurs et d'intensités* (1950), p. 2.
[75] György Ligeti, 'Pierre Boulez - Decision and Automatism in Structures IA', in *Die Reihe* 4, (1975), pp. 36-62. Ligeti also notes that the emphasis on the technical procedures of composition has detracted from the experience of the music as music.
[76] Lynden Deyoung, 'Pitch Order and Duration Order in Boulez' Structure Ia', *Perspectives of New Music*, 16, 2, (1978), 27-34.

Figure 1.24: The twelve-tone row and matrices. [77]



A

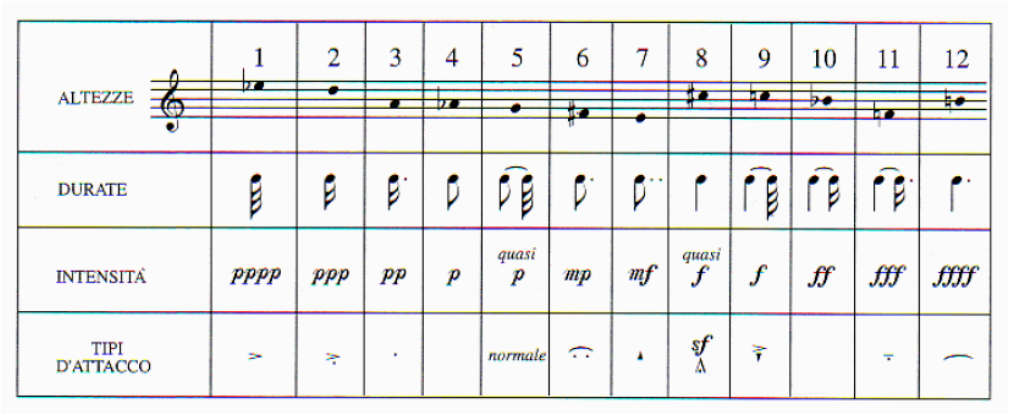
1	2	3	4	5	6	7	8	9	10	11	12
2	8	4	5	6	11	1	9	12	3	7	10
3	4	1	2	8	9	10	5	6	7	12	11
4	5	2	8	9	12	3	6	11	1	10	7
5	6	8	9	12	10	4	11	7	2	3	1
6	11	9	12	10	3	5	7	1	8	4	2
7	1	10	3	4	5	11	2	8	12	6	9
8	9	5	6	11	7	2	12	10	4	1	3
9	12	6	11	7	1	8	10	3	5	2	4
10	3	7	1	2	8	12	4	5	11	9	6
11	7	12	10	3	4	6	1	2	9	5	8
12	10	11	7	1	2	9	3	4	6	8	5

B

1	7	3	10	12	9	2	11	6	4	8	5
7	11	10	12	9	8	1	6	5	3	2	4
3	10	1	7	11	6	4	12	9	2	5	8
10	12	7	11	6	5	3	9	8	1	4	2
12	9	11	6	5	4	10	8	2	7	3	1
9	8	6	5	4	3	12	2	1	11	10	7
2	1	4	3	10	12	8	7	11	5	9	6
11	6	12	9	8	2	7	5	4	10	1	3
6	5	9	8	2	1	11	4	3	12	7	10
4	3	2	1	7	11	5	10	12	8	6	9
8	2	5	4	3	10	9	1	7	6	12	11
5	4	8	2	1	7	6	3	10	9	11	12

According to Yun-Kang Ahn et al[78] Boulez goes further than most serialist composers because he uses the same matrices in order to determine all note durations, intensities and dynamics. Boulez uses the thirty-second note as the basic time unit, which he then multiplies by the numbers in each row of the matrices. Boulez also assigns twelve different dynamic values and twelve kinds of articulation (see Figures 1.25).

Figure 1.25 Determination of the duration, intensities and attacks in Structures Ia. [79]



[77] Etty Mulder, 'Piere Boulez Structures 1 en 11' http://www.ettymulder.nl/m/images/BoulezStructuresmatrix.pdf (last accessed 27 February 2016).
[78] Yun-Kang Ahn, Carlos Agon, and Moreno Andreatta, 'Structures Ia pour deux pianos' by Boulez: towards creative analysis using OpenMusic and Rubato' http://articles.ircam.fr/textes/AHN07a/index.pdf (last accessed 27 February 2016).
[79] Etty Mulder, 'Piere Boulez Structures 1 en 11' http://www.ettymulder.nl/m/images/BoulezStructuresmatrix.pdf (last accessed 27 February 2016).

Moreover, the matrices also determine the order in which rows are used and the structure of the piece is organized with extreme care, leaving few elements to chance. Boulez argues that in this composition he wanted "to use the potential of a given material to find out how far automatism in musical relationships would go".[80]

In my methodology, the mapping process is derived from the structure of a primary weave and its pre-defined parameters, which emphasize the links between visual and sonic experience via highly interrelated and overlapped parameters. The principles of the mapping process are outlined by the attempt to eradicate contradictions in the transformation process in order to arrive at a more consistent synthesis, emphasizing the overall aesthetic concept for each composition.

The design process of the textile fabric commences with the construction of an appropriate *primary weave*,[81] which has a particular sequence or code for the interlacement of warp and weft. Moreover, the appearance and the division of the primary weave, the count of warps and wefts, and the total amount of the primary weave, governs the fundamental organisation of musical parameters that are related to a particular composition.

The introduction of the primary weave represents the characteristics that impact the overall mapping process from the textile pattern into musical parameters. For example, in the composition *Textile_3*, the code of the primary weave follows a particular sequence YY 2, 3, 2, 1, 1, which represents the following characteristics:

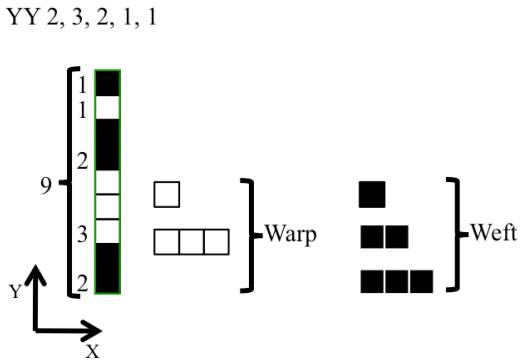
(1) The direction of the primary weave organized in the y-axis, i.e. the beginning of the placement starts at the bottom square and finishes at the top;

(2) The total number of squares: (2+3+2+1+1) = 9;

(3) The number of warp and weft yarns. (For each composition, a green border marks the primary weave (see Figure 1.26)).

[80] Pierre Boulez, *Conversations with Célestin Deliège* (London: Eulenburg Books, 1976), p. 55.
[81] Frankie Ng and Jiu Zhou, *Innovative Jacquard Textile Design Using Digital Technologies* (Cambridge: Woodhead Publishing, 2013), p. 60.

Figure 1.26: The basic elements of the primary weave.



The features of each individual primary weave relate to a particular mapping process in each composition, preserving its structure and the relationship between warp and weft, emphasizing the unique structural characteristics of a given pattern. These characteristics are reflected in the resulting music by coding the primary weave, which enables the weave pattern to be transformed into structured musical patterns of dynamics, rhythm, pitch, and timbre. The applied methods of transformation are intended to draw connections between the various approaches and concepts, which are presented in detail in the description of the individual composition.

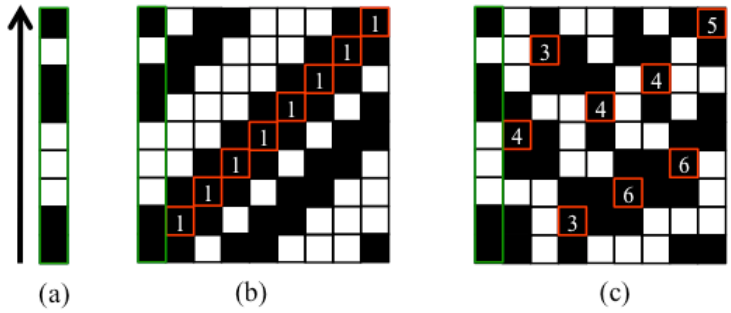
The design of the *primary weave* not only determines the crucial parameters of the mapping process, but also impacts the structure of the overall textile fabric. The structure of the primary weave and the appearance of the overall textile fabric are essential characteristics that create tight connections between visuals and sound. Each commentary chapter will include a description of the primary weave, presented in the green border of the weave diagram.

1.2.3 DESIGN AND MAPPING OF THE OVERALL TEXTILE PATTERN

In order to establish the overall structure of the textile fabric, the *primary weave* follows numerous variations of transformation. The most common method of transformation relies on shifting the primary weave to different positions. The so-called *position number* describes the specification of the relative movement of the next warp end in relation to the previous one. For example, if the position number is

1, then the next warp will start one position higher than the previous warp. Figure 1.27 illustrates the identical primary weave highlighted in green border (a), which produces two different overall textile patterns (b and c) by shifting it to contrasting positions. The primary weave (a) and the overall textile pattern (b) form the basis for the composition *Textile_3*. In addition, the overall textile patterns that are used in each of the distinct compositions are my own original and unique design.

Figure 1.27: (a) Primary weave, (b) the primary weave is shifted by constant positions, (c) the primary weave is shifted by distinct positions: 4, 3, 3, 4, 6, 4, 6, and 5.



In order to design distinct textiles, the transformation of weave patterns follows particular processes, such as negative interchanging, symmetrising, overlapping, rotation, repeats, transposing, order changing, adding/reducing warp/weft yarns, expansion in any direction, repetition, inversion, and so forth.[82] These features, which affect the overall structure of textile fabric, can also be applied to techniques of musical construction. Moreover, the appearance of the overall textile fabric depends on the code of the primary weave, which follows particular rules, relying on a logical approach and numerical similarities.[83] Contrasting factors influence the appearance, visual impression and physical properties of a woven textile fabric,[84] such as yarn appearance, handle, wear capability,[85] cloth width, threads per centimetre in the warp and weft directions, warp and weft cover factors, and the type

[82] Andrew C. Long, *Design and Manufacture of Textile Composites* (Cambridge: Woodhead Publishing Limited, 2005), p. 14.
[83] Alain Daniélou, *Music and the Power of Sound: The Influence of Tuning and Interval on Consciousness* (Rochester, Vermont: Inner Traditions, 1995), p. 1.
[84] Robin Netherton and Gale R. Owen-Crocker, *Medieval Clothing and Textiles 4* (Woodbridge, UK: The Boydell Press, 2008), p. 71.
[85] Peter R. Lord, Mansour H. Mohamed, *Weaving: Conversion of Yarn to Fabric*, *Weaving: Conversion of Yarn to Fabric* (Cambridge: Woodhead Publishing Limited, 1982), p. 17.

of warp and weft yarns.[86] Each of these characteristics emphasise the properties of a woven textile fabric.

My methodology of mapping is based on pre-defined structures, which derive from the structure of the weave. In this regard, my intention is that the sounding phenotype of the music is perceived to be *more* than its *serial* underlying genotype. American minimalist composer Steve Reich has argued that in serial music "the compositional processes and the sounding music have no audible connection and the series itself is seldom audible".[87] Just as Reich, and in their very different ways Xenakis and Johnson aimed to find a more audible connection between compositional technique and the sounding result, so too in my methodology I focus on making connections between technique and the specific atmospheres, emotions or *rasa* perceived by the listener. As Povilas Vaitkevičius has commented about my work in a recent article:

> The extended progressions provoke visions of slowly slanting lines and gradually release the mind from straining thoughts. At the end of the piece a listener is immersed in a deluge of unwound sound. These changes remind me of that 'entering into the meditative state' moment, when the mind transitions from a conscious decision to ease up and slowly moderates the hegemony of thoughts and forgets about itself altogether.[88]

The strict structure behind my music does not necessarily have to restrain its expressive power, but I hope that, on the contrary, it can add to it. As a textile designer and engineer, I consider textile weaves as *texture, ambience, sonority, an atmosphere, or motion*, which I transfer into a particular composition. The structure of a primary weave or the overall textile serves as a background, or guide in order to shape the composition, through predefined musical parameters, such as dynamics, harmony, timbre, and rhythm which add a *specific colour* to the weave and generates a particular atmosphere. The chosen mapping method itself is a *creative* decision, one that combines fundamental characteristics of both the visual and the audible, creating a new identity and interaction between each.

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[86] Richard Horrocks and Subhash C. Anand, *Handbook of Technical Textiles* (Cambridge: Woodhead Publishing Limited, 2000), p. 77.
[87] Steve Reich, 'Music as a Gradual Process' in *Steve Reich, Writings About Music* (Halifax, N.S.: The Press of the Nova Scotia College of Art and Design, 1974), pp. 9-11.
[88] Povilas Vaitkevičius, 'Spaces within Forms: The Case of Egidija Medekšaitė', *Lithuanian Music Link*, 2016, p. 35.

1.3. SUMMARY

The mapping process focuses on the translation of my specific textile fabric designs into musical compositions, with an eye to its relevant characteristics, emphasizing its connections and interrelatedness. This process serves as the basis for a more intuitive/poetic/aesthetic exploration of the possibilities latent in these structures, an exploration that is brought to the foreground. Establishing these personal methods of transformation, I have taken inspiration from previous research, in particular studies of the interaction between sound and textile in other cultures and contemporary technologically-driven developments. In addition, the mapping process bears links to *serialism* (pre-defined structures, order), *minimalism* (continuity), and *stochastic* processes (randomness, probability).

As I show in the commentary, the generation of the primary weave and the overall textile fabric derives from the structure of a textile fabric (*Textile_3*, *Textile_4*, *Moorchana*, *Habotai*, and *Textile_5*), or by relating the textile pattern and therefore also the musical composition to a particular Indian raga (*Nigamagamini*, *Sandhi Prakash*). The initial concept of each composition impacts the structure of the textile pattern, which then impacts on the specific musical decisions made in the process of composition mapping one domain to another.

In summary, this PhD Commentary describes my personal inspiration for what I have found to be a productive new musical technique, one that is based on an exploration of mapping processes, translating the patterns of textile fabrics into sonic experiences.

2. TEXTILE_3

Textile_3 (2012), for four percussion players
Duration: approximately 10 minutes

The earliest work in my portfolio, *Textile_3*, explores the transformations of a Twill Weave textile pattern, which is the second basic weave[89] and often used in weaving manufacturing. It contains the single warp thread (primary weave), which rotates in various interlacings for the purpose of ornamentation, both in textile fabric and in music composition. Furthermore, the persistently repeated pattern forms diagonal rows, creating dense and tiny textures that are often used to create textiles for daily use.[90] *Textile_3* aims to explore a method of mapping visuals to sonic art that could be developed further in future compositions through successive, thorough and complete transformations of specific textile patterns.

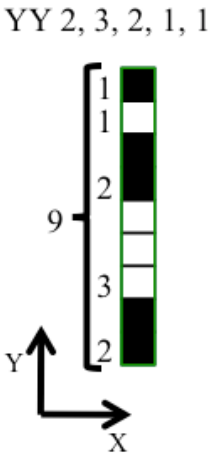
My intention was to use this particular Twill Weave textile pattern in such a way that its structure and musical parameters would transform into a ritualized performance. For example, the distinct amounts of warp and weft construct repetitive rhythmical patterns, the contrasting variations of Twill Weave textile pattern define a micro-macro form, and the rotation process establishes different instrumental timbres. In addition, *Textile_3*, one of the earliest pieces in my portfolio, resembles in its musical language and aesthetic the style of minimalism, producing a hypnotic atmosphere, where the form, its structure and rhythm are all unified by a single number, in this case, 9.

The nine distinct textile patterns are constructed from the primary weave (code YY 2, 3, 2, 1, and 1) and indicated by a green border. As noted before in the

[89] Peter R. Lord and Mansour H. Mohamed, *Weaving: Conversion of Yarn to Fabric* (Cambridge: Woodhead Publishing Limited, 1982), p. 166.
[90] Helaine Selin, *Encyclopedia of the History of Science, Technology, and Medicine in Non - Western Cultures* (Dordrecht: Kluwer Academic Publishers, 1997), p. 958.

Introduction, the definition of the code specifies different characteristics of a weave, such as the direction of the pattern (*y* axis), the total amount of threads (9), and the distinct counts of warp and weft yarns (2, 3, 2, 1, and 1) (see Figure 2.1).

Figure 2.1: The primary weave of Textile_3.

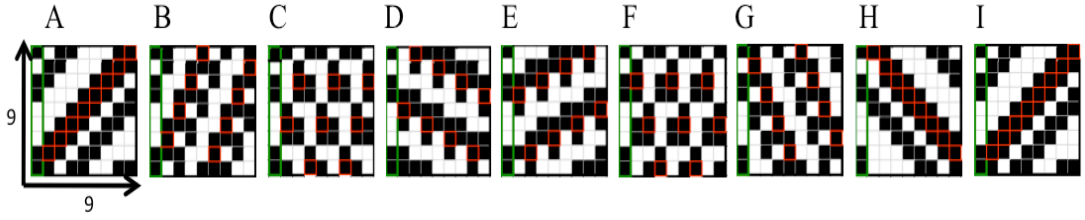


The length (9 squares) and the subdivisions of the primary weave could be said to resemble the Indian tala cycle, known as *Sankirna Jati*[91] (South Indian) or *Bartha Lay*[92] (North India), which consists of nine beats (*mantras*) and is only played in Indian music on rare occasions:[93] for example, the total sum of the primary weave contains nine squares, which are equivalent to nine beats in my mapping process. This echoes the grouping that is found in the primary weave: 5 (2+3) + 4 (2+1+1).

In order to generate variegated patterns (or 'compound' weaves), the primary weave shifts into different sequences referenced by individual letters. For example, the primary weave is shifted by one diagonal step in square A (the red border indicates the new beginning of the primary weave in each new line); two steps in square B, three steps in square C, and so on (see Figure 2.2).

[91] Robert S. Gottlieb, *Solo Tabla Drumming of North India: Its repertoire, Styles and Performance Practices* (Delhi: Motilal Banarsidass Publishers, 1993), p. 38.
[92] Ibid., p. 38.
[93] http://www.ravishankar.org/-music.html (last accessed 25 March 2015).

Figure 2.2: The primary weave and its variations (compound weaves).



However, each textile pattern (A to I) consists of nine vertical and horizontal lines, maintaining an equivalent size of structure, but distinguished from each other by contrasting appearances. In addition, my mappings of the primary weave and its variations are used to construct rhythmical ornamentation, which will be explained further later.

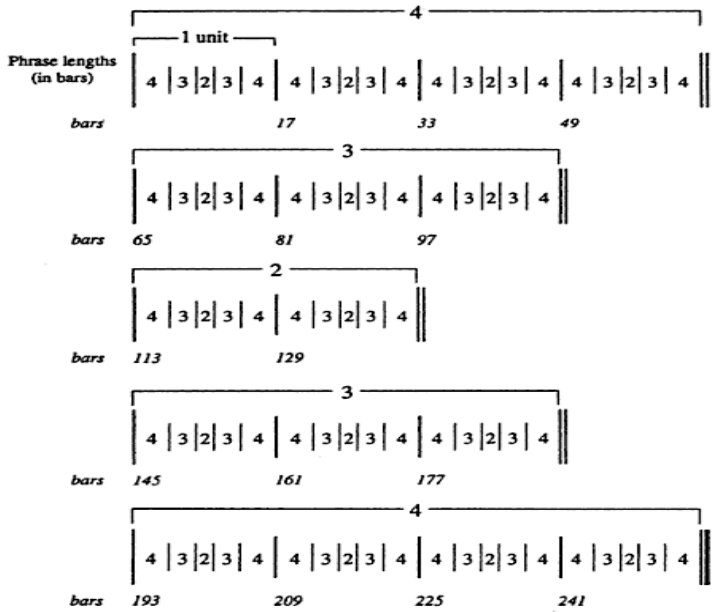
2.1 STRUCTURE

The overall structure of the piece *Textile_3* is based on a "micro-macro" method, where the small-scale rhythmical structures are reflected in the large-scale formal proportions. A feature of its construction is that the "micro-macro" structure is derived directly from the Textile Pattern A and its variations (see Figure 2.2).

An early example of a similar 'micro-macro' method can be found in the series of compositions entitled *Construction* for different percussion ensembles, written by the American composer John Cage between 1939 and 1941. The *First Construction (in Metal)* (1939) has historical significance because it is credited as John Cage's first composition utilizing a "micro-macrocosmic" structure.[94] The proportional division 4:3:2:3:4 applies to the grouping of the sixteen large sections. Within each segment of the macrostructure, there is a microstructure of similar divisions of measures, which is also palindromic[95] (see Figure 2.3).

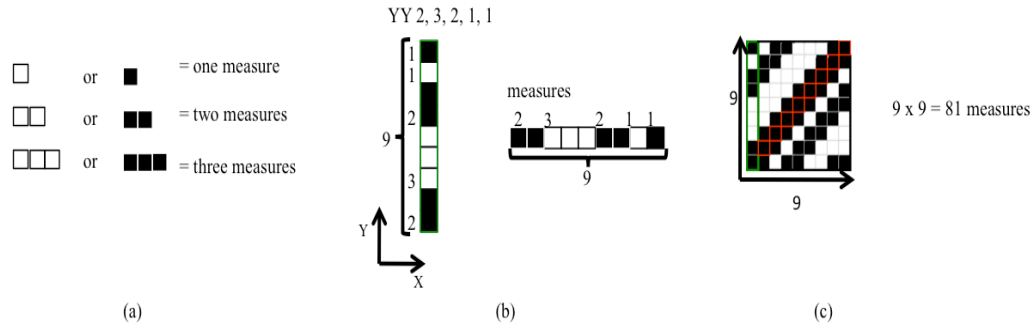
[94] Kenneth Silverman, *Begin Again: A Biography of John Cage* (New York: Alfred A. Knopf, 2010), p. 75.
[95] James Pritchett, *The Music of John Cage* (Cambridge: Cambridge University Press, 1996), p. 17.

Figure 2.3: Micro-macrostructure of First Construction (in Metal) from James Pritchett, The Music of John Cage. [96]



The entity of the macrostructure depends on the mappings of different groupings of white and black squares of Textile Pattern A to an equivalent number of measures: for example, one black or white square equals one measure, two black or white squares are assigned to two measures, and three squares black or white squares are identical to three measures. Following this process of transformation, each line of any textile pattern generates homogenous lengths of duration, in this case, nine measures. In addition, the overall macrostructure consists of 81 measures in total (see Figure 2.4).

Figure 2.4. (a) The system of transformation of white and black squares into measures, (b) the mapping process of the division of the primary weave into measures, (c) the total amount of measures.



[96] Ibid.

The divisions of the macrostructure depend on the analogous distribution of Textile Pattern A: for example, Textile Pattern A consists of 9 lines, which correspond to 9 different sections, as indicated by the letters from A to I. The form of section A is built on the first line of Textile Pattern A, the form of section B contains the second line of Textile Pattern A, the form of section C is constructed from the third line of Textile Pattern A, and so on. Moreover, the subdivisions of each section rely on the individual division of black and white squares of each line of the Textile Pattern A: for example, section A has five subsections (A1, A2, A3, A4, and A5). The subsection A1 lasts two measures, A2 lasts three measures, A3 lasts two measures, and A4 and A5 last one measure. The section B has four subsections (B1, B2, B3, and B4) and so on (see Figure 2.5).

Figure 2.5: (a) Textile Pattern A, (b) the macro structure of the piece based on Textile Pattern A.

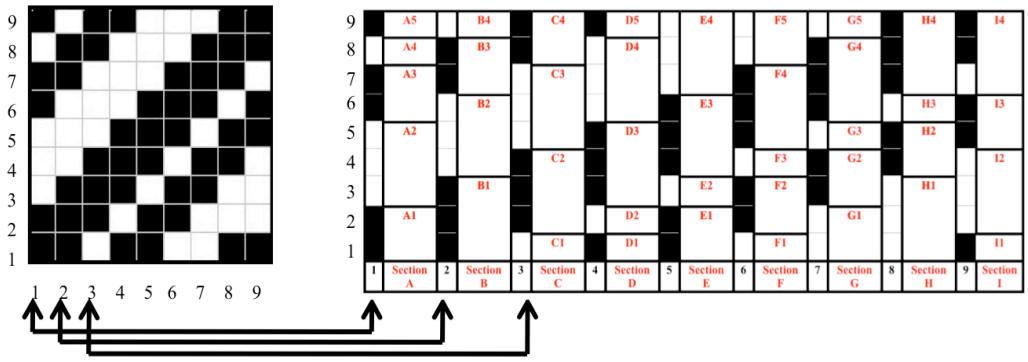
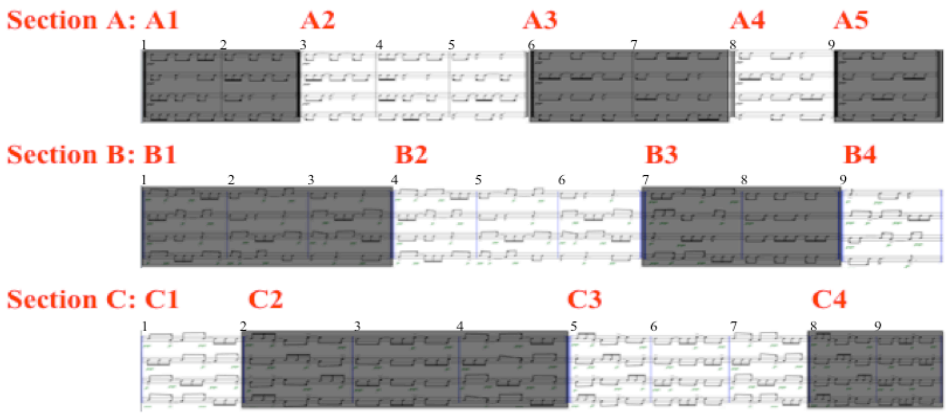


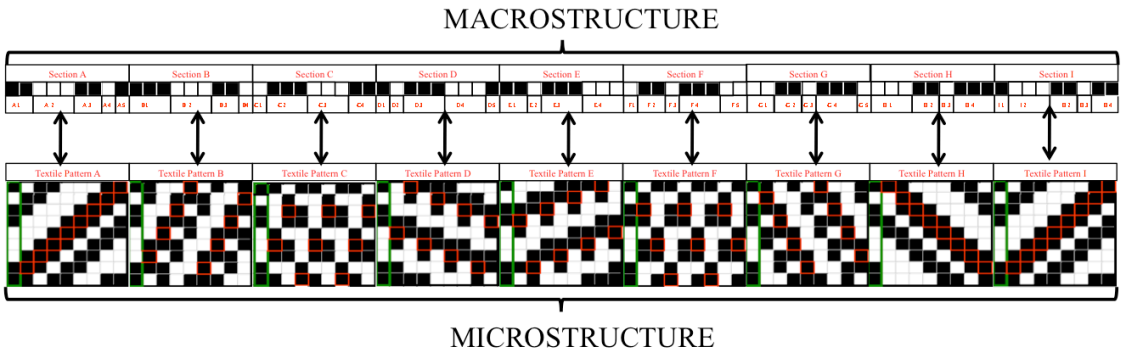
Figure 2.6 illustrates the large-scale structural divisions of sections A, B and C in the composition.

Figure 2.6: The macro structure of the sections A, B and C.



Within each segment of the macrostructure, there is a microstructure, which relies on the nine distinct Textile Patterns from A to I: for example, the form (macro structure) of section A is based on the first line of Textile Pattern A, while the microstructure contains the structure of the textile pattern A; the form (macro structure) of section B is based on the second line of Textile Pattern A, while the microstructure contains the structure of the textile pattern B. Pattern B is based on pattern A, but shifted along by two steps (see Figure 2.2). The form (macro structure) of section C is based on the third line of the Textile Pattern A, while the microstructure contains the structure of the textile pattern C, which is shifted along by three steps. The form (macro structure) of section D is based on the fourth line of Textile Pattern A, while the microstructure contains the structure of Textile Pattern D, which is shifted along by four steps. The same transformational process applies for the other sections of E, F, G, H and I (see Figure 2.7).

Figure 2.7: Macro and microstructures of Textile_3 (see Appendix A).



Textile _3 explores the levels of interaction between the micro-scale and the macro-scale through the use of precise mappings between visual structures and parameters of sound, embedding the rules of textile fabric division, sub-division and ordering into the music. My intention is to highlight the parallels between textile fabric and sound throughout, mapping specific features of textile pattern, which corresponds to music composition, such as the total amount of threads, which construct a micro-macro form; the distinct counts of warp and weft yarns establish rhythmical patterns and divide the macrostructure into particular subdivisions; the order of textile structure defines the order of music composition. All these particular parameters of textile patterns and their variations underline the musical idea.

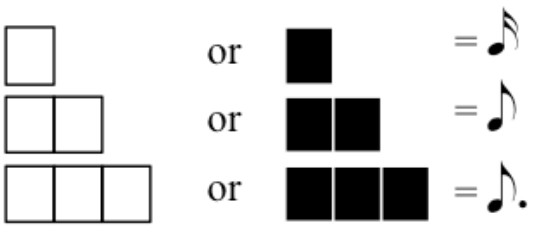
However, *Textile_3* maintains a continuity and consistency throughout, via gradual changes of rhythmical patterns and the development of dynamics and timbre, rather than emphasizing a contrast of character between each section.

2.2 RHYTHM

The construction of rhythm relies on the aforementioned shifting process of the primary weave, generating nine particular textile patterns (see Figure 2.2), resulting in nine distinct variations of rhythmic patterns, which are fundamental elements for the microstructure.

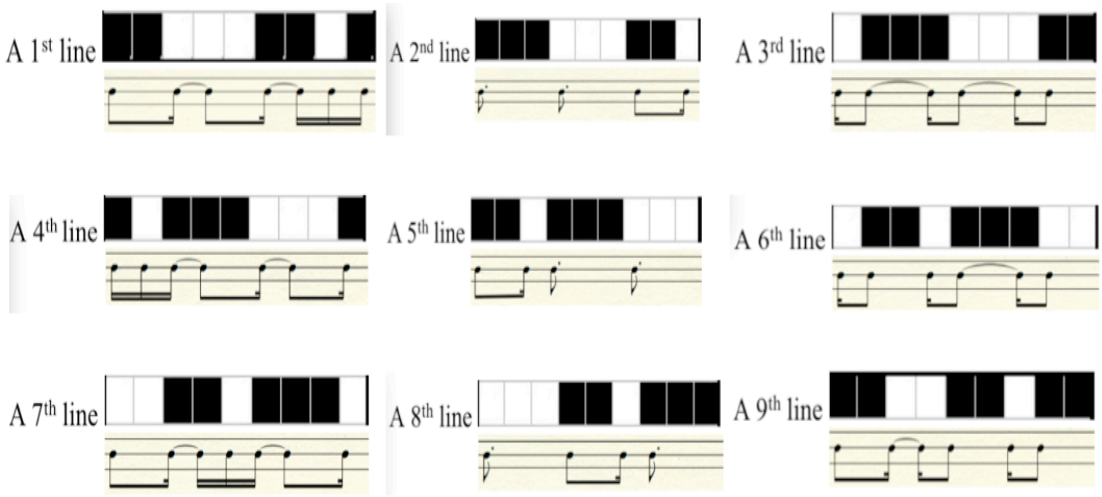
The mapping process follows the same rules as the mapping of the macrostructure, in which white and black squares represent the varying durations of notes in the micro level of the piece, instead of measures: for example, if one square of white or black equals one semiquaver, then two of the white or black squares are equivalent to one quaver or two semiquavers, three squares of white and black are identical to one dotted quaver or three semiquavers, and so on (see Figure 2.8).

Figure 2.8: The system of transformation of white and black squares into duration of notes.



In order to achieve rhythmical variety, the mapping process based on the structural subdivisions of individual textile patterns (Textile Pattern A, Textile Pattern B and so on), forms nine different rhythmical patterns, following the system described above. Figure 2.9 illustrates the nine distinct rhythmical patterns of section A, while the same rules apply for the other sections.

Figure 2.9: The rhythmic variations based on Textile Pattern A for section A.



Furthermore, the transformations of each textile patterns into rhythmic patterns are organized in such a way that each nine-measure section introduces four or five rhythmic motives, which resemble the subdivisions of a particular textile pattern, by precisely matching the macrostructure. However, five rhythmic motives of section A contain subdivisions into two, three or one measure respectively, resembling to the division of Indian *tala* of nine beats (see Figure 2.10 and Figure 2.11). In addition, it emphasizes that within each segment of the macrostructure, there is a microstructure of different rhythmical patterns.

Figure 2.10: Five rhythmic motives for section A.

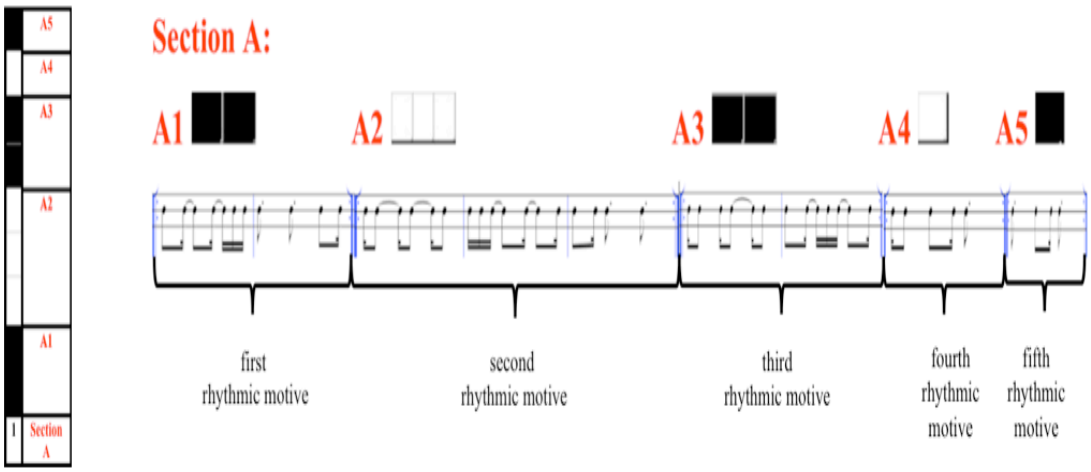
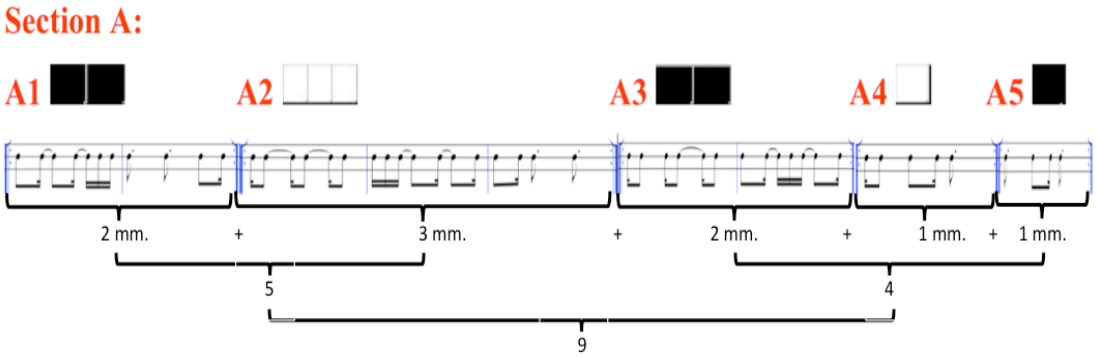
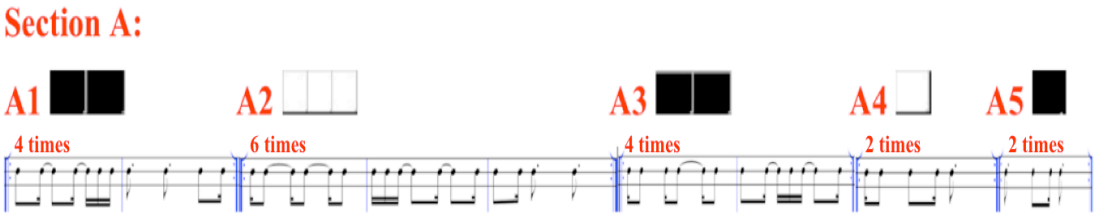


Figure 2.11: The subdivision of five rhythmic motives for section A.



Moreover, the principles of repetition highlight the individuality of the groupings of four or five rhythmic motives by following the same proportions as those used to produce the subsections of particular textile pattern, using multiplication: for example, textile subsection A1 contains two squares, the same as rhythmic motif A1 (two rhythmic patterns), which is repeated four times (multiplication); textile subsection A2 consists of three squares, the same as rhythmic motif A2 (three rhythm patterns), and is repeated six times, textile subsection A3 has two squares, similar to rhythmic motif A3 (two rhythm patterns) and is repeated four times, and so on (see Figure 2.12). My intention was that ordering of repetitions not only generates a character of unpredictability, but it also challenges the listener to determine the structure of repetitions.

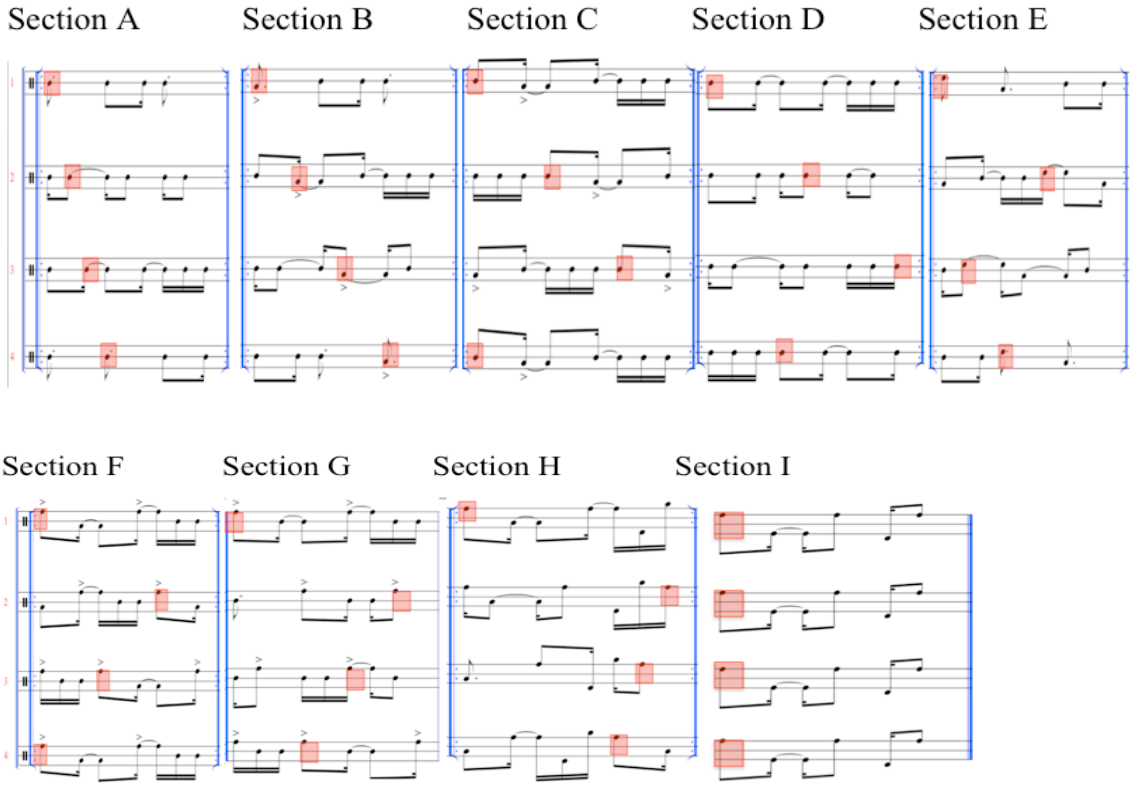
Figure 2.12: Presentation of the rhythmical patterns for section A.



In order to create overlapping rhythmic layers for each performer followed by an identical sequence of gestures, rotation techniques are applied to the rhythmical patterns. These rotations are based on the same procedure that created nine distinct textile patterns by shifting a pattern through the various steps. Figure 2.13 illustrates how in every section, the same rhythmic pattern is rotated by contrasting steps: for

example, in section A – 1 step (as Textile Pattern A), in section B - 2 steps (as Textile Pattern B), in section C – 3 steps (as Textile Pattern C), until the section I, in which all the performers play in rhythmic unison.

Figure 2.13: The idea of rotation of the basic pattern was used to create different rhythmical layers for each percussion player.



The mapping process generates a number of rhythmical patterns, with distinct repetitions and overlapping gestures in order to amalgamate visual and sound parameters into one continuum.

2.3 DYNAMICS / INSTRUMENTATION

Textile_3 is scored for four instruments of the performer's choice. The variety of timbre highlights the possibility to project overlapped sonority structures by combining distinct instruments. The instrumentation diagram to be adhered is shown below (see Table 2.1), followed by the ordering of the various required timbres.

Table 2.1: Instrumentation diagram.

D	C	B	A	B	C	D

There are two options for set-up of the instruments: (a) the first set-up requires percussion instruments with different pitches; (b) the second set-up requires distinct surfaces (see Table 2.2). My aspiration was that the first version of timbral choice produces a gradual transformation from one timbre quality to another, while the second option determines the different materials without highlighting the pitch, which generates a more diverse soundscape than the first option.

Table 2: Two options for instrumentation.

Instruments	**First option:**	**Second option:**
A	An extremely high pitch with continuous reverb	Glass surface
B	High pitch	Plastic surface
C	Middle pitch	Wood surface
D	Very low pitch	Metal surface

The performers are free to choose which kind of set-up they would like to use. However, each player has to perform with two different mallets: left hand - hard, right hand – soft in order to achieve distinct dynamics and timbre between the same instruments.

Furthermore, each instrument is assigned different dynamics, which remain constant throughout the entire piece (see Figure 2.14).

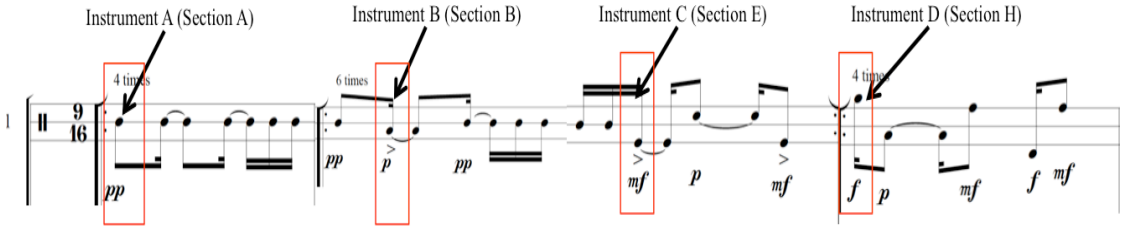
Figure 2.14: Dynamic plan built on instrumentation.

Instrument	D	C	B	A	B	C	D
Dynamics	*f–ff*	*mf*	*p*	*pp*	*p*	*mf*	*f–ff*

ff *pp* *ff*

The choice of instruments and the organization of dynamics are constructed in such a way as to produce different qualities of timbre from one section to another, by adding a complementary instrument: for example, at the beginning of piece, each player starts from instrument A (section A), then the sonority of timbre is changed by adding instrument B (section B), until all instruments are used at the end (sections H and I) (see Figure 2.15).

Figure 2.15: The development of dynamics and timbre.



The interaction between timbre and dynamics produces two versions of the sonority throughout a gradual development of various timbres, which emphases four individual lines proceeding simultaneously in rotating rhythmic structures.

2.5 SUMMARY

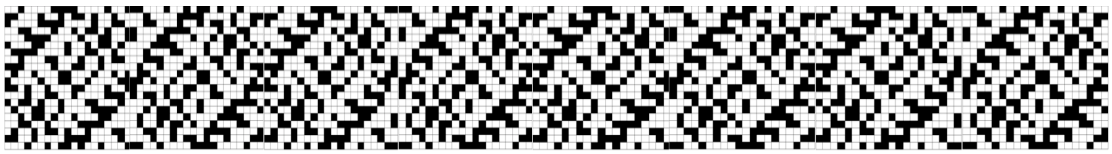
Textile_3 is the first piece written during my PhD studies, which explores the transformation of the Twill Weave textile pattern. However, *Textile_3* is based on the primary weave, generating nine distinct textile patterns (Textile Pattern A-I), which resemble specific features in composition: (a) the macrostructure of composition relies on the Textile Pattern A; (b) nine distinct textile patterns form nine contrasting sections; (c) the various counts of warp and weft yarns define the subdivisions of macrostructure and generate rhythmical patterns for the microstructure; (d) the rotation of the primary weave is mapped to the rotation of instruments in order to establish overlapping rhythms. By using certain textile patterns to generate musical structures it was my aim to find correspondences in my music with the visual associations that the textile patterns have for me. Finally, during the piece, performers not only reproduce the identical or overlapping rhythmical movements, but also the appearance of different timbres, each time extending the sound perception of the

weaving process, creating a ritualized performance throughout of coherent timbral textures.

The interaction between textile fabric and composition, by mapping analogous parameters, highlights the substantial elements of two distinct artistic domains, which precisely corresponds to the textile pattern and to the musical idea.

3. HABOTAI

Habotai (2012), for amplified string quartet and piano
Performed by Ives ensemble (the Netherlands)
Duration: approximately 12 minutes



The term Habotai derives from the definition of Chinese silk, which means 'soft as down'.[97] It signifies a plain-weave fabric with a smooth, lustrous surface that corresponds to silk painting techniques, and textile artists' use it predominantly. Lightweight silk threads create an impenetrable fabric based on a simple and plain pattern.[98]

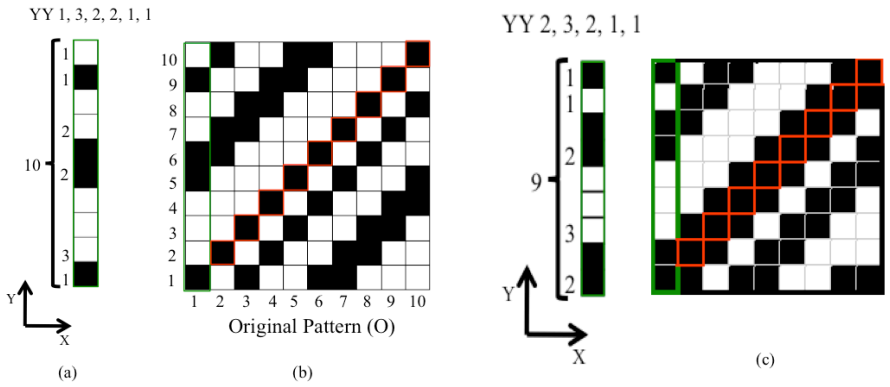
In order to generate the exceptional appearance of Habotai fabrics, an alternative to the plain weave, *Crepe weave* is used. It consists of very finely textured rough and fuzzy layers forming a sprinkled appearance with small spots in the surface, which generally establishes a continuum of pattern rather than an individual ornament. The two layers of Habotai pattern constitute a duality, with the fine rough layer serving as a background, and the fuzzy layer consisting of small ornamental spots. This duality becomes a fundamental aspect of the composition. Generally speaking, Habotai explores the transparency and fragility of the Habotai pattern through a dichotomy[99] between timbre and harmony. These characteristics derive from the Habotai textile fabric based on a Crepe weave.

The structure of the Crepe weave follows the pattern's transformation in four stages. The first stage establishes the primary weave (code YY 1, 3, 2, 2, 1, and 1), which regularly shifts in the y-axis, generating an original weave pattern of diagonal

[97] Jenne Giles, *Felt Fashion: Couture Projects From Garments to Accessories* (Massachusetts: Quarry Books, 2011), p. 26.
[98] Caroline A. Dahl, *Transforming Fabric: Creative Ways to Paint, Dye and Pattern Cloth* (Iola: Krause Publications, 2003), p. 141.
[99] Tim Howell, Jon Hargreaves, and Michael Rofe, *Kaija Saariaho: Visions, Narratives, Dialogues* (Burlington, VT: Ashgate, 2011), p. 159.

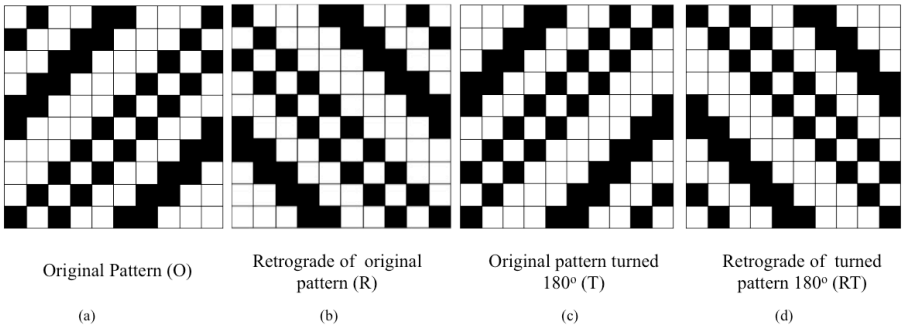
lines. However, it resembles the structure of the textile fabric of the composition *Textile_3* (see Figure 3.1).

Figure 3.1: (a) The structure of the primary weave, (b) the overall textile fabric (O), (c) the primary weave of Textile_3.



Secondly, in order to produce three additional models of textile patterns, the original textile pattern moves backwards (1), or turns by 180 degrees (2), or moves backward and turns by 180 degrees (3). Figure 3.2 illustrates the transformation of the original pattern, which constructs a retrograded textile pattern (R), the original textile pattern turned 180 degrees (T), and the retrograde turned by 180 degrees (RT). In addition, four textile patterns maintain precisely organized and rigorous appearances, which contain diagonal lines.

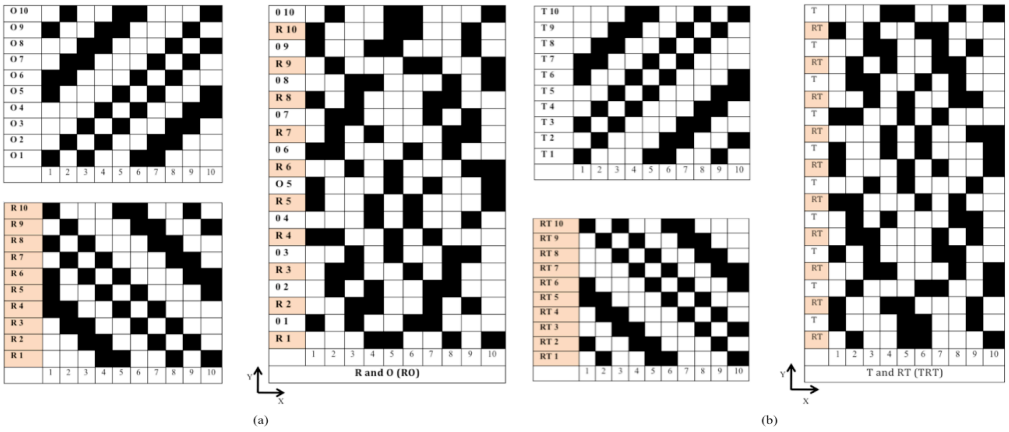
Figure 3.2: Four distinct textile patterns: (a) original pattern, (b) retrograde (c) original textile pattern turned 180^o, and (d) retrograde of original textile pattern turned 180^o.



In order to design the additional fuzzy layers of the textile appearance, separate lines of the four patterns alternate in the x-axis consecutively in order to

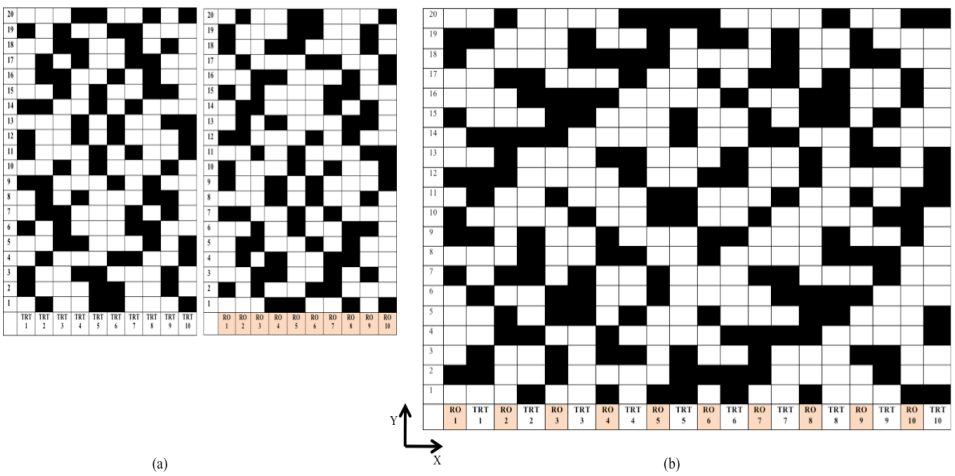
produce two new patterns (RO and TRT). For example, the first line of retrograde pattern (R) forms the first line of RO, then the first line of original pattern (O) is the second line of pattern RO, and so on. The same process applies to the pattern known as TRT, which relies on the structures of the original and retrograded patterns turned by 180 degrees (T and RT) (see Figure 3.3).

Figure 3.3: (a) New pattern RO, (b) new pattern TRT.



Finally, the two new patterns RO and TRT generate the overall textile pattern, following the preceding alternating process, which this time is orientated in the y-axis (see Figure 3.4). The overall textile fabric consists of twenty vertical and horizontal lines, totalling four hundred non-repetitive white and back squares, which forms the overall structure, rhythmical patterns, the structures of harmony and timbre of the composition Habotai.

Figure 3.4: (a) Two patterns RO and TRT, (b) the overall textile pattern.

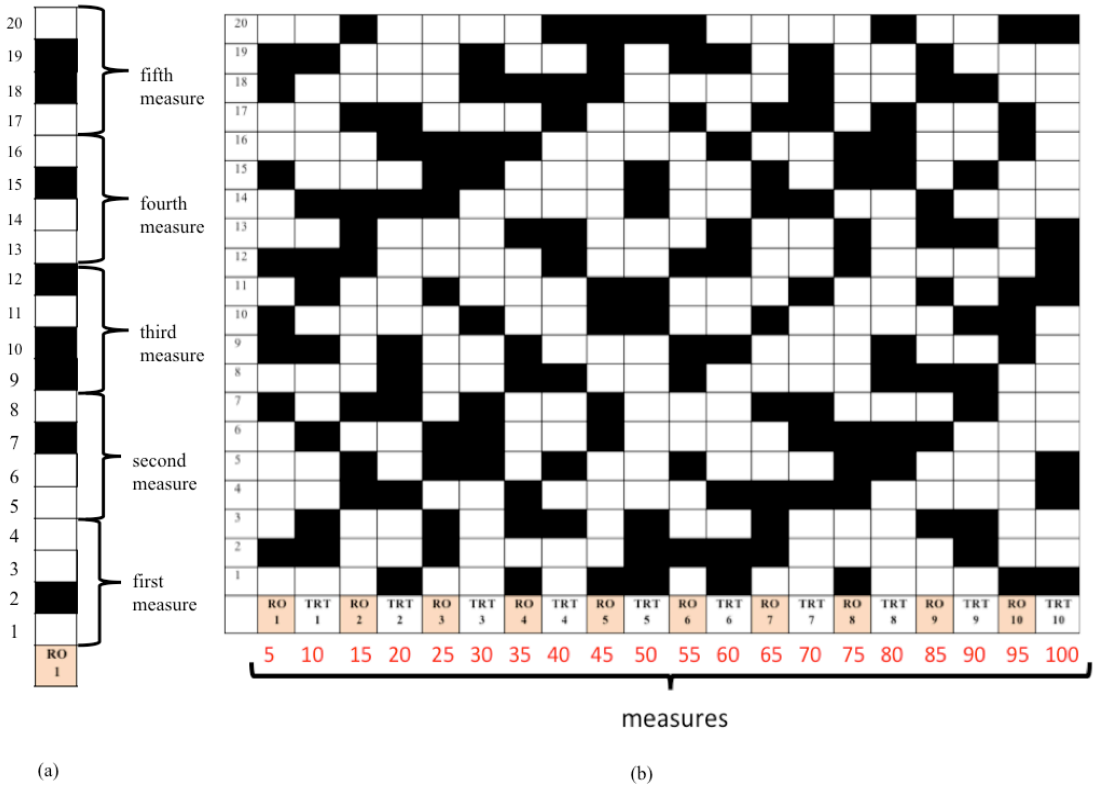


The structure of the Habotai textile pattern relies on the Crepe weave, which produces the fundamental characteristics for the piece Habotai such as non-repetitiveness and duality. In addition, the features of the Crepe weave resemble the musical language through their transformation into distinct sound parameters, such as rhythmical patterns which examine aspects of non-repetitiveness, and overlapping un-pitched events with natural harmonics which investigate the duality of timbre and harmony. However, my intention was to generate one continuous movement based on pre-determined structures, which correspond to the definition and structure of the final Habotai fabric.

3.1 STRUCTURE

The overall structure relies on the mapping of four white and black squares to one measure. In other words, a single line of the textile pattern applies to five measures, producing a total of one hundred measures, which in turn define the overall structure of the composition (see Figure 3.5).

Figure 3.5: (a) Mapping a single line of the textile fabric into measures, (b) the overall structure.



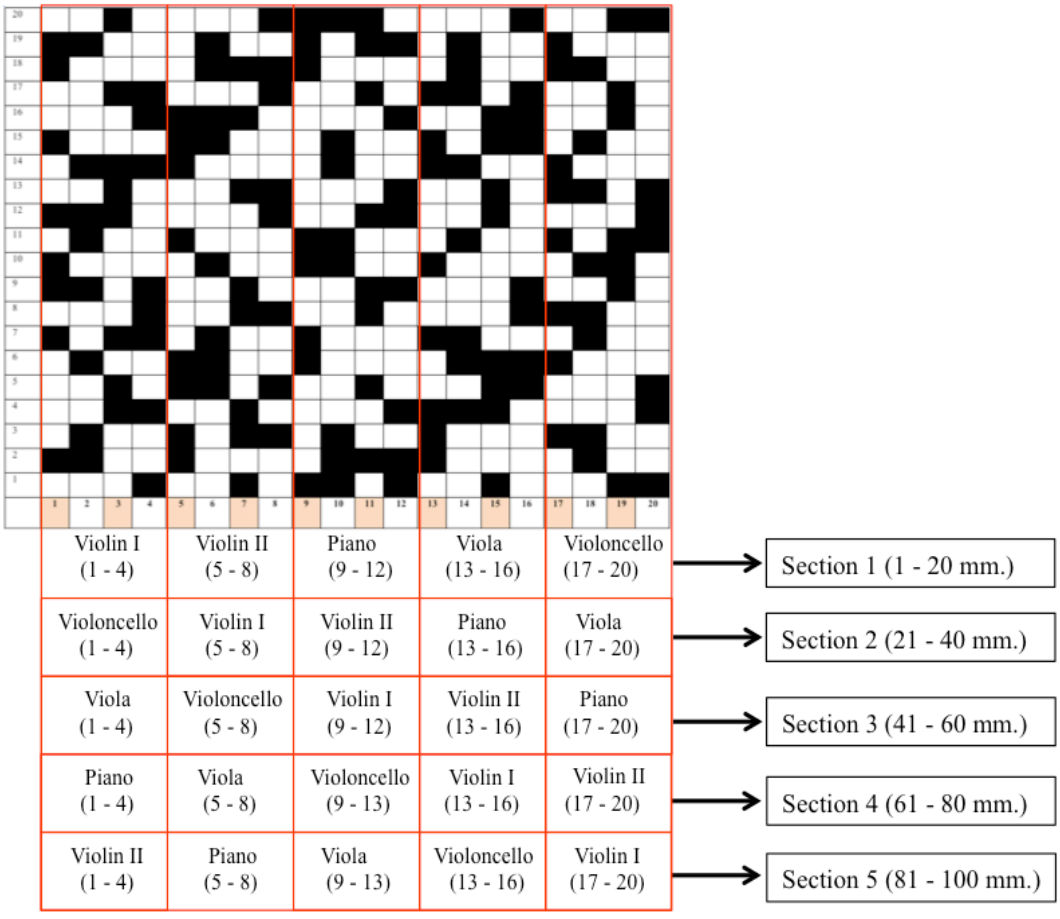
However, the overall structure of one to a hundred measures divides into five sections, (corresponding to five instruments), each containing twenty measures (see Table 3.1).

Table 3.1: The division of the structure.

Sections:	1	2	3	4	5
Measures:	1 - 20 mm.	21 - 40 mm.	41 - 60 mm.	61 - 80 mm.	81 - 100 mm.

In addition, each section marks various rotating lines of the final textile pattern, which are assigned to contrasting instruments in order to extend the timbral / harmonic variety, and avoid repetitiveness. Figure 3.6 illustrates the division of the overall textile pattern, and how the textile lines are distributed amongst the different instruments.

Figure 3.6: The distribution of distinct instruments.

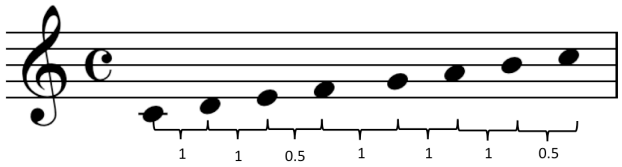


In summary, the structure of the composition relies on the mapping of the overall structure of the Habotai pattern. However, the development of musical material and its ordering depends on the rotation of the distinct instruments, which is defined by a division into five sections and the assignment to particular lines of the Habotai textile pattern. Moreover, the Habotai pattern serves for the mapping of rhythmical patterns, which will be explored below in section 3.4.

3.2 HARMONY

The harmony relies on the Indian raga *Gopi Kambhoji*, which belongs to the Kalyana group, expressing selflessness and peace.[100] The definition of the raga *Gopi Kambhoji* closely resembles the description of the Habotai pattern, which conveys an idea of fragility and transparency. The scale of the raga *Gopi Kambhoji* consists of two tones, one half tone, three tones and a half tone respectively (see Figure 3.7).

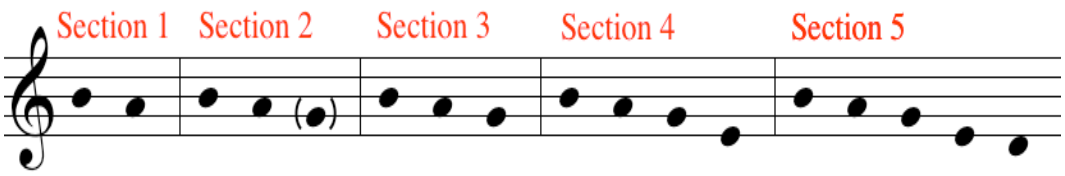
Figure 3.7: The scale on Indian raga Gopi Kambhoji.



However, I have used a descending scale of five pitches: B, A, G, E, and D, where pitches A, G, E and D are based on the tuning of the open strings of orchestral string instruments, which are pentatonic. Moreover, the primary pitch sequence (B, A, G, E, and D) expands and descends over five sections forming phrases of two, three, four and five pitches respectively. For example, section 1 contains two pitches, B and A, section 2 uses mainly two pitches, with pitch G occasionally occurring, in section 3 three pitches are used, and so on (see Figure 3.8). In addition, the harmony acts as a static and relatively unchanging background compared to the development of timbre, which will be explained below in section 3.3.

[100] Alain Daniélou, *The Ragas of Northern Indian Music* (New Delhi: Munshiram Manoharlal Publishers Pvt. Ltd, 2007), p. 266.

Figure 3.8: The development of harmony over five sections.



The harmonic plan described above is the structure used for mapping extended string techniques: this is another expression of the characteristic of duality of the Habotai textile pattern. For example, (1) the pitches A, G, E, D are essential for the production of natural harmonics on string instruments. This corresponds to the plain transparency layer of the Habotai pattern, and I have assigned groupings of black squares in the textile pattern to natural harmonics played on particular pairs of strings. (2) The un-pitched events, performed on any string, echo the fuzzy layer of the Habotai pattern, and are assigned to the white square of textile pattern (see Figure 3.9).

Figure 3.9: Mappings of natural harmonics and un-pitched events.

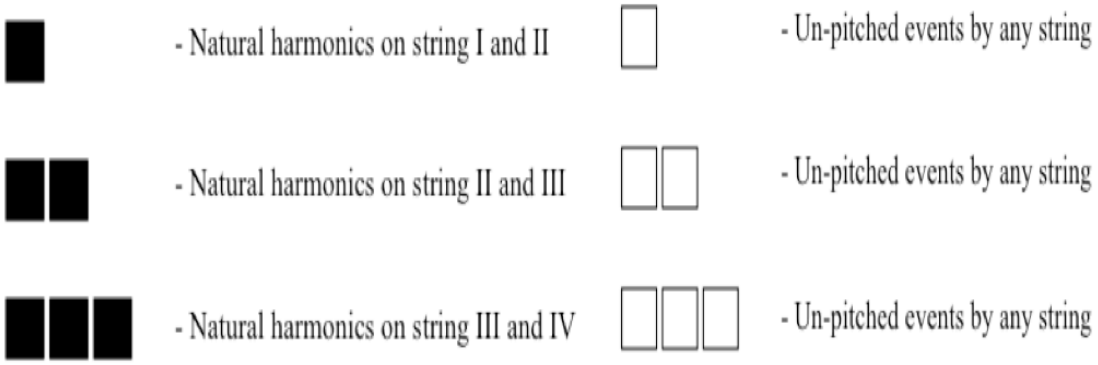
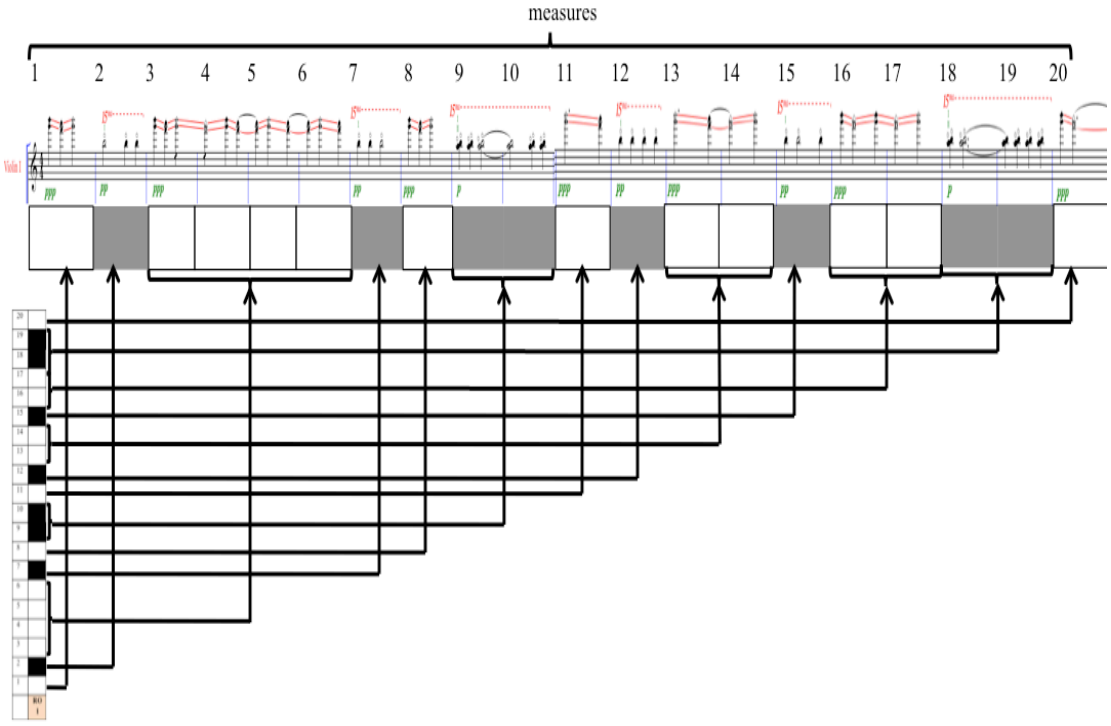


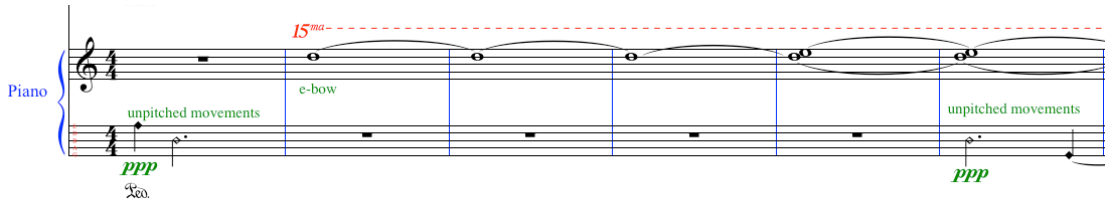
Figure 3.10 illustrates the mapping process of natural harmonics and un-pitched events for violin I for first twenty measures and how it is related to Habotai pattern. However, the length of each of the extended techniques depends on the number of white or black squares. The same process is applied to the rest of the instruments throughout the entire piece.

Figure 3.10: The example of mapping natural harmonics and un-pitched events for violin I (see Appendix B).



The biggest issue of the composition was the transformation of the piano timbre into a sustained 'string' instrument. In the first version of the composition, the piano part as a 'string' instrument consisted of a sustained harmony and un-pitched events, within which the drone relied on performance by e-bow. The un-pitched events were produced on particular pitches (B, A, G, E, and D), using the same scale as the harmony (see Figure 3.11).

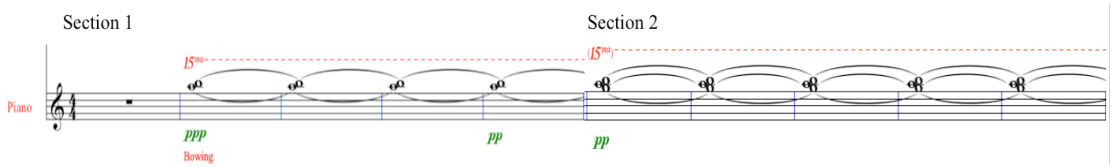
Figure 3.11: The first version of piano part.



The blending between the piano and string instruments was not achieved effectively, and the un-pitched events in the piano destroyed the overall sonority of the composition by the contrasting quality of timbre. In the final version, the piano emphasizes the harmonic plan, producing sonorities through extended techniques

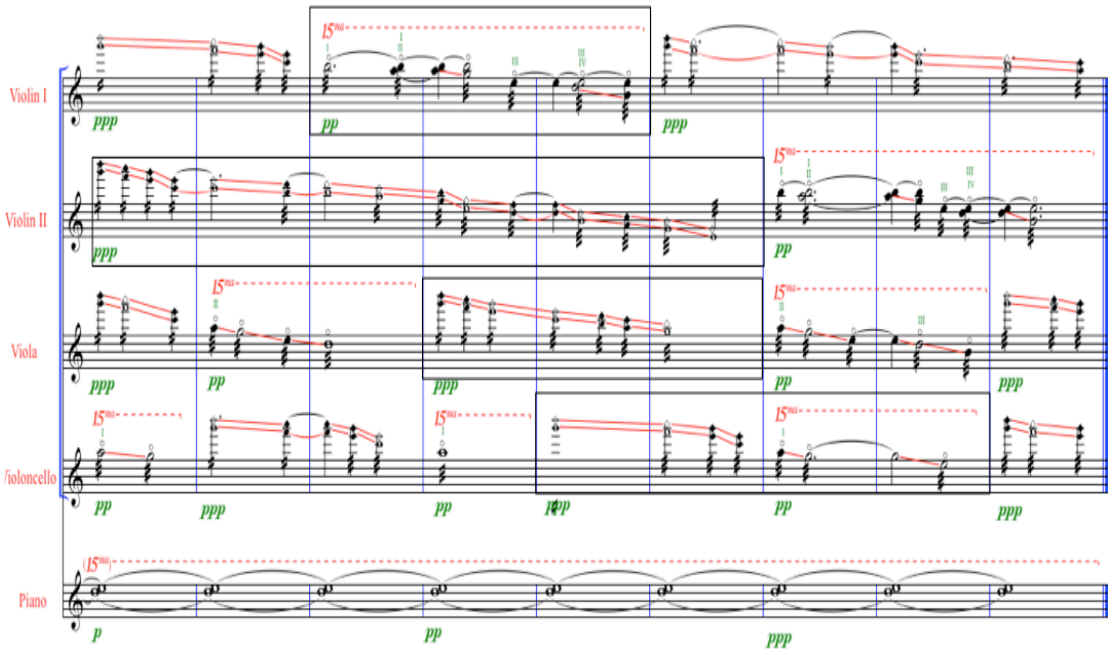
such as bowing with cords, made from a variety of materials. In each section, the piano maintains a cluster of particular pitches. For example, in section 1, the harmony is a dyad consisting of pitches B and A, in section 2 the drone maintains pitches B, A and G, and so on. The harmony of the piano produces a constant texture of high pitches only, which remains unchanged throughout the entire piece (see Figure 3.12).

Figure 3.12: Bowing technique for the last version of piano part.



Generally speaking, the harmony of the melodic instrumental passages fluctuates between natural harmonics and un-pitched events, constantly adjusting the balance of the transparent, fragile sounds and noisy sounds, which echoes the description of Habotai pattern. Towards the end of the piece, the shimmering effect gradually increases through the development in dynamics and a general expansion in diapason range, which reaches a climax with a descending scale, for example, from pitches B to D. The distinct descending melodic scales produce impenetrable sounds adding density and intensity to the harmonic texture (see Figure 3.13).

Figure 3.13: The development of the harmonic plan in the last measures of the piece.



The harmony is created through a descending diatonic scale, representing the Indian raga of *Gopi Kambhoji*, producing a gradual expansion from soft to dense textures, following the order and appearance of Habotai textile pattern. The interaction of dual harmonic events (natural harmonics and un-pitched events) throughout the rotation process of instruments prevents repetitiveness in the entire piece.

3.3 TIMBRE

The exploration of the relationship between timbre and harmony has been widely investigated by those composers associated with the term *Spectral* music, especially by French composers Gerard Grisey and Tristan Murail, who were founders of the Spectral movement. These composers often used computer analysis to explore the perceptual phenomena arising from the interaction between timbre and harmony.[101]

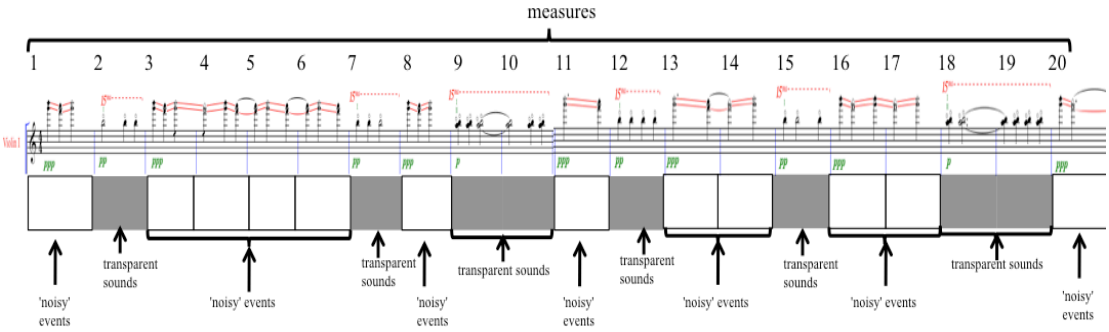
Another example, which has similar approach in terms of the organisation of timbre and harmony is the composition *Verblendungen* (1982-84), for orchestra and tape, written by the Finnish composer Kaija Saariaho. In this piece Saariaho contrasts the analytical detail of time-stretched recorded string sound with the 'imperfections' of a live orchestra to the point where the distinction between harmony and timbre becomes blurred.[102] These approaches of the interaction of timbre and harmony resembles *Habotai* through a colourful display of the instruments' dynamics and range, which is significant for the structure of the composition.

Furthermore*, Habotai* examines the interaction between timbre and harmony throughout mapping identical types of material, creating an interwoven polyphony, which leads to a continuous motion of a number of textures. For example, the harmony explores a duality through natural harmonics and un-pitched events, which produces (1) transparent high pitches and (2) noisy sounds in the mapping of timbre. Moreover, the mapping of timbre relies on the same rule that was used for harmony.

[101] Tristan Murail, 'Spectra and Pixies' trans. by Tod Machover, *Contemporary Music Review* 1, 1 (1984), 157-70 (p. 158).
[102] Kaija Saariaho, trans. by Welborn S. 'Timbre and Harmony: interpolations of timbral structures', *Contemporary Music Review* 2, 1 (1987), 93-133 (p. 110).

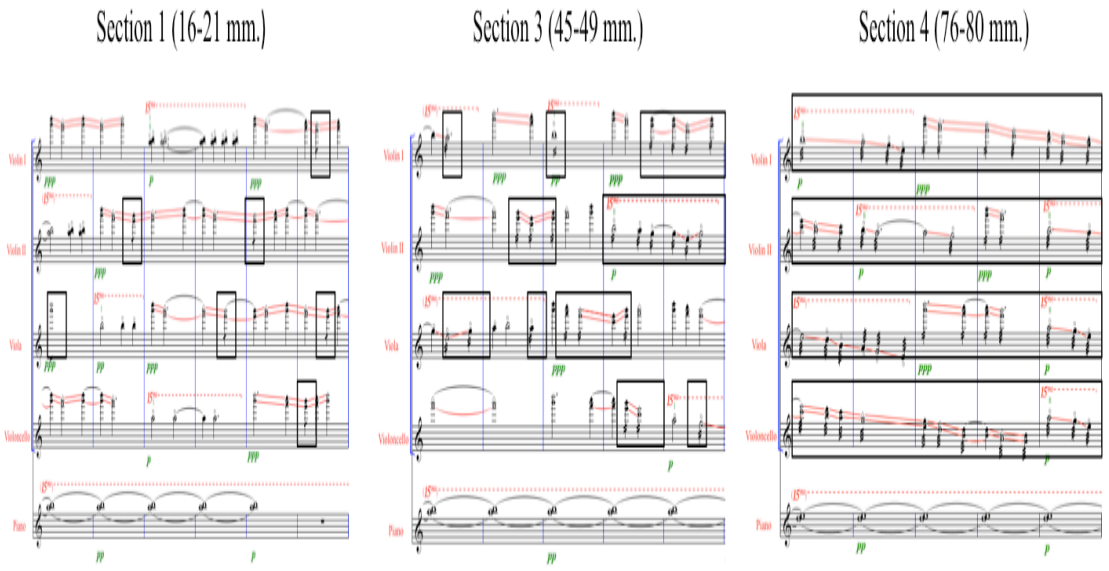
The black squares indicate the transparent sounds (timbre), which are based on natural harmonics (harmony), and the white squares indicate 'noisy' events (timbre) created through un-pitched sounds (harmony) (see Figure 3.14).

Figure 3.14: The mapping process of harmony and timbre for violin I.



One playing technique, the tremolo effect, is a crucial element of the piece. It expands dramatically from very soft transparent textures to very dense textures, throughout distinct types of tremolo, evoking sonorities of harmony and timbre. For example, in section 1 (16-21mm.), the tremolo contains soft pulsation in amplitude, in section 3 (45-49 mm.), the amplitude becomes more intense and dense, and in the section 4 until the end (76-80mm.), the tremolo maintains rapid reiterations, which generates solid and dense timbral textures (see Figure 3.15).

Figure 3.15: The development of tremolo.

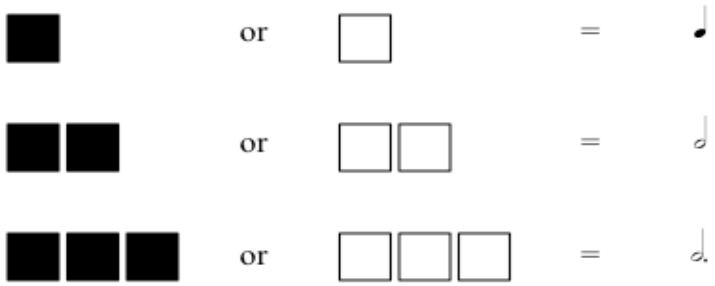


Habotai explores the interaction between timbre and harmony, creating variation and contrast in order to emphasize a heterogeneous expression of motion in the general textural effect. However, the connection between timbre and harmony unfolds through the idea of a general sonority, which draws parallels between harmonic colour and sound colour. My intention was that the sound of the natural harmonics would shine through a diffuse and misty atmosphere produced by un-pitched events, and that the final combination of these non-traditional and traditional playing techniques would be analogous to the characteristics of the textile fabric. The idea of duality of timbre and harmony is explored further in the final composition of this portfolio *Textile_5*.

3.4 RHYTHM

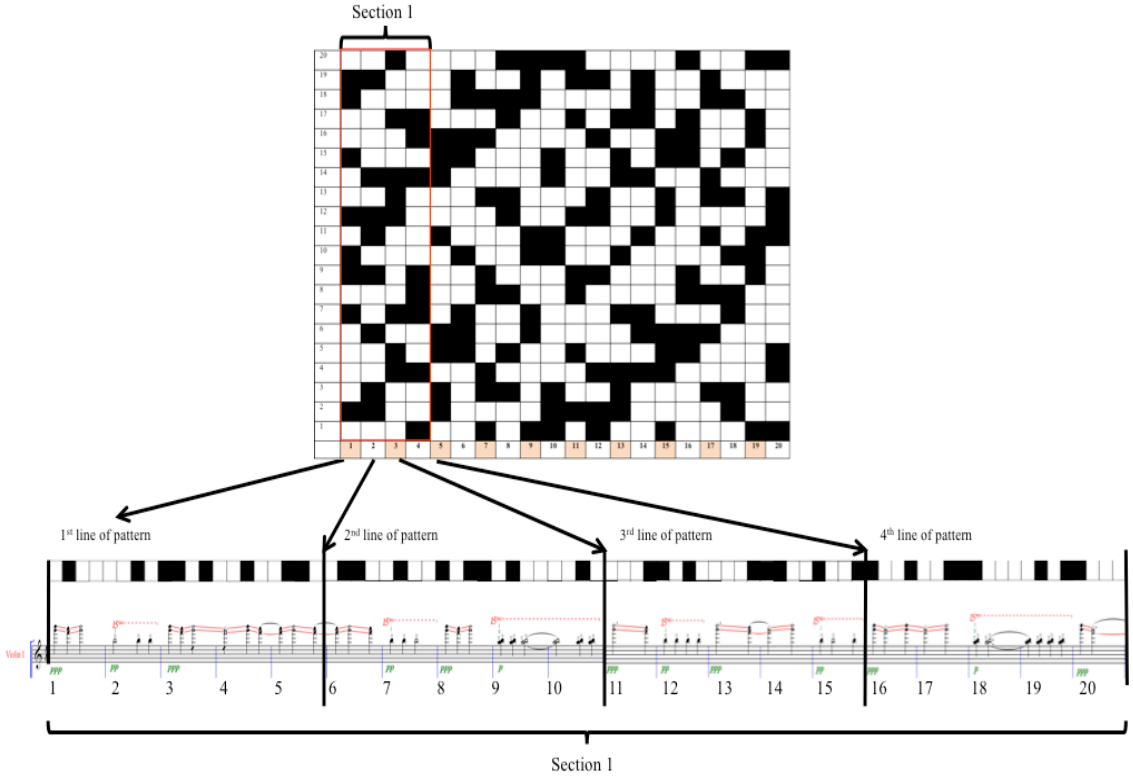
The methodology of the transformation of the textile patterns into rhythmical cycles is similar to the previous piece *Textile_3*, where different proportions of white and black squares are assigned to different durations of time. For example, one white or black square is assigned to a crotchet, two white or black squares equal a minim, and three white or black squares are equivalent to a dotted minim (see Figure 3.16).

Figure 3.16: Mapping patterns to rhythm.



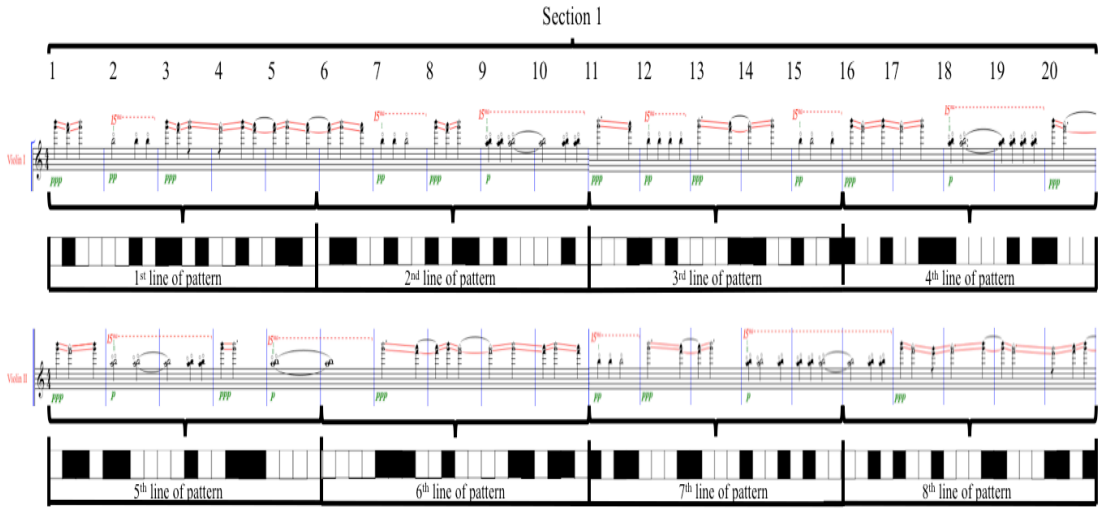
As described earlier, each line of the textile fabric consists of a total of twenty white and black squares, which, using the mapping process above, generates a rhythmical pattern lasting five measures (see Figure 3.17).

Figure 3.17: Mapping of rhythm for the violin 1 for section 1.



In order to establish overlapping rhythmical layers, each instrument performs different lines of the textile pattern, maintaining its own rhythmical cycle. Figure 3.18 illustrates the rhythmic pattern of violin I and violin II for section 1. The same mapping rule of rhythm is applied during the other sections.

Figure 3.18: The distinct rhythmical layers.



The composition is notated in 4/4 meter, but these measures are not accentuated in order to maintain a feeling of floating freely through time rather than marked musical partitions. The superimposition of several rhythmic layers creates the impression of contemplation and integrity.

3.5 DYNAMICS

Throughout the entire piece, the development of timbre and harmony changes to great effect, pushing individual instrumental parts towards their upper and lower limits of pitch range. However, the dynamic markings remain piano or pianissimo, out of which emerges a web of sound clusters that move seamlessly through time (see Table 3.2).

Table 3.2: Development of dynamics.

	Natural harmonics	Un-pitched events
Section 1	*pp*	*ppp*
Section 2	*pp*	*ppp*
Section 3	*pp*	*ppp*
Section 4	*p*	*ppp*
Section 5	*p*	*ppp*

The relationship between notated and sounding dynamics remains conceptual rather than perceptual, in that the sounds produced by extended techniques dominate the sounding image to such an extent that the traditional sounds are not easily perceptible. Despite the fact that during the rehearsal of the piece the performers tended to play louder than was written in the score, the dynamics remain unchanged in order to maintain consistency and to resemble to the analogous appearance of Habotai textile fabric.

3.6 SUMMARY

Habotai highlights the idea of the duality between harmony and timbre in such a way that harmonic colour becomes timbral colour. The duality between timbre and harmony is expressed by the production of two types of textural sonorities: the first

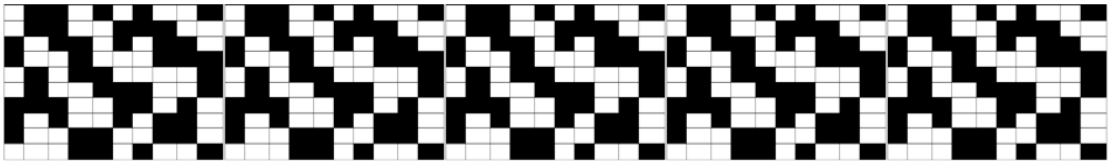
group represents a static motion based on natural harmonics, producing fragile and transparent sounds; the second group maintains un-pitched events, which are based on noisy sounds, and serves as tension.

In addition, the structure of the Habotai fabric controls the order and appearance of the musical parameters, emphasizing its connection and interaction: for example, the harmony and timbre rely on the mapping of numbers of white and black squares of the Habotai pattern. The overall structure of the composition is based on the physical length of the Habotai; the rotation of the contrasting instruments depends on the divisions of the Habotai pattern.

Habotai reveals a strong connection with the definition of the Habotai textile pattern as “soft as down”. Its transformation into musical language creates a transparent monochrome piece, with aspects of impenetrable texture, something like the translucent, yet densely woven textile pattern.

4. MOORCHANA

Moorchana (2013), for oboe, bass clarinet B-flat, violin, viola, violoncello and percussion
Performed by ensemble 7Bridges on 14 April, 2013 at Durham University
Duration: approximately 13 minutes



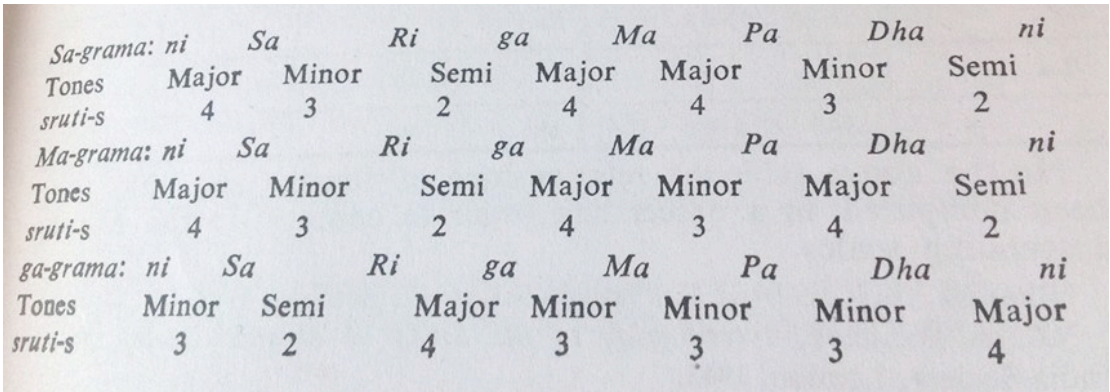
Each composition aims to examine particular possibilities for mapping from visuals into sounds, using analogous parameters of textile design and sound, and highlighting the interaction between them. However, some of the mapping processes require reconsideration in order to outline specific elements, which correspond both to textile patterns and to composition: for example, how the appearance of the textile fabric transforms into the structure of the composition, how distinct amounts of warp and weft generate contrasting patterns of rhythm, harmony, timbre or dynamics, and so forth.

The composition *Moorchana* required the largest amount of pre-compositional and preparatory sketches. This illustrates that the mapping processes demanded particular decisions in order to emphasize the connections between textiles and music. The challenges arose here in the construction and use of a specific textile pattern, where I sought to integrate individual rhythmic and harmonic layers of contrasting instruments. The previous compositions relied on the same kind of instruments (i.e. of similar timbres), for example, four percussionists (*Textile_3*), and a string quartet and 'transformed' piano (*Habotai*). However, *Moorchana* is written for a mixed ensemble of instruments: oboe, bass clarinet B-flat, violin, viola, violoncello and percussion, which presented challenges in terms of achieving an appropriate blending of timbre.

The concept of the composition and the design of the textile pattern derive from the definition of Mūrch'hanā, which describes the different types of Indian medieval music scales. There are three kinds of mūrch'hanā-s: (1) *Sa-grama*, whereas the relation between *Sa* and *Pa* is a perfect fifth, (2) *Ma-grama,* the pitch *Pa* is lower

by one *sruti,* and (3) the scale *ga-grama* no longer exists in the present day in modern Indian music[103] (see Figure 4.1).

Figure 4.1: The ancient music scales of India.[104]



Sa-grama:	*ni*	*Sa*	*Ri*	*ga*	*Ma*	*Pa*	*Dha*	*ni*
Tones	Major	Minor	Semi	Major	Major	Minor	Semi	
sruti-s	4	3	2	4	4	3	2	
Ma-grama:	*ni*	*Sa*	*Ri*	*ga*	*Ma*	*Pa*	*Dha*	*ni*
Tones	Major	Minor	Semi	Major	Minor	Major	Semi	
sruti-s	4	3	2	4	3	4	2	
ga-grama:	*ni*	*Sa*	*Ri*	*ga*	*Ma*	*Pa*	*Dha*	*ni*
Tones	Minor	Semi	Major	Minor	Minor	Minor	Major	
sruti-s	3	2	4	3	3	3	4	

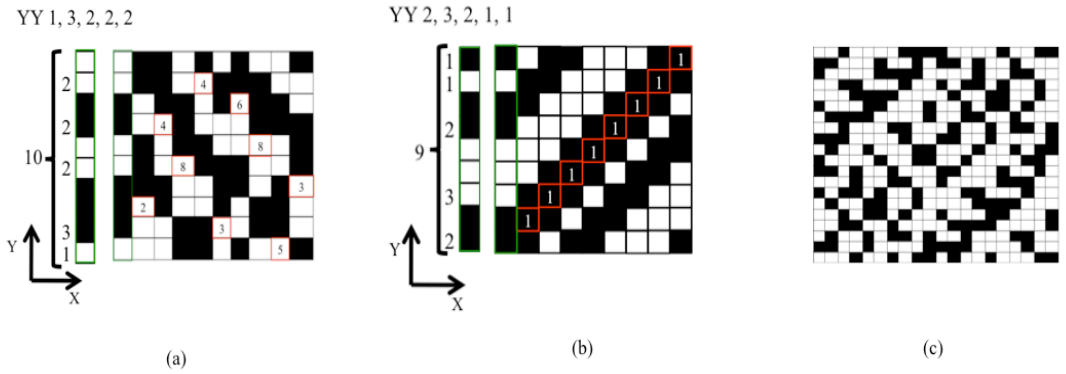
However, according to singer, saint-poet of the khayal lyric, and maestro extraordinaire of the Indore gharana[105] Bindu Chawla, Mūrch'hanā in Sanskrit means unconsciousness.[106] In order to refer to the meaning(s) of Mūrch'hanā, I have created a microtonal composition, which gradually transforms from one sonic texture to another, through distinct timbral intonations, which emphasize micro-fluctuations of harmony and rhythm throughout the entire piece. However, the design of the textile fabric explores Mūrch'hanā's meaning via a non-repetitive structure and contrasting amounts of warps and wefts, which are used to map the musical parameters to be discussed below. In addition, the non-repetitive structure of the textile pattern highlights a continuity that emerges from dynamic elements of the textile pattern (variable amounts and uneven division of warp and weft), which become essential features of the composition. These characteristics of both the textile pattern and the music represent the motion of volatility, which corresponds to the uncontrolled stream of thoughts.

The construction of the overall textile pattern is similar to *Textile_3* with regards to the alteration of the primary weave (code YY 1, 3, 2, 2, and 2), which is

[103] Bigamudre Chaitanya Deva, *The Music of India: A Scientific Study* (New Delhi: Munshiram Manoharlal Publishers Pvt. Ltd., 1981), p. 51.
[104] Ibid., p. 51.
[105] http://www.binduchawla.com/profile.html (last accessed on 8 May 2015).
[106] Chawla Bindu, 'Shadaj Sadhana in Hindustani Music', *India International Centre Quarterly*, 4, 32 (2006), 51-65, (pp. 54-55).

indicated by the green border. It consists of a total of ten white and black squares and shifts by irregular numerical sequences; 2, 4, 8, 4, 3, 6, 8, 5, and 3, producing a non-repetitive structure. This is in contrast to *Textile_3*, within which the primary weave moves by a constant numerical sequence, generating diagonal lines in the textile's appearance. However, the final textile's appearance in *Moorchana* resembles the composition *Habotai* in accordance with its non-repetitive structure (see Figure 4.2).

Figure 4.2: (a) The primary weave and final textile pattern of Moorchana, (b) the primary weave and final textile pattern of Textile_3, (c) the final textile pattern of Habotai.



Music compositions, such as *Habotai* and *Moorchana*, which rely on the complementary design of the textile pattern (non-repetitive structure) are distinguished from each other by mapping contrasting elements (structure, distinct amount of warp and weft, the division of the overall structure) into the musical parameters, in order to provide a new quality of the musical structure, timbral sonorities, harmonic or rhythmical textures - whatever I find interesting. In addition, the compositions represent contrasting approaches to compositional techniques; for example, *Habotai* highlights *spectralism* in terms of an exploration of the duality of timbre and harmony,[107] and *Moorchana* references techniques of *microtonality,* given its use of tempered and inflected microtones, which change the colour of the pitch precisely or approximately for its harmonic structure. The distinct fluctuations of the pitch will be explored in the chapter 'Harmony'.

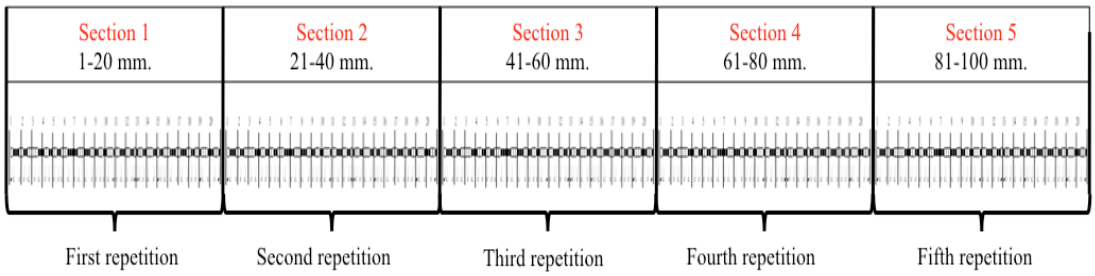
[107] Tristan Murail, 'Spectra and Pixies' trans. by Tod Machover, *Contemporary Music Review* 1, 1 (1984), 157-70 (p. 158).

Generally speaking, the overall textile pattern explores the meaning of Mūrch'hanā through mapping its non-repetitive structure and its elements into "mutating" musical parameters, which gradually transform from one sonic texture to another. In addition, distinct variations of timbre and diatonic harmony, which rely on non-repetitive rhythmic patterning, highlight the unstable motion.

4.1 STRUCTURE

As in earlier pieces such as *Textile_3* or *Habotai*, the overall structure of *Moorchana* is derived from the mapping of the final textile pattern, which determines the order and appearance of all musical parameters. However, the rhythmical pattern influences the design of the overall structure, which is based on the principle of five repetitions (see Figure 4.3).

Figure 4.3: The overall structure of Moorchana.



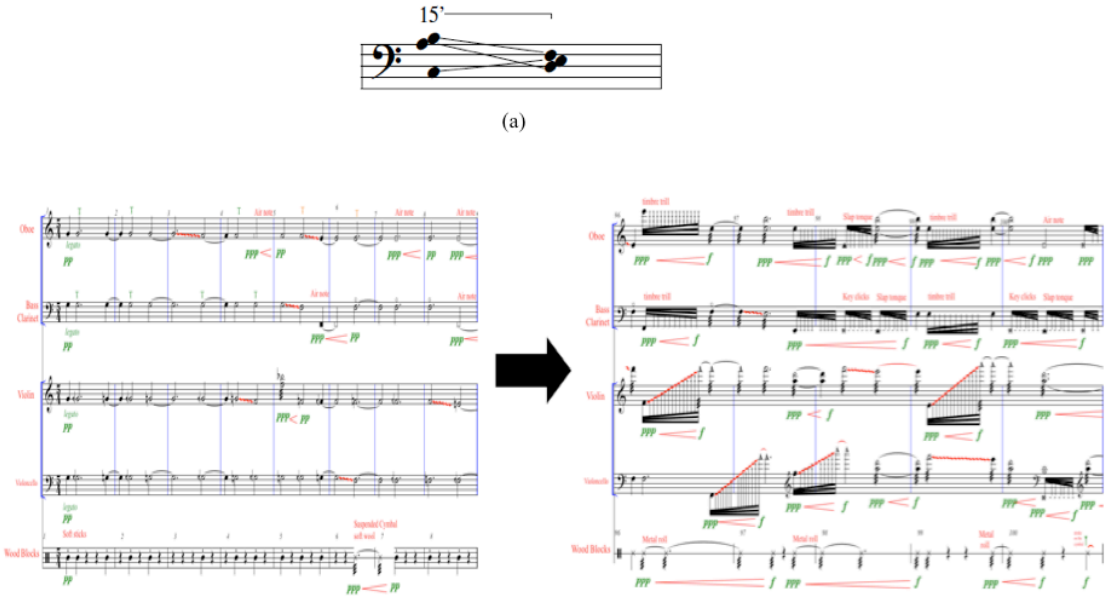
Although the overall structure relies on rhythmic repetition, generating five sections, at this point, a sectional analysis of the work would be misleading because the climax is the outcome of an unbroken continuum achieved by a gradual transformation from one sound entity to another. However, the idea of repetition incorporates a constant renewal of substantial musical parameters, such as timbral variations, the fluctuations of harmony, which sometimes consciously and even subconsciously remould an existing idea.

The musical idea of *Moorchana* resembles that found in the composition *Vers le blanc* (1987), [108] written by Finnish composer Kaija Saariaho in terms of its slow changes of musical events and textual continuity. However, Saariaho uses two chords,

[108] Clifton Callender, 'Continuous transformations', *Music Theory Online*, 3, 10 (2004), 1- 44 (p. 2).

which transform from one to another through three simultaneous glissandos,[109] while *Moorchana* highlights the transformation from one timbral sonority to another (see Figure 4.4).

Figure 4.4: The changes of musical events: (a) harmonic interpolation in Vers le blanc, (b) the timbral transformation in Moorchana.



Generally speaking, the structure of *Moorchana* conveys a continuum of transformation, where musical ideas weave into a constantly changing musical soundscape, at least on the surface. In addition, the structure of the textile pattern serves both as a template for the overall timings and proportions of the piece, and as the inner structure for mapping different musical parameters such as harmony, rhythm and timbre, which will be explained in the following sections.

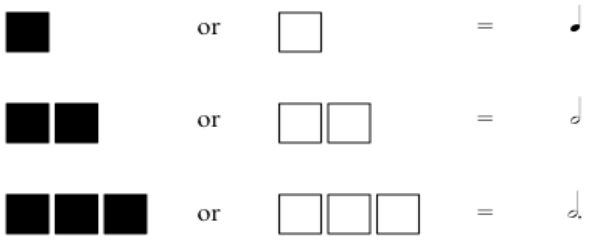
4.2 RHYTHM

The rhythm mapping corresponds to similar rules to those applied in composition *Habotai*: one white or black square corresponds to one quaver, two white

[109] Ibid., p. 2.

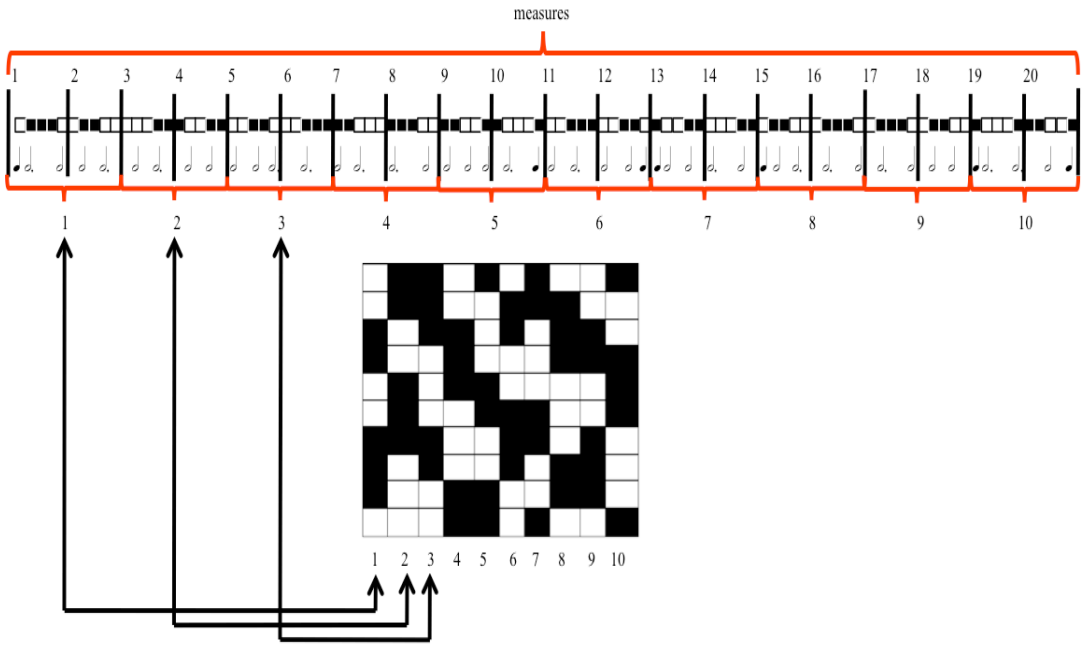
or black squares corresponds to a minim, and three white or black squares correspond to a minim with dot (see Figure 4.5).

Figure 4.5: The mapping distinct length of notes.



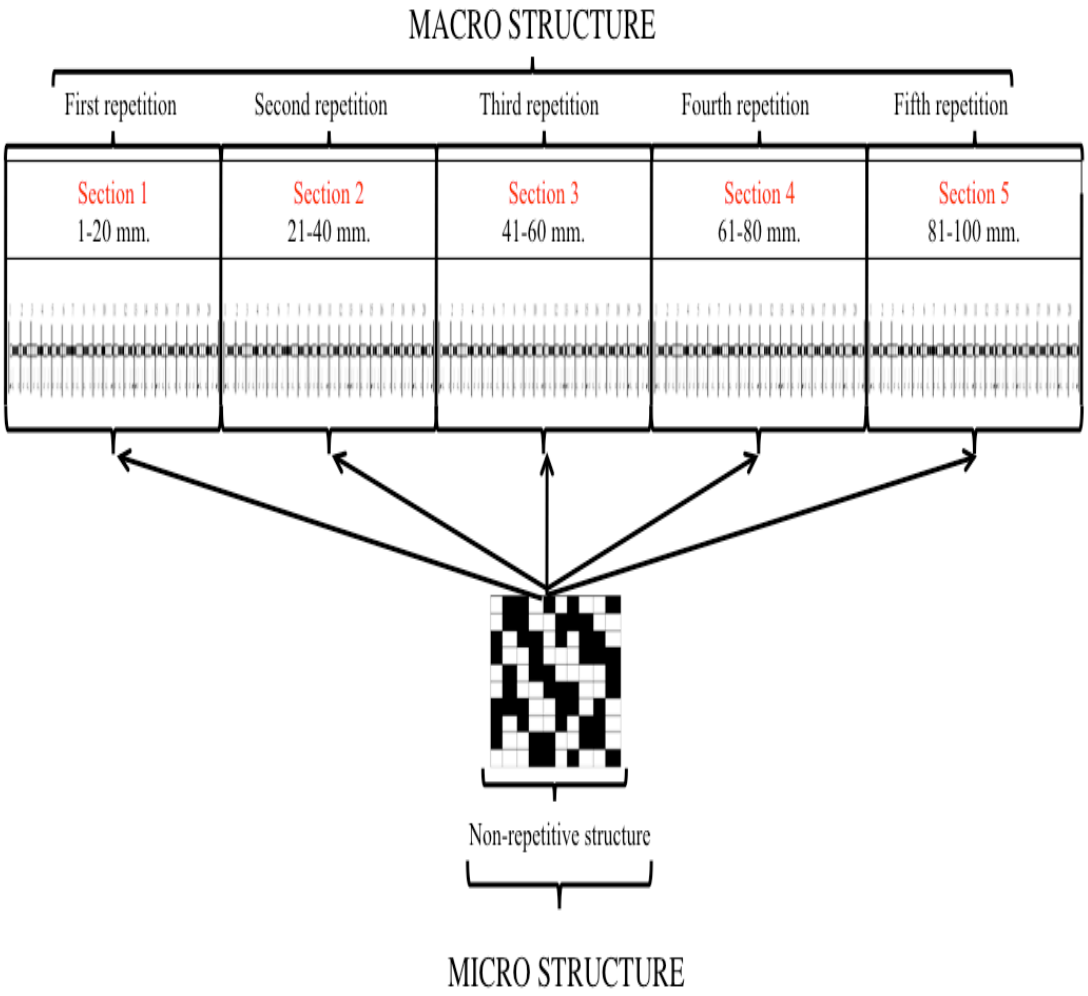
The initial rhythmical pattern relies on the mapping of the overall textile pattern, which generates a non-repetitive rhythm lasting twenty measures. The constantly changing rhythmic pattern creates a sense of fluctuation and variability, which enables the listener to identify the cycle of rhythmical motion. In this case any rhythmical value can indicate the beginning, or the middle, or the end of the rhythmic structure, which generates cyclical time. Figure 4.6 illustrates how the spread out textile pattern is mapped into one line and its transformation into the initial rhythmical cycle.

Figure 4.6: The initial isorhythmical cycle based on the 'spread out' textile pattern.



However, this non-repetitive, irregular rhythmical pattern repeats five times, determining the overall structure of the composition *Moorchana*, generating one hundred measures in total. At this point, the interaction between the non-repetitive microstructure and the repetition of the macro-structure highlights the duality of two contrasting approaches (see Figure 4.7)

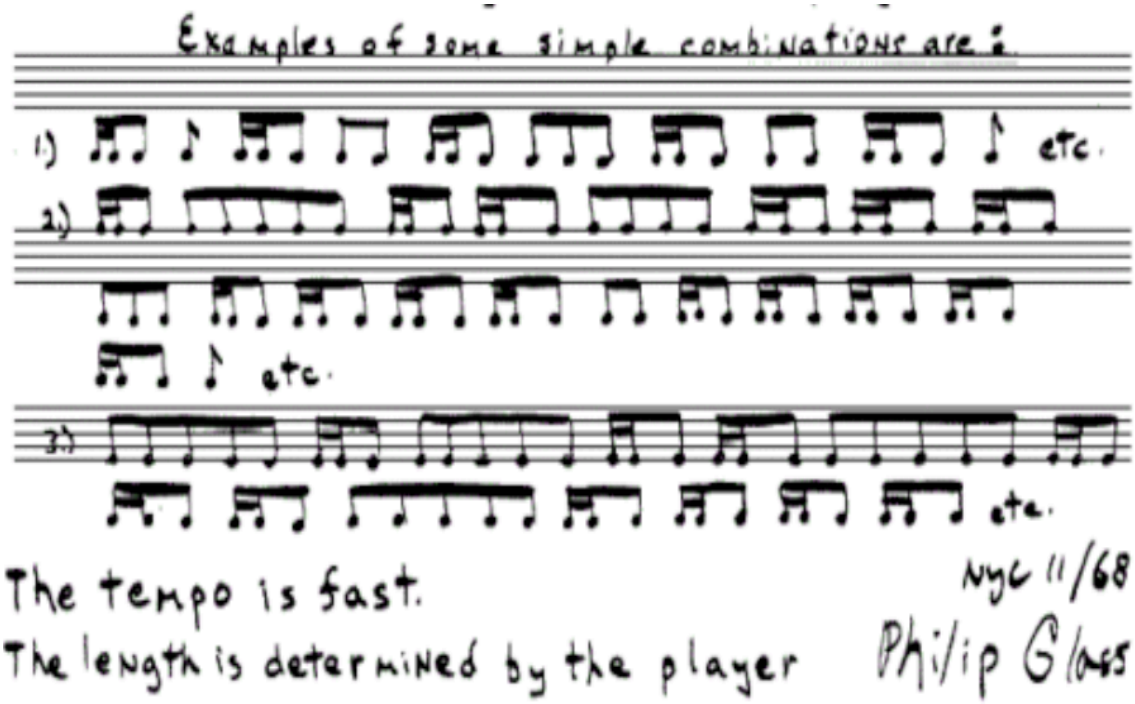
Figure 4.7: The micro-macrostructures of Moorchana.



Furthermore, the repetition of rhythmical patterns occurs in the distinct compositions of Minimalism, and, its use manifests itself in different ways. For example, in the compositions *Piano Phase/Marimba Phase,* and *Violin Phase* (1967), written by the American composer Steve Reich, the variable number of each bar is assigned to different instruments in order to construct shifting rhythmical patterns, or 'phasing' between two performers. During the performance, the process of gradual

phase shifting and then holding the new stable relationship is continued with the repetitive patterns, which gradually fade in (in unison) and fade out, in which the second performer gradually increases his/her tempo very slightly and begins comes to move very slowly ahead.[110] Another example is the composition *1+1* (1968) by Philip Glass, the work contains only two basic musical elements and utilizes the simplest of forces: a lone performer tapping on a table top, the sound of which is amplified by a contact microphone. This work utilizes a technique that has come to be known as 'additive/subtractive process',[111] involving the gradual lengthening and eventual shortening of a musical figure, proceeding note by note. These expansions and contractions thus impose a constantly shifting metrical orientation upon the musical surface and melodic shapes are made of slowly extending and retracting melodic arcs or valleys. The player is also instructed to combine repetitions and alternations of these two rhythms at a fast tempo for an unspecified length of time and 'in continuous, regular arithmetic progressions' (see Figure 4.8).

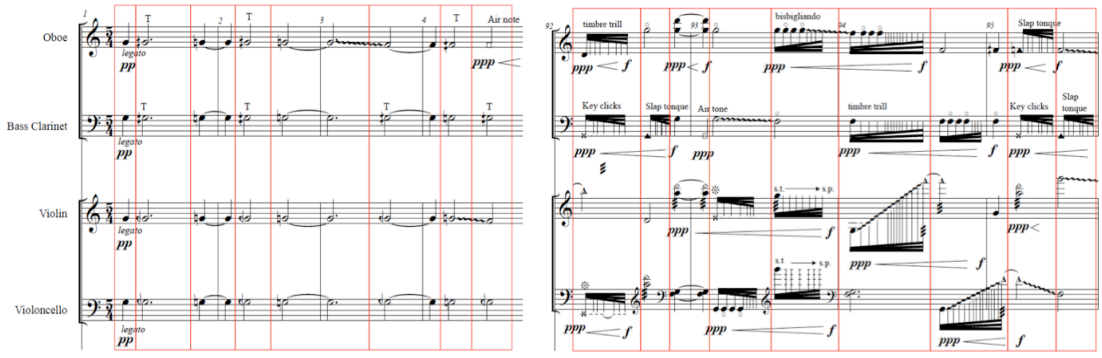
Figure 4.8: Additive process in 1+1 by Phillip Glass.[112]



[110] Philip Ball, *The Music Instinct: How Music Works and Why We Can't Do Without It* (Vintage: Random House, 2011), p. 223.
[111] Hartmut Obendorf, *Minimalism: Designing Simplicity* (Dordrecht: Springer, 2009), p. 47.
[112] Ibid.

In *Moorchana*, the use of repetitions emphasizes an additional plan of motion, from which emerges a non-teleological meditative atmosphere similar to a mantra.[113] However, the expansion and development of the parameters of timbre and dynamics gradually destroy the rhythmical repetitions until the surface texture finally mutates into a timbral sonority: for example, at the beginning of the composition, the pulsation of rhythm is clearly perceptible and dominates the sound, which relies on its isorhythmic pattern. From the middle of the piece, timbre and dynamics start to reach their limits, creating dense textures of polyphony. At the end of the piece, the sonority becomes so intense that it overwrites and audibly covers the perceptual clarity of the rhythm (see Figure 4.9).

Figure 4.9: (a) Isorhythmic pattern at the beginning, (b) the rhythmical pattern at the end of the piece.



Generally speaking, *Moorchana* maintains a singular isorhythmic pattern, which repeats five times, during which the development of timbre and dynamics transforms the perception of rhythm from synchronous patterning into timbral sonority.

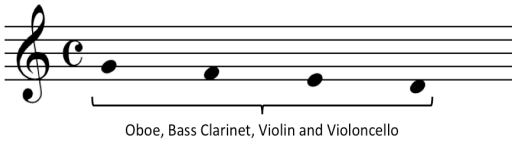
4.3 HARMONY

As in the previous composition *Habotai*, the harmony of *Moorchana* relies on a constantly descending scale based on the pitches G, F, E, and D throughout the entire piece. The distinct instruments repeat the fundamental melodic motif through a

[113] Harvey P. Alter, *Understanding Mantras* (New Delhi: Motilal Banarsidass Publishers Pvt. Ltd., 1991), p. 204.

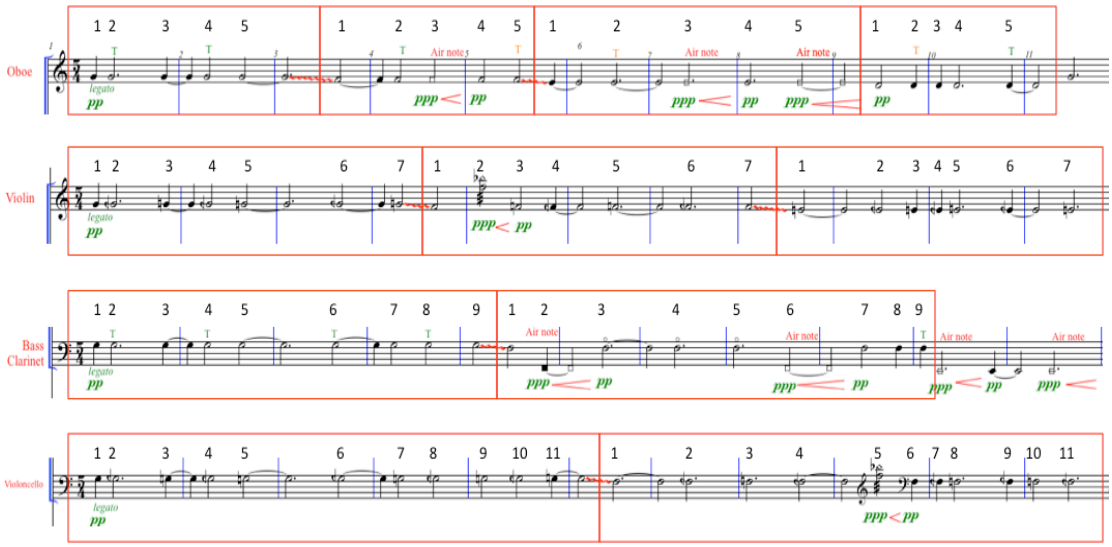
descending motion, capturing the essence of elegy, which is central to the character of the composition (see Figure 4.10).

Figure 4.10: The initial scale of harmony for Moorchana.



The distinct repetitions of each pitch generate independent descending melodic lines, which remain consistent throughout the entire piece: for example, the oboe repeats each note five times, violin – seven, bass clarinet nine, and violoncello - eleven (see Figure 4.11).

Figure 4.11: The different repetitions of each note of the scale assigned to distinct instruments.



However, there is an extremely slow-moving harmonic fluctuation during the repetition of each note, which does not coincide with rhythmical patterns, thus forming isorhythmical cycles. This approach links to one of the greatest chamber works of the twentieth century *Quartet for the End of Time* (1941), written by French composer Olivier Messiaen (1908-1992). In the first movement *Liturgie de cristal*, the cycles of pitch and rhythm of the piano rely on two independent repeating patterns: the rhythmic cycle consists of a patterns of seventeen durations, and the pitch cycle

maintains a series of twenty-nine chords.[114] In addition, in *Moorchana*, the distinct isorhythmic cycles begin to shift, either by a microtone (tempered quartertone) or by extended techniques, such as timbral variations, air notes, etc. It is an almost imperceptible element, since the distinct harmonic patterns sustain the inner motion within the descending melodic line (see Figure 4.12 and Figure 4.13).

Figure 4.12: A repetition based on microtonal motion in violin's part.

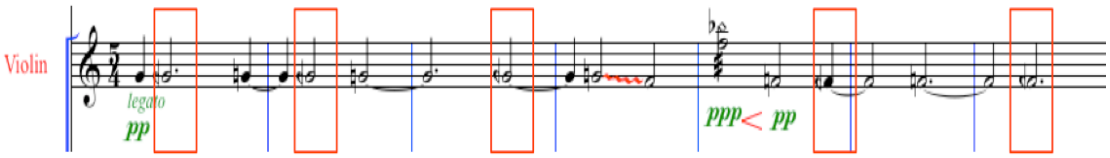
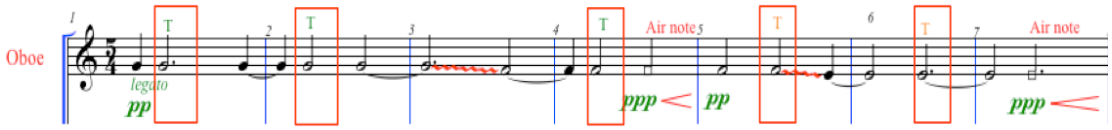
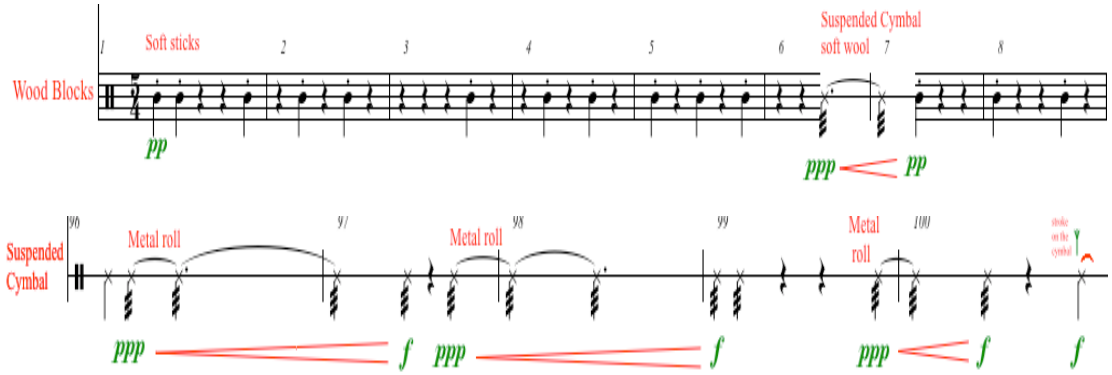


Figure 4.13: A repetition based on timbral change in oboe's part.



The percussion creates an additional layer, which highlights the unity of harmonic development: for example, wood blocks perform an *ostinato*, which remains a constant and insistent feature, until the interruption of the suspended cymbal, which gradually takes over from the previous sounds, transforming them into a totally different sonic texture (see Figure 4.14).

Figure 4.14: The sound transformation from wood blocks to suspended cymbal.



[114] Richard Taruskin, *Music in the Early Twentieth Century: The Oxford History of Western Music* (New York: Oxford University Press, 2010), p. 237.

To sum up, the structure of harmony relies on the repeated descending scale, which is interwoven with distinct timbres in order to transform from one sound image to another. Moreover, the contrasting isorhythmic cycles generate overlapped harmonic layers through distinct microtonal shifts in order to eliminate the *ostinato* motion.

4.4 TIMBRE

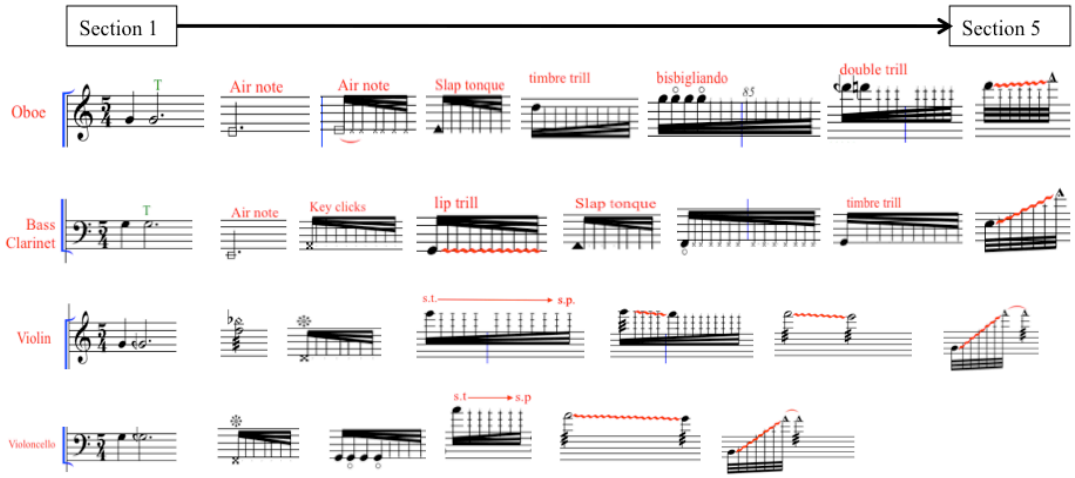
The most complex challenge with the work presents is the combination of contrasting timbres of instruments, while maintaining a smooth transformation from one sound texture to another.

The composition *Atmosphères* (1961), written by the Hungarian composer György Ligeti (1923-2006), maintains a gradual transformation from one texture to another, through changes of colours and densities.[115] However, the polyphonic structure of multiplied lines occurs in the score, which generates a unity of textures, resembling an 'atmospheric plane of sound'.[116]

A similar approach to the transformation of sonority appears in my composition *Moorchana*, which also explores the development of timbres. My pre-determined plan of contrasting timbres illustrates the ordering of timbral changes, which occur throughout the entire piece. At the beginning, the composition contains fragile and transparent sounds in a narrow register, which gradually transform into a chromatic flourish across a wide register. My intention was that each performer would employ between five and seven timbre-based gestures, giving them a separate sonic identity and rate of change (see Figure 4.15).

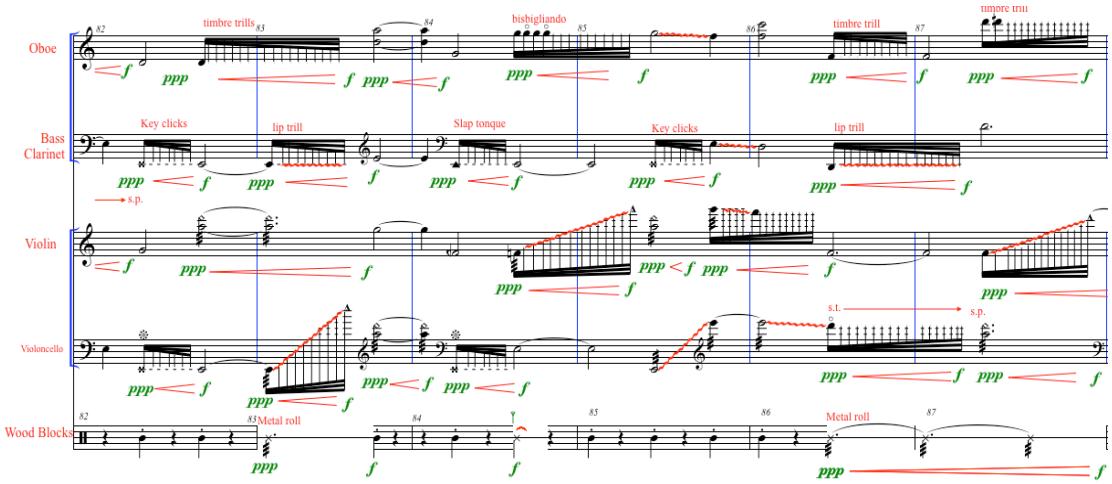
[115] Ingeborg Hoesterey, *Zeitgeist in Babel: The Postmodernist Controversy* (Bloomington: Indiana University Press, 1991), p. 211.
[116] Byron Almén, *Approaches to Meaning in Music*, ed. by Edward Pearsall (Bloomington: Indiana University Press, 2006), p. 54.

Figure 4.15: The development of timbre for each separate instrument.



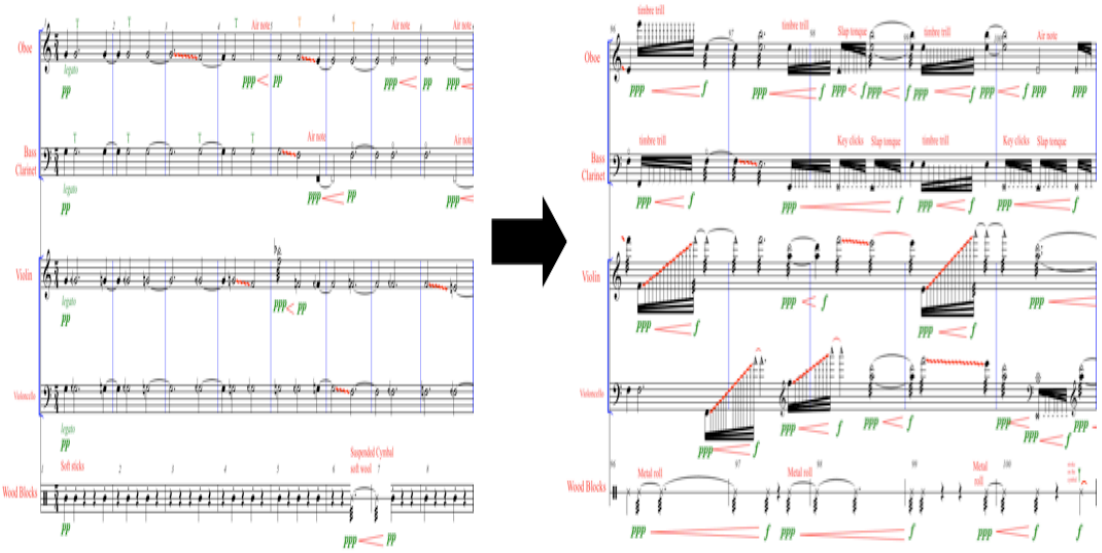
For the first time, the appearance of contrasting timbres bears no relation to the textile pattern, and is defined by intuitive decision-making. However, my intention in selecting distinct timbres was that at the beginning of the piece, intimate and inaudible timbres such as *air notes* and *key clicks* could resemble the 'stable' state of mind; the middle section maintains more active sonorities through the selection of *slap tongues* or *bisbigliando*; at the end, the timbral texture could become "active" through dense extended techniques, such as *timbral trills* and *glissando*. Different timbres link together via a numbers of repetitions, which form a continuous transformation from homophony to polyphony. In addition, the new dynamics emphasise the individuality of each timbre, which also highlights the texture of each instrument. The climax of the piece occurs at the end of the piece, where the dynamics transform from *pianissimo* to *forte* (see Figure 4.16).

Figure 4.16: The development of dynamics.



Finally, Figure 4.17 illustrates the first and last measures of the score in order to present the two distinct sound images, which start and end the piece, respectively.

Figure 4.17: The timbral development at beginning and the end of the piece.



Generally speaking, *Moorchana* presents a gradual transformation of sounds, from one distinct sonic image into another, where rhythmic repetitions gradually but completely change into timbral sonority.

4.5 SUMMARY

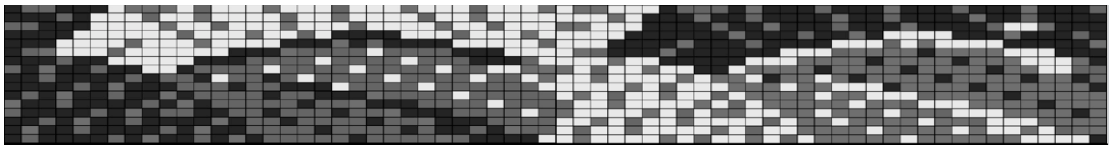
Moorchana remains the single composition in my portfolio that explores microtonal shifting from one texture to another, using repetitive rhythmical patterns, which derive from the mapping of the overall textile pattern. Throughout the entire piece, distinct timbral sonorities interrupt the static isorhythmic pattern, which at the end becomes a new sonority of distinct textures. In addition, the constant harmonic plan for heterophonic instruments emphasizes the timbral continuity, which establishes the perfect blending of the instruments.

Moorchana highlights a unique approach to translating the textile pattern into musical language, proving that there are many possibilities for the mapping process, just as there are many ways of generating a specific textile pattern. However, each

composition relies on similar methods of mapping process (rhythmical patterns derive from the contrasting lines of textile patterns, the structure of the composition depends on the overall textile fabric, the changes of timbre and harmony are mapped from the distinct amount of warp and weft), in which the distinct nature of the textile pattern or musical idea distinguishes one composition from another.

5. TEXTILE_4

Textile_4 (2013), for prepared piano and live electronics of four prepared acoustic pianos, performed by Rima Chačiaturian, piano (Lithuania)
Premiere: 16th of August 2013 in the concert cycle "Orbitos" in Druskininkai, Lithuania



Textile_4 is based on a compound weave of two or more sets of warps or wefts, producing a double cloth.[117] The weight, luxury, and versatility of double cloth distinguish it from single weaves. Moreover, double weaves offer unique design possibilities, resulting in functional, sculptural or purely decorative works of art.[118] The fabric pattern is reversible, consisting of distinct weaves or colours,[119] and the pattern on each surface complements the opposite side.

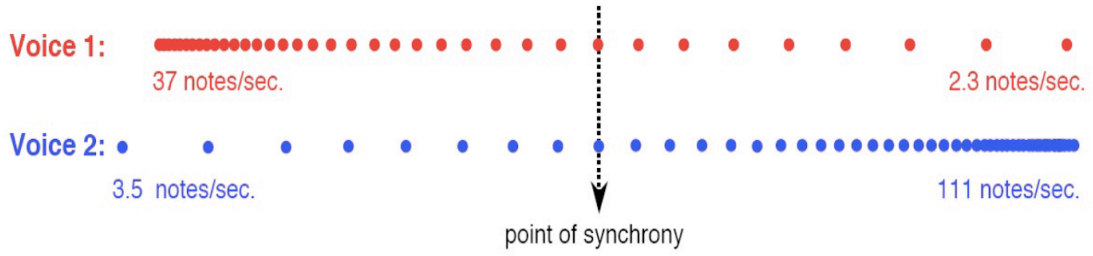
Textile_4 is the only piece in my portfolio that is based on the *double* weave. Similar to earlier pieces, such as *Textile_3*, *Habotai* or *Moorchana*, the transformation emerges from the establishment of pre-defined structures, which derive from mapping the distinct properties of the textile fabric. However, *Textile_4* represents a meditative journey exploring the analogous characteristics of double cloth and music, as the two individual layers bring about clashes of tempi and the distinct colourful interlacings generate various patterns of pitch and rhythm. Double weaves are the most complex textile fabrics that I have ever used as a main "tool" for transformation into musical language.

In order to effectively integrate predefined structures of rhythm and tempo that correspond to the structure of the double cloth, I analysed compositions which explore the interaction between these parameters through mathematical approaches. *Player Piano Studies #1–30*, (1948–1960), written by American-born Mexican composer

[117] Elena Phipps, *Looking at Textiles: A Guide to Technical Terms* (Los Angeles: J.Paul Getty Trust, 2011), p. 85.
[118] Jennifer Moore, *The Weaver's studio: Doubleweave* (Loveland: Interweave Press, 2010), p. 9.
[119] Claire Shaeffer, *Sew Any Fabric: A Quick Reference to Fabrics from A to Z* (Iola WI: Krause Publications, 2003), p. 32.

Conlon Nancarrow, redefine the act of musical composition in a technical sense.[120] Many of Nancarrow's *Studies* are strict canons which explore polyrhythms, superimpositions of tempo, and patterns of contrasting grouping. For example, in *Study No.21,* better known by the title *Canon X*, each voice is based on a melodic cycle of 54 notes, losing one note in each round (e.g. 54, 53,…3, 2, 1). In addition, the work consists of a superimposition of two voices in which the first voice progressively slows down whilst the other speeds up (see Figure 5.1).

Figure 5.1: Player Piano Study No.21 – "Canon X" (1948-60)



Canon X was a major source of inspiration for the establishment of a connection between the rhythm and tempo of two independent layers in *Textile_4*.

Textile_4 has two realisations: (A) for four prepared acoustic pianos (pianos 1 - 4), and (B) for solo prepared piano (piano 1) and live electronics (pianos 2 - 4); Both realisations are rhythmically challenging and, in order to achieve the coordination of rhythm and predefined tempo in both interpretations, separate click tracks are required for the performers. Though the two versions are based on the same mapping process, they employ different preparations of the piano(s). This particular aspect will be discussed later.

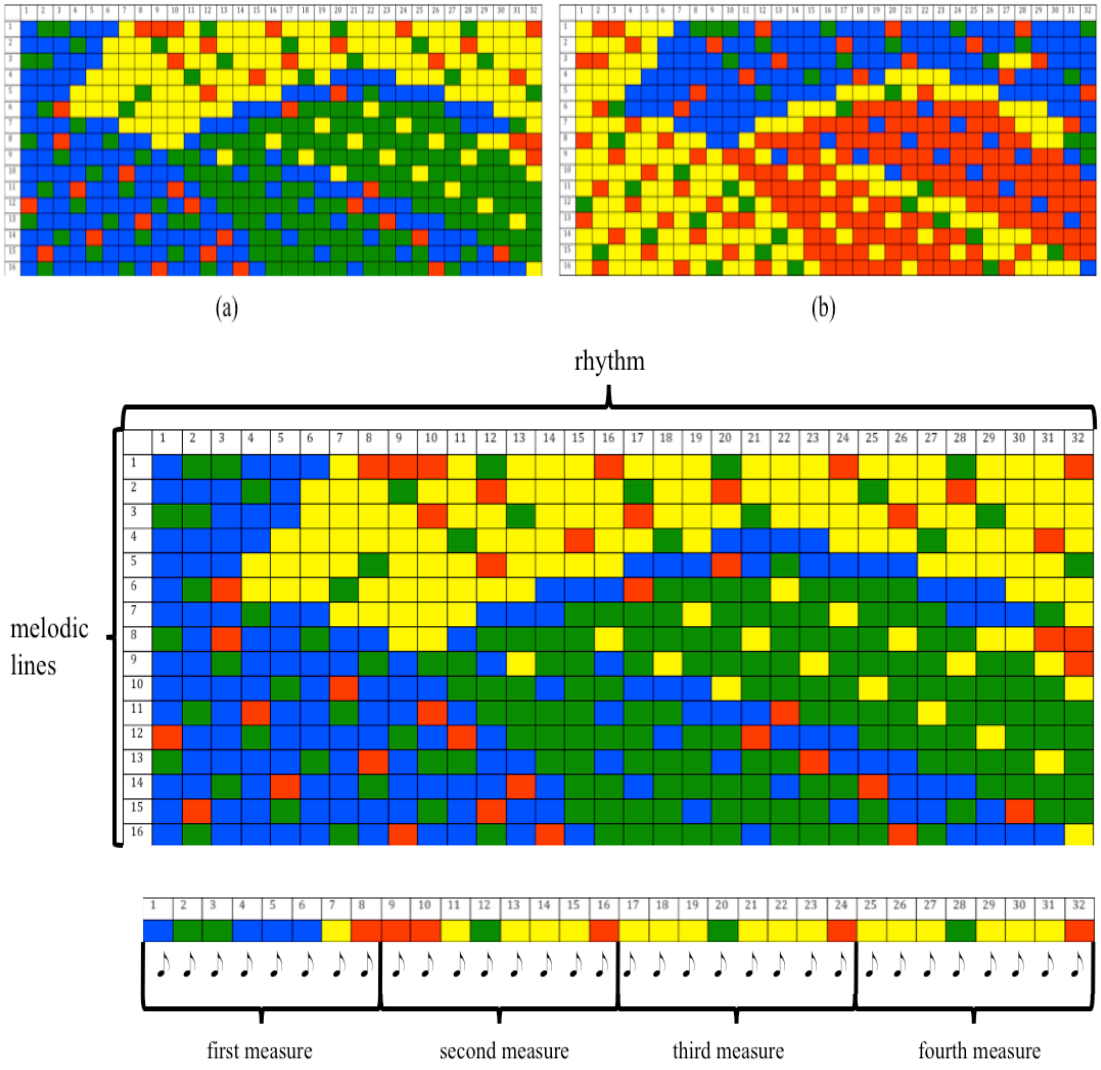
5.1 STRUCTURE

The overall structure of *Textile_4* is mapped to the physical size (length and width) of the double cloth, which consists of sixteen vertical lines and thirty-two horizontal squares on each side. The number sixteen is mapped to sixteen independent pitch melodies, while the number thirty-two is assigned to the mapping of rhythm,

[120] Kyle Gann, *The Music of Conlon Nancarrow* (Cambridge: Cambridge University Press, 1995), p xi.

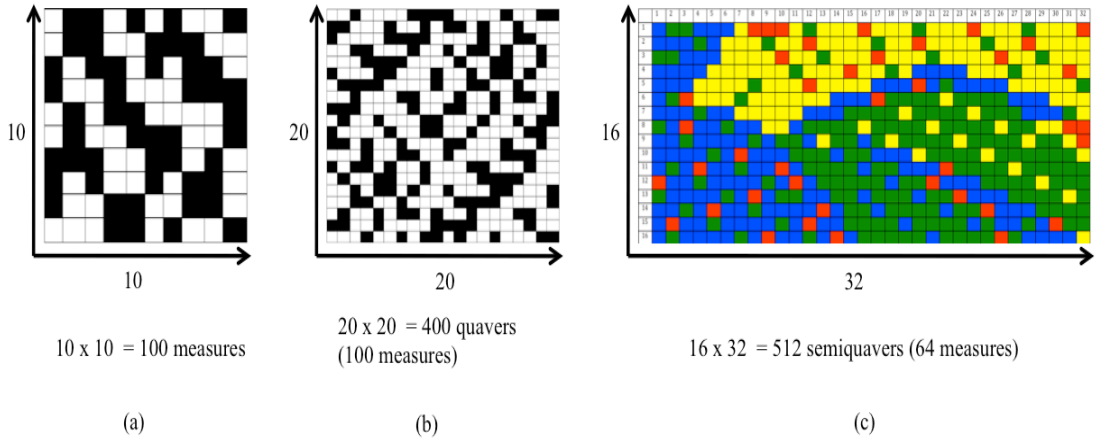
translating into thirty-two semi-quavers on every single line and, in turn, producing four measures of melodic line at each appearance (see Figure 5.2).

Figure 5.2: (a) Original side of the double weave, (b) reverse side of the double weave, (c) the mapping of the double weave into melodic patterns, followed by the example of the mapping into time duration and measures.



The structure is a straightforward transformation into musical form of the physical piece of double woven textile fabric as a whole, i.e. without separation into individual units or combination of smaller elements. This approach is similar to the compositions *Habotai* and *Moorchana*, where the structure of the overall textile pattern determines the duration of the piece (see Figure 5.3).

Figure 5.3: The overall structures of (a) Moorchana, (b) Habotai, (c) Textile_4.

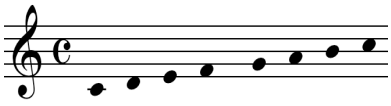


Generally speaking, in *Textile_4,* the overall structure represents the double cloth by its physical length, and its inner elements are used for the mapping of tempo shifts, piano preparation or construction of pitch patterns. The building of such a structure can be compared to a piece of visual art applying a template in which interest is provided by change of emphasis on colour and density. The fundamental intention behind the structure of *Textile_4* was to explore connections between colour and pitch, pitch and tempos, producing an effect of fluctuation.

5.2 HARMONY

The harmony of both realisations of *Textile_4* is based on the scale of the North Indian raga *Bilaval*, which is similar to the Western diatonic scale (see Figure 5.4):

Figure 5.4: The Indian raga Bilaval.

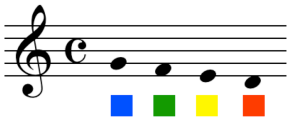


Each Indian raga has its own distinct psychological or physical effect, which relates to a colour, a mood, a metre, a deity, or one of the subtle centres (chakra-s) of the body.[121] In *Textile_4*, I chose the four pitches that correspond to the expression of

[121] Alain Daniélou, *The Ragas of Northern Indian Music* (New Delhi: Munshiram Manoharlal Publishers Pvt. Ltd, 2007), pp. 92-93.

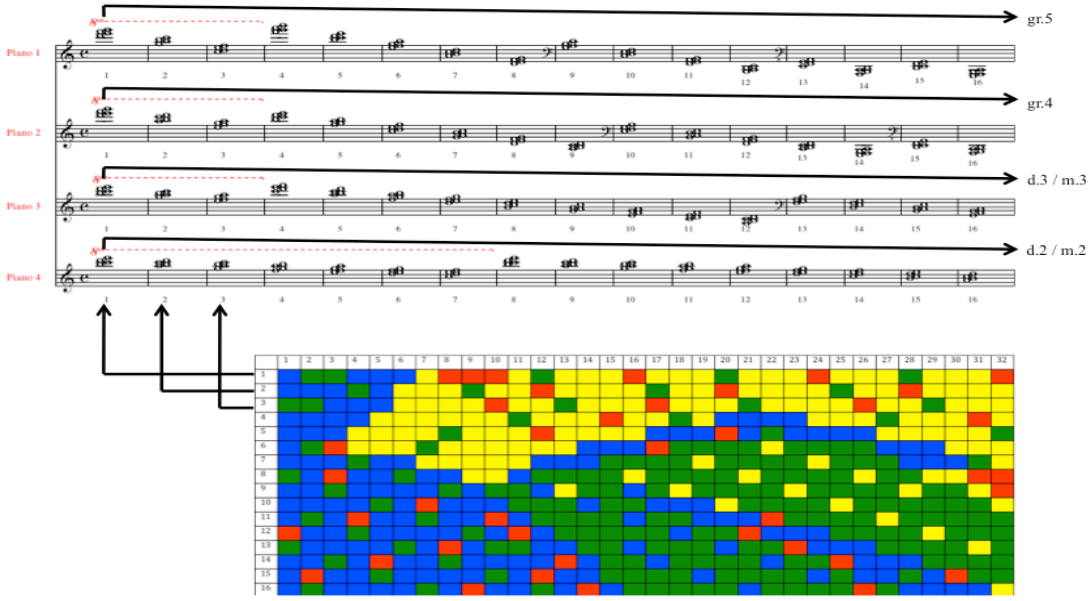
each of these notes within the *Bilaval*[122] raga. They refer to the following emotions: clearness (G), tenderness (F), happiness (E), and self-assertiveness (D). I then linked these emotions to my own interpretation of the emotions of the colours of the double cloth: blue, green, yellow, and red, respectively (see Figure 5.5).

Figure 5.5: Pitch connection to a specific colour.



These four pitches (G, F, E and D) were subsequently used in the development of the harmony. They form an initial cluster, which descends fifteen times through different transpositions, generating a total of sixteen distinct clusters for each performer. All of the performers begin with the same cluster in the highest register of the piano. However, the interval of descent of the cluster is different for each of them. Piano 1 descends each time by a perfect fifth, piano 2 descends by a perfect fourth, piano 3 by a major/minor third, and piano 4 by a major/minor second. As a result, the four layers cover starkly contrasting ranges. The clusters of pianos 1-2 cover almost the entire keyboard, while the cluster of pianos 3-4 descend only within a mere range of 2 to 3 octaves (see Figure 5.6).

Figure 5.6: Distinct transpositions for four pianos.

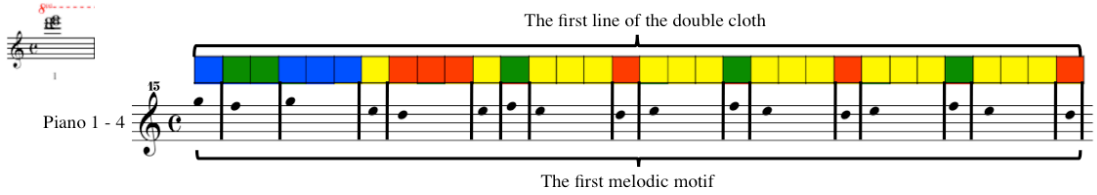


[122] Ibid., pp.190-191.

The sequence for each piano is constructed out of sixteen melodic lines, bringing about its own harmonic characteristics. Though each piano performs the same line of the double cloth, the harmony changes according to the difference in clusters.

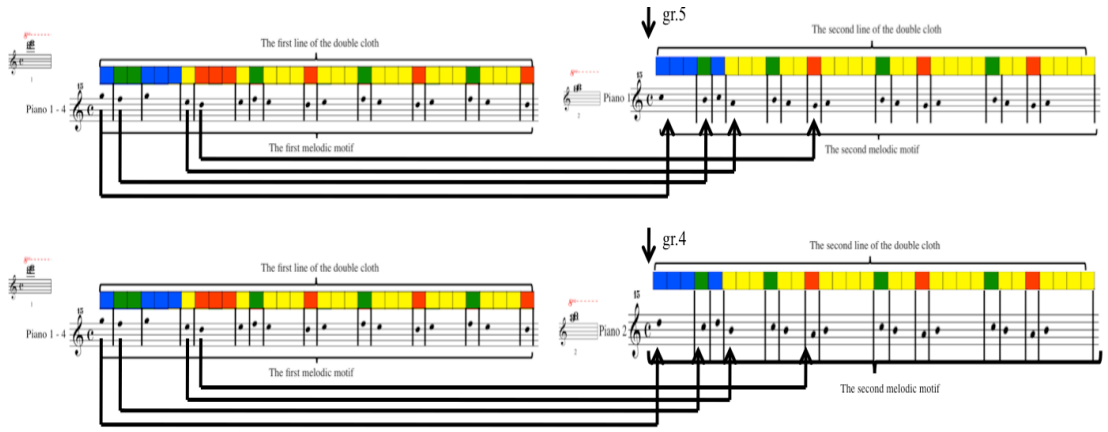
The core melodic line follows the same mapping process (blue - G, green - F, yellow - E, and red - D). In the first melodic motif, all pianos follow the same textile pattern (see Figure 5.7).

Figure 5.7: The first melodic motives for four pianos.



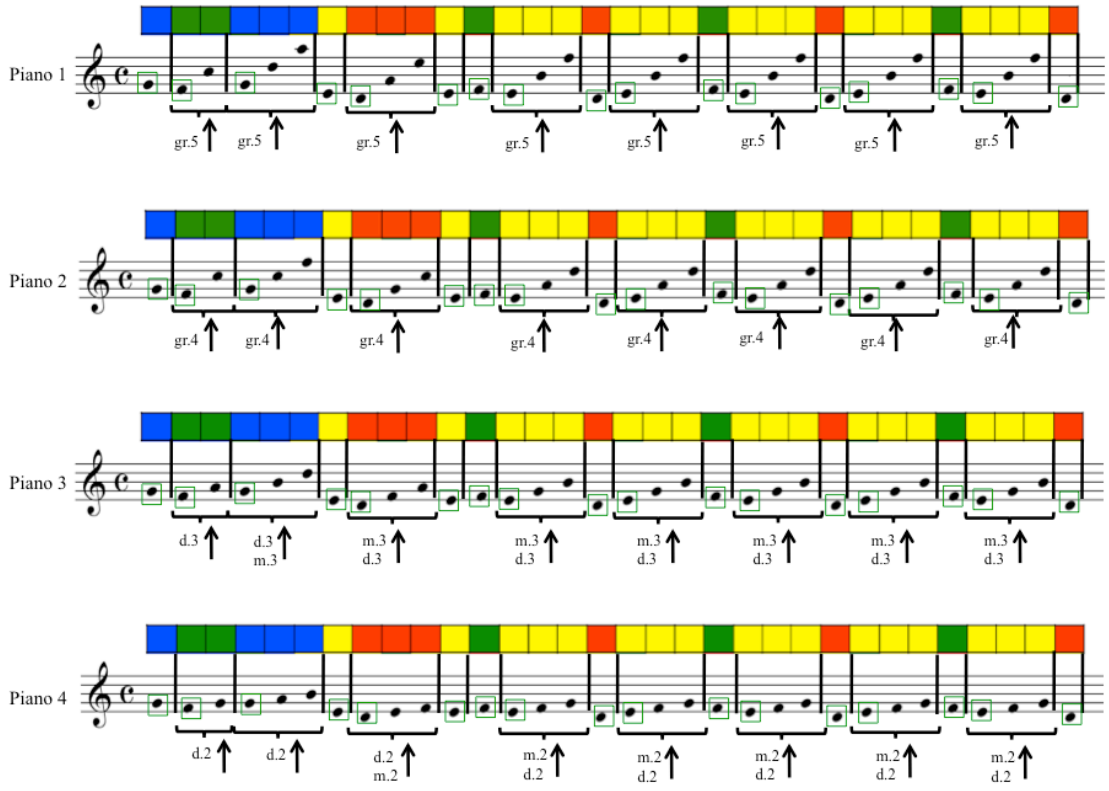
As we can see in Figure 5.8, all the piano lines of the second melodic motif are equally mapped from the second line of the double cloth. However, because of the different transposition of the cluster for each line, the notes in the motif transpose by the same interval. For example, in piano 1 the second entire cluster is transposed down by a perfect fifth, so the initial note of the second melodic motif follows the harmonic transformation by a perfect fifth from G to C. The second cluster of piano2 shifts by perfect fourth, and the second melodic motif transposes down by perfect fourth, and so on. The other melodic lines follow the same rules of transposition.

Figure 5.8: The transposition of second melodic motifs for piano1 and piano 2.



In order to create further harmonic development and differentiation between the melodic lines of each piano, a separate mapping method was used. Figure 5.9 illustrates how this was achieved. In areas of the cloth where there is more than one square of the same colour, the first square is always the original allocated pitch, e.g. blue assigned to G. Subsequently, any additional squares are assigned different pitches according to a particular mapping method. In piano 1, the interval of a descending perfect fifth is used to transpose the cluster, forming the harmony of the line. In the melodic motif, additional pitches are similarly connected to the perfect fifth. However, in order to create an opposite motion to the *descending* harmonic clusters, the additional pitches in the melodic line in piano 1 *ascend* by a perfect fifth. In the other piano parts the same principle applies, i.e. using the interval of a perfect fourth for piano 2, etc.

Figure 5.9: Four melodic lines based on the first line of the double cloth.

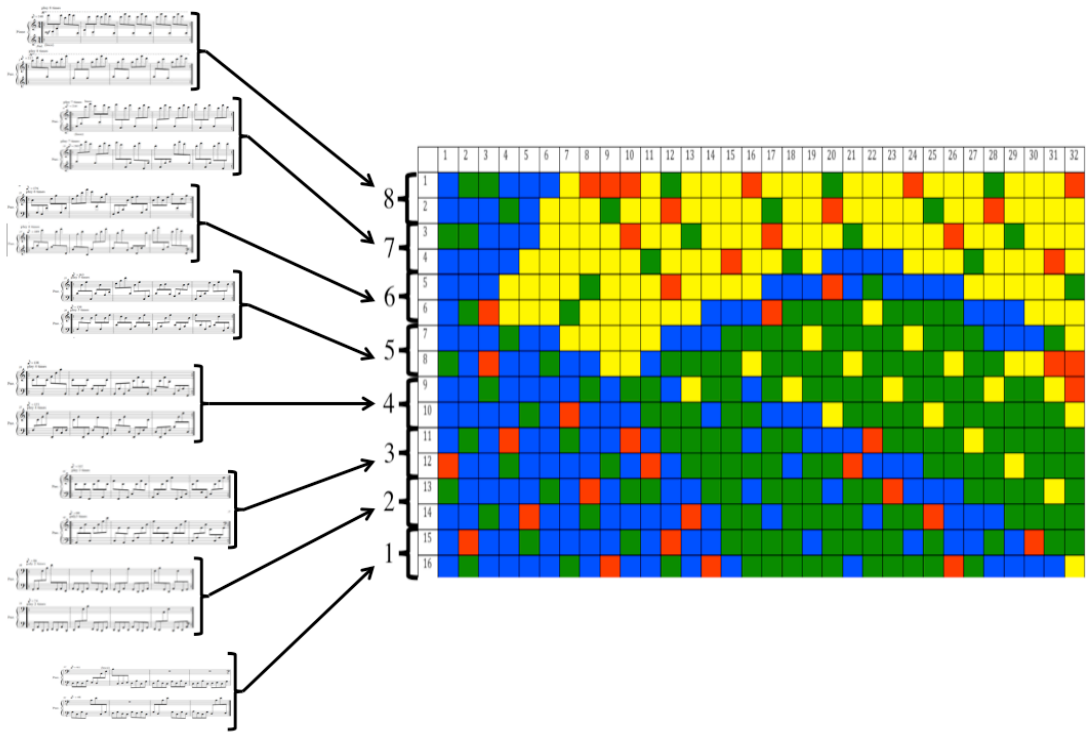


The juxtaposition of two different directions of transposition – descending for clusters, and ascending for the inner motion of melodic motifs – avoids too purposeful a motion of the overall composition in a single direction from the highest register to

the lowest: whilst the clusters descend, the ascending motion of the inner melody acts as a “counterweight”.

The varying repetitions provide each melodic line with a unique character. Each line is assigned a number of repetitions. The amount of repetitions reduces gradually throughout the double weave, i.e. line 1 and 2 are performed 8 times, whereas the number of repetitions in lines 3 and 4 is only 7 times, and so on (see Figure 5.10).

Figure 5.10: Plan of repetition for Textile_4.



Generally speaking, each piano, through its individual melodic lines and unique harmonies, generates a dense soundscape by contributing to the overall polyphonic structure. The appearance of the double cloth, and the amount of each colour within it, form the sixteen clusters and sixteen melodic motives, which are transposed in different directions, creating the swirling polyphony which resembles a 'raindrop' effect.

5.3 TEMPO

Tempo is an essential component in *Textile_4*, as it torques the otherwise regular and repetitive rhythm of the sixteen melodic motifs. The connection between pitch and rhythm is similar to Henry Cowell's approach in his *New Musical Resources* (1930), in which intervals and cross-rhythms rely on the same fundamental division.[123] In his compositions *Quartet Romantic* (1915-17) and *Quartet Euphometric* (1916-19), Cowell maps the pitches of the overtone series to both rhythmic and metrical values. For example, the fourth, fifth and sixth partials of a given fundamental are used to form a triad and these proportions are also used to generate cross-rhythms of 4:5:6.[124] In *Textile_4* I was inspired to apply Cowell's approach, but in relation to tempi, linking the intervals of transposition to the deceleration process of the four piano lines.

As mentioned above, the harmonic plan is developed from four sequences of transposed clusters, in which each harmonic interval is related to the transposition of the cluster and to the inner motion of the melody. The interval of descending harmonic transposition for each of the four piano lines is directly related to the proportion of tempo deceleration applied to each of these lines. For example, as the melodic line of piano 1 descends by a perfect fifth, the tempo decreases fivefold; the melodic line of piano 2 falls by a perfect fourth and therefore the tempo becomes four times slower, and so on (see Table 5.1).

Table 5.1: Connection between distinct transpositions and tempo.

Instrument	Transposition	Tempo division	Section 1	Section 16
Piano 1	A perfect fifth	240 / 5	240 bpm	48 bpm
Piano 2	A perfect fourth	240 / 4	240 bpm	60 bpm
Piano 3	A third	240 / 3	240 bpm	80 bpm
Piano 4	A second	240 / 2	240 bpm	120 bpm

[123] Kyle Gann, *The music of Conlon Nancarrow* (Cambridge: Cambridge University Press, 1995), p. 5.
[124] Nicholas Cook and Anthony Pople, *The Cambridge History of Twentieth-Century Music* (Cambridge: Cambridge University Press, 2004), p. 218.

The independent deceleration of the four voices makes the presence of click tracks essential in ensuring a smooth transition between tempi (see Table 5.2).

Table 5.2: Gradual deceleration from section 1 to 16 for four pianos.

	A process of tempo deceleration through Section 1 to 16 (bpm)															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Piano 1	240	227	214	202	189	176	163	150	138	125	112	99	86	74	61	48
Piano 2	240	228	216	204	192	180	168	156	144	132	120	108	96	84	72	60
Piano 3	240	229	219	208	197	187	176	165	155	144	133	123	112	101	91	80
Piano 4	240	232	224	216	208	200	192	184	176	168	160	152	144	136	128	120

Independent tempo modulations bring about variations in contrast towards the regularity of the rhythmical patterns. Alongside the melodic motifs and harmonies, they contribute to the interwoven polyphonic texture and consequently form one of the most vital ingredients of the work as a whole.

5.4 PIANO PREPARATION:

The main sources of inspiration for the piano preparation in *Textile_4* were John Cage's *Bacchanale* (1940) and *Sonatas and Interludes* (1946-1948).[125] Cage modified the sound of the piano in many different ways using a wide variety of objects of varying materials and sizes.[126] I researched two options for piano preparation: (1) approximate piano sound alteration, (2) precisely calculated tuning.

(1) The piano preparation for the version for four pianos is created using various objects made from different materials, following the colour scheme of textile pattern. As can be seen from the Table 5.3, each colour of the textile pattern is matched to the distinct material. For example, wood is mapped to green, and plastic is assigned to yellow.

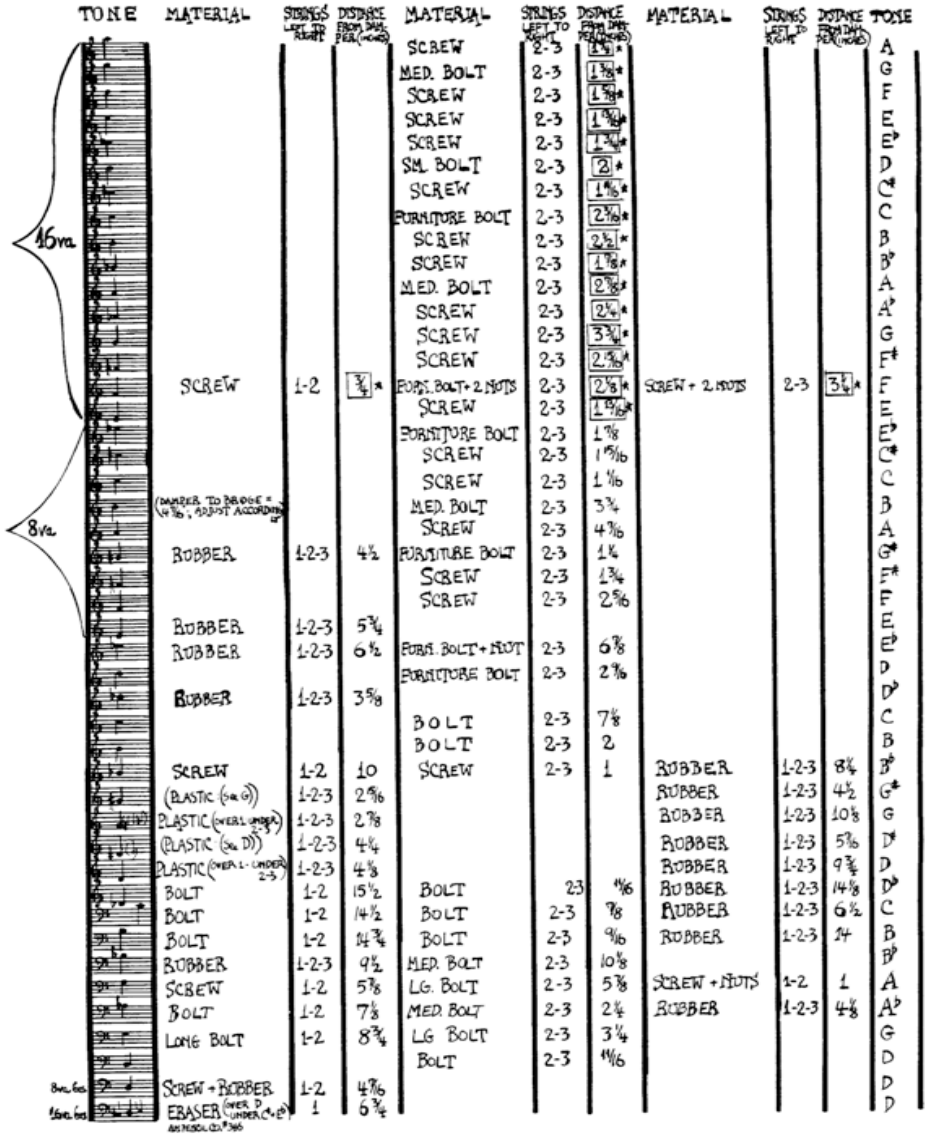
[125] James Pritchett, *The Music of John Cage* (Cambridge: Cambridge University Press, 1996), p. 22.
[126] Ibid., p. 23.

Table 5.3: Connection between colour and material of prepared object.

Colour				
Preparation material	Wood	Plastic	Rubber	Metal

Although the preparation material is predetermined, the performers have some choice in the selection of the objects and their sizes; for example, each player can use different sizes of metal screws, different sizes of rubbers, and so on. It is similar to Cage's idea of the piano preparation in piece *Sonatas and Interludes* (see Figure 5.11).

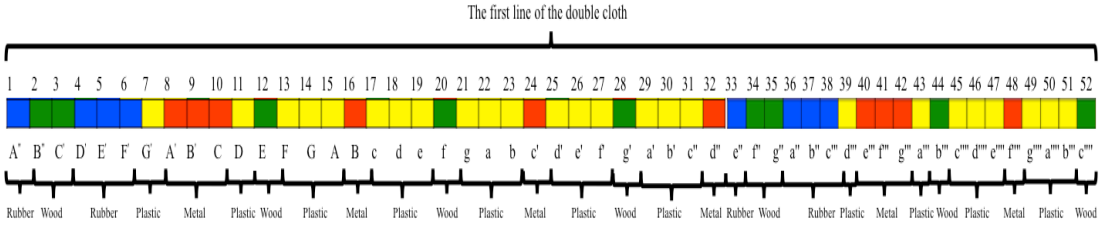
Figure 5.11: Instructions for the piano preparation of Cage's Sonatas and Interludes.[127]



[127] http://www.phy.duke.edu/~dtl/136126/restrict/after/14/piano/eccent.html (last accessed 24 December 2015)

In *Textile_4*, each performer can choose any line of double cloth in order to generate a system of objects for the preparation, following the colour scheme. Figure 5.12 illustrates the preparation of fifty-two white keys, which are mapped to colour scheme, from the lowest to the highest note. The pitch notation is based on Helmholtz's notation system.[128]

Figure 5.12: First line of textile pattern as a colour scheme for identification of distinct materials for prepared piano.



Each performer has a certain amount of freedom with regard to preparing the piano, following his/her own imagination and creativity, so that their individual choices will lead to different atmospheres.

(2) In the second version, for solo piano and live electronics, the electroacoustic materials were composed using sounds generated by two patches of the MAX/MSP program. The patches contain a number of controllers for the tempo, for individual pitches (green, yellow, red, and blue colours), and randomly perform the sixteen melodic lines of both sides of the double cloth independently, creating a dialogue between natural organic (piano) and unnatural mechanic sounds (MAX/MSP program). Due to the random selection of the sixteen melodic lines from both sides of the double cloth, the final result produces organic sounds in non-repetitive modes (see Figure 5.13 and Figure 5.14).

[128] Murray Campbell, Clive A. Greated, and Arnold Myers, *Musical Instruments: History, Technology, and Performance of Instruments of Western Music* (Oxford: Oxford University Press, 2004), Appendix I.

Figure 5.13: Midi track of the original of the double cloth by MAX/MSP

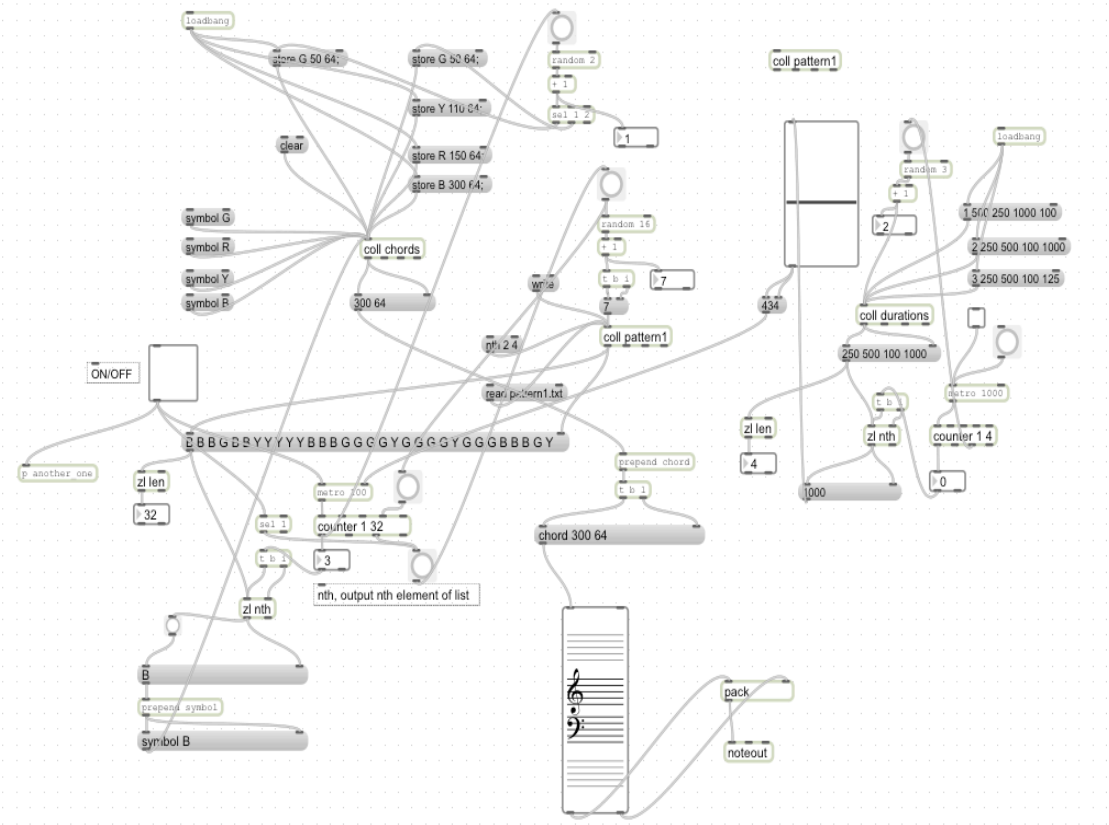
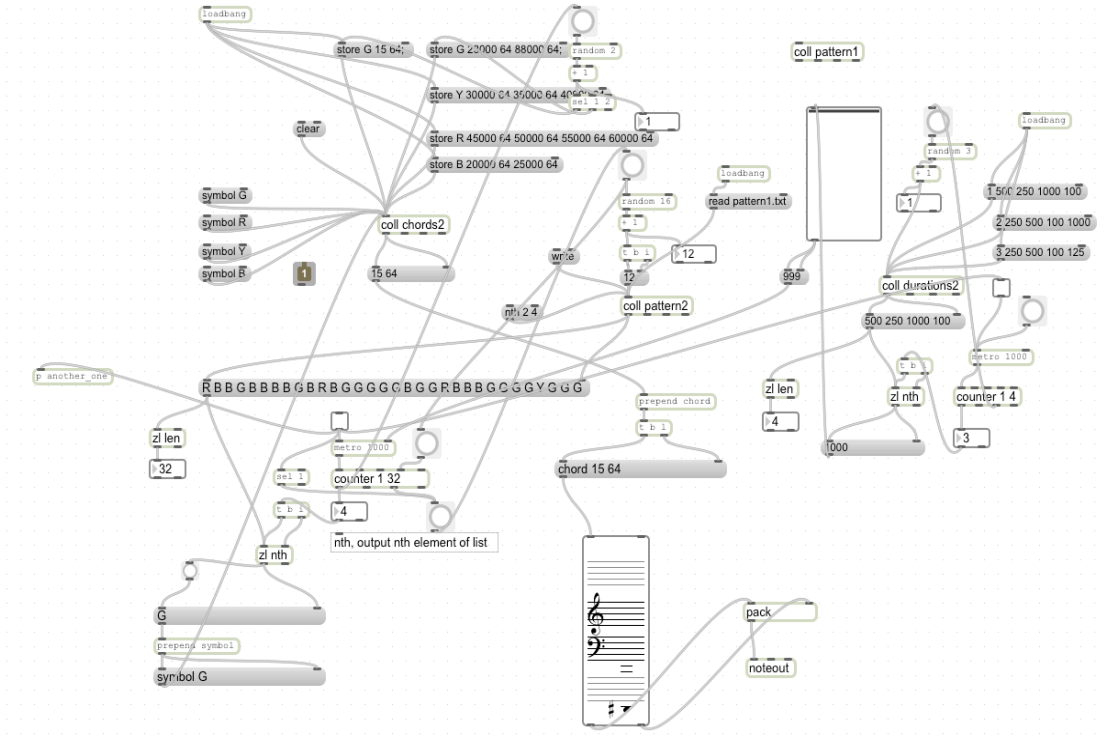
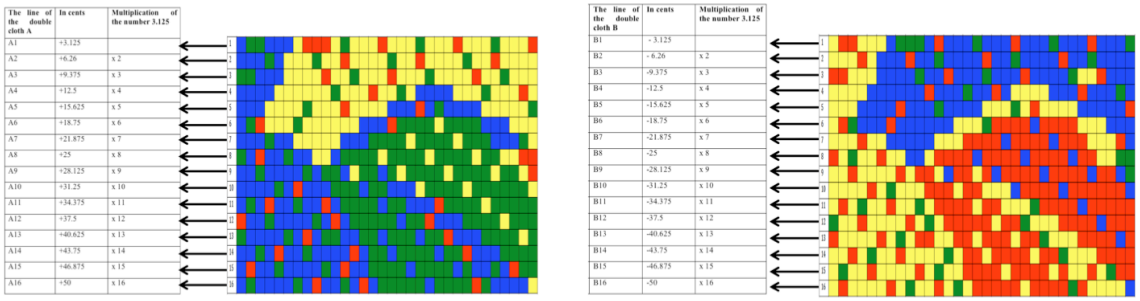


Figure 5.14: Midi track of the reverse side of the double cloth by MAX/MSP



Each pitch of a melodic line of live electronic sounds is part of a precisely constructed tuning system, which can only be generated and performed by a computer program. Half tones were meticulously calculated and divided into sixteen steps, whereby the first melodic motif A1 (original side) is detuned by a rising proportion of 3.125 cent, and the first melodic motif B1 (reverse side) is lowered by 3.125 cent. The second melodic motif A2 rises by the 6.25 (multiplication of the number 3.125), and the second melodic motif B2 is lowered by 6.25. The number 3.125 is tripled for the third melodic motif for both sides, and so on (see Table 4). Each pitch of the melodic motif in each piano transforms electronically, bringing about a proliferation of microtonal pitches (see Figure 5.15).

Figure 5.15: System of different tuning for (a) A side- original, and (b) for side B- reverse.



(a) (b)

The combination of tuning and piano preparation produces sounds that are complex, inharmonic, microtonal and which emphasize the sound textures throughout the piece as a whole.

5.5 SUMMARY

Textile_4 explores the organic development of "colourful sound" patterns through four melodic motifs derived from the appearance of the double cloth. The rhythmic pattern is based on the constant movement of quavers, which is deconstructed by decelerating tempos, producing an overlapping '*quasi*- diatonic' polyphony.

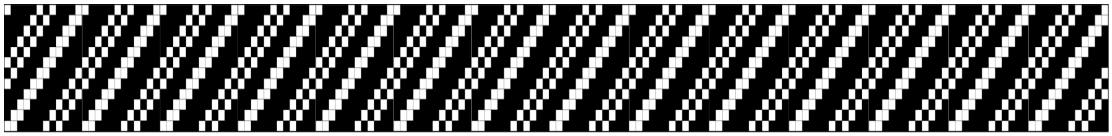
As in *Habotai* and *Moorchana*, the structure of the textile pattern of *Textile_4* remains unmodified, serving as the concept for the development of pitch, tempo and

colours. The structure of the sixteen melodic lines derives from mapping the sixteen lines of the double weave, following the connection between sounds and colours. The mapping process relies on the same rules for both versions of the composition. The term “colourful sound” is relevant in describing this work, as it is a response to the musical and textural visuality through the assignment of the pitch to a specific colour.

The pitch motifs and deceleration of tempo diminishes the sense of repetition, making every measure sound fresh and intuitively mismatched. The piano preparation plan provides an improvisational aspect to the piece, providing more freedom of interpretation. The alternative, electronic preparation plan emphasizes the timbre of each piano through microtonality, creating an inharmonic sonorous soundscape.

6. NIGAMAGAMINI

Nigamagamini (2014), for solo bass flute and pre-recorded electronics
Performed by flutist Richard Craig at Klang festival, on 21st of July 2014, at the Music Department of Durham University
Duration: approximately 10 minutes



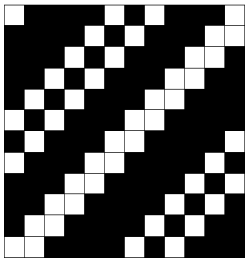
Nigamagamini played a crucial role in the development of my mappings of textile patterns into the sonic experience, through the exploration of a distinct approach to the establishment of the structure, involving musical characteristics which I had not explored before.

Firstly, the composition is based on the idea of 'open form', which was founded by American avant-garde composer Earle Brown, who was himself inspired by shifting perspectives of Alexander Calder's mobiles' and by multidirectional canvases of Jackson Pollock.[129] I was fascinated of Brown's idea of creating a mobile situation in a piece of music by composing with an interchangeable palette of sound events.[130] A representative piece by Brown where he explored these ideas is *Twenty-Five Pages* (1953) for one or twenty-four pianos.[131] Similarly to *Twenty-Five Pages*, in *Nigamagamini* the performer has the choice of playing the sound events in any order. The differences between these works are that the duration of a performance of *Twenty-Five Pages* can vary between eight and twenty-five minutes, while *Nigamagamini* has a predefined duration. Moreover, *Twenty-Five Pages* has more mobile elements, such as page sequence and inversion, clef disposition and duration, guaranteeing that no performance is ever likely to be identical, while *Nigamaganimi* has a much more defined structure and time scale, in which the performance has fewer options and a more controlled approach to spontaneity.

[129] http://www.earle-brown.org/works/view/53 (last accessed 19 June 2015).
[130] Roland Jackson, *Performance Practice*: *A Dictionary-Guide for Musicians* (New York: Routledge/Taylor & Francis Group, 2005), p. 54.
[131] Piotr Grella-Mozejko, 'Earle Brown - Form, Notation, Text', *Contemporary Music Review*, 3/4, 26, (2007), 437 – 469, (p. 453).

The structure of Nogamaganimi is based on the structure of the textile pattern (see Figure 6.1).

Figure 6.1: The textile pattern for Nigamagamini.



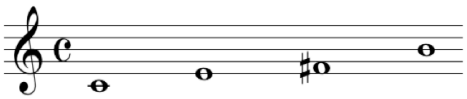
Secondly, *Nigamagamini* explores the interaction between the performer and the pre-recorded material, which is realized by sound spatialisation using the 8.1 system. Moreover, in a similar method to that used in the piece *Textile_4*, *Nigamagamini* employs pre-recorded electronics supporting a continuous interwoven sonic entity of gradual changes of timbre. My intention was to create a monolithic soundscape, which is derived from the same harmonic material, but interpreted by different flutists who will weave a complex mosaic of distinct sound into a single atmospheric continuum. This idea also resembles the performance of Carnatic music, being a composition that includes elements of improvisation.[132] In addition, *Nigamagamini* is scored for solo bass flute, and the origin of the flute in Carnatic music, according to Madhumita Dutta, was influenced by a study of various sound effects, which were produced when air passed through a hollow piece of bamboo.[133] In Indian music, the flute has many names, such as *bansuri*, *vansh* or *venu*, and the Carnatic flute is smaller than the ordinary flute with its nine openings.[134]

Thirdly, in contrast to previously discussed pieces such as *Textile_3*, *Habotai*, and *Moorchana*, whose harmonic plans were based on the North Indian melodic modes (ragas), the harmony of *Nigamagamini* derives from the Carnatic raga of

[132] Gopala K. Koduri, Marius Miron, Julian Serra, and Xavier Serra, 'Computational approaches for the understanding of melody in Carnatic music' *International Society for Music Information Retrieval*, 2011), p. 263.
[133] Madhumita Dutta, *Let's Know Music and Musical Instruments of India* (London: ibs Books, 2008), p. 10.
[134] Ardal Powell, *The Flute* (New Haven: Yale University Press, 2002), p. 11.

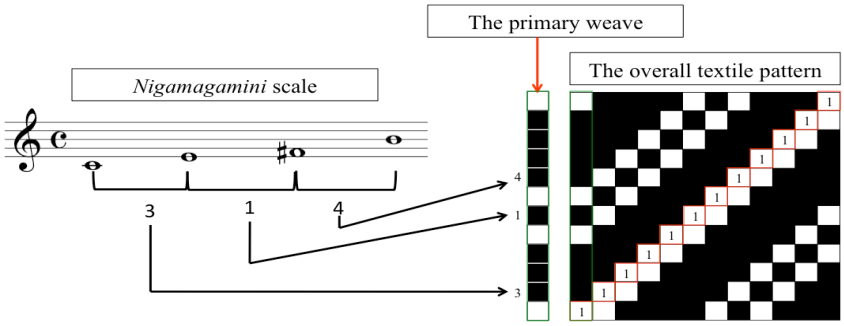
southern India, the 4th *rāga* in the 4th *chakra Veda,*[135] its mnemonic name being *Kharaharapriya,*[136] which has the same title as my work. Furthermore, I was inspired by the evocation of the natural world in Carnatic music, which is often imitative of the sounds of animals and birds:[137] for example *Sa* is the note of the peacock, *Ri* belongs to the bird of the rainy season *chataka*, *Ga* resembles goat, *Ma* belongs to crane, *Pa* derives from the sound of the cuckoo, *Dha* is a frog, and *Ni* means an elephant.[138] The harmony of *Nigamagamini* is built on four pitches: C, E, F# and B (see Figure 6.2).

Figure 6.2: The Nigamagamini mode (raga).



The derivation of the primary weave is based on the *differences* between the pitches of the raga *Nigamanimi*, intervals which are mapped onto the exact number of black squares, which are then placed vertically from the bottom to top. My knowledge of textile engineering defines the number of white squares in order to emphasize the textile pattern, which is marked in the green border. The overall textile pattern is based on shifting the primary weave by one step (see Figure 6.3).

Figure 6.3: The derivation of the primary and overall textile pattern from the Nigamagamini scale.



[135] T. M. Krishna, Vignesh Ishwar, 'Carnatic music: Svara, Gamaka, Motif and Raga identity', *2nd CompMusic Workshop*, Universitat Pompeu Fabra, (2013), p. 12.
[136] P.N. Sundaresan, ed., 'Sruti', *South Indian Classical Music and Dance magazine,*1 (1983) p. 51.
[137] Judith Becker, 'Is Western Art Music Superior?', *The Musical Quarterly*, 1, 72 (1986), 341-359.
[138] Arthur Henry Fox-Strangways, *The Music of Hindostan* (New Delhi: Mittal Publications, 1967), p. 149.

Finally, *Nigamagamini* explores breathing, which is the most important physiological aspect of sound production on a wind instrument. Woodwind or brass players have physiological limitations for breathing, in spite of the fact that nowadays many can breathe circularly.[139] The physical and physiological features associated with playing wind instruments result in the fact that lower sounds require more air in order to produce notes in comparison with the high pitches.[140] My intention was to explore the compositional use of a single breath and its limitations associated with any pitch in any diapason.

I developed a particular transformation of the textile patterns into musical language that enabled me to specify more general aspects of a musical design, such as density, register and timbre, whilst leaving more detailed choices of specific tones, rhythms and colours to be determined spontaneously by the player during each performance.

Nigamagamini is an example of a dense, slow-moving kaleidoscopic motion, which generates a feeling of space and musical time. The open form of the composition provides a lot of freedom for the performer to reconstruct a piece, by exploring different timbral repetitions, which are linked to the musical traditions of Carnatic music.

6.1 STRUCTURE

The overall structure of the composition features seven sections, which are mapped from the division of the primary weave. However, the number seven has a significant meaning in Carnatic music, where the time measure (tala) depends on the seven basic tala patterns, known as seven *suladi talas.*[141] Each tala consists of one, two or three different beat units: short, medium, and long respectively (see Figure 6.4).

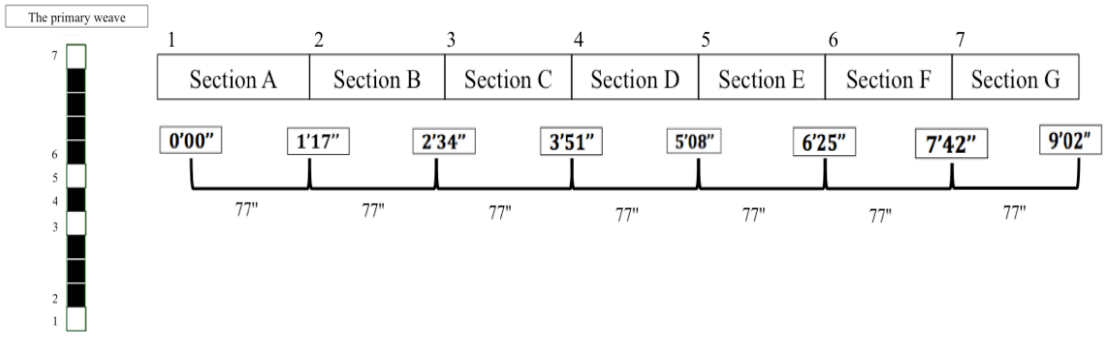
[139] Nancy Toff, *The Flute Book: A Complete Guide for Students and Performers* (Oxford: Oxford University Press, 2012), p. 90.
[140] Rusty L. Myers, *The Basics of Physics* (Westport: Greenwood Press, 2006), pp. 136-141.
[141] Charles Capwell, "South Asia", in *The New Harvard Dictionary of Music*, ed. by Don Michael Randel (Cambridge, Mass., and London: Harvard University Press, 1986), p. 816.

Figure 6.4: The seven suladi talas.[142]

dhruva-tāla—long, medium, long, long
maṭhya-tāla—long, medium, long
rūpaka-tāla—medium, long
jhampā-tāla—long, short, medium
tripuṭa-tāla—long, medium, medium
āṭa-tāla—long, long, medium, medium
eka-tāla—only a single long.

My intention was to use the number seven not only to indicate the seven distinct sections, but also to define the durations of each section, by symbolically combining two number sevens in order to get seventy-seven seconds for each section (see Figure 6.5).

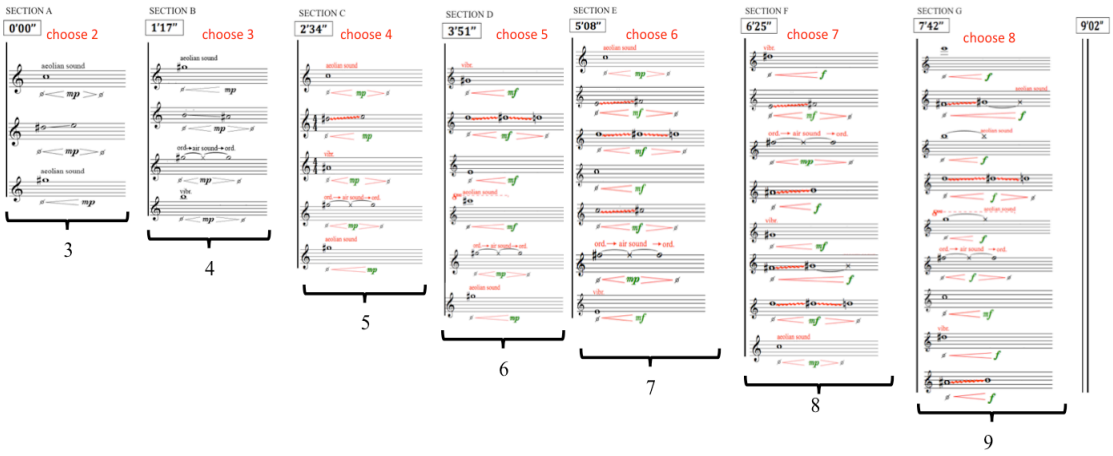
Figure 6.5: The division of the overall structure into seven sections.



Furthermore, each section consists of different amounts of independent sound events, which gradually expand and reappear in following sections: for example, section A consists of three sound events; the section B has four options, and so on. Moreover, the performer has the freedom to choose different modes, which are defined in each section. The musical material becomes gradually denser and more intense due to the increasing amount of available modes for combination in subsequent sections. For example, in section A the performer can play two sound events during seventy-seven seconds, while in section C, the performer plays three sound events, with fewer pauses in comparison with section A (see Figure 6.6).

[142] Kathleen Kuiper, ed., *The Culture of India* (New York: Britannica Educational Publishing, 1st edition, 2011), p. 258.

Figure 6.6: The available choices of different sound events for each section.



The overall structure consists of the seven sections, each lasting seventy-seven seconds, which enables the performer to improvise and recreate musical material by the choice of different sound events. Generally speaking, the open form of *Nigamagamini* provides a renewing process, achieved through timbral variations, which constantly grow into a single homogenous soundscape.

6.2 HARMONY

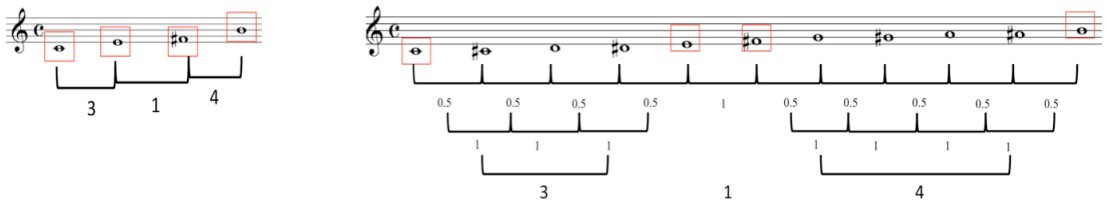
The most striking aspect of Carnatic music for me is the beauty of the raga's melodic outline and its ornamentation, in which the distinct melodic contour, relying on exactly the same set of pitches, can result two different ragas[143] within two contrasting emotions: for example, if the phrase begins *Ni2 Ni2 Ni2* with a minimal *Kampita gamakaas*, it will resemble raga *Surati*, though the same phrase with exactly same pitches can appear in raga *Ritigaula*. The same phrase in the two distinct ragas determines the cognitive association between the svara, phase and the raga.[144]

My intention was to combine two harmonic scales, both based on raga *Nigamagamini*, in order to generate two different harmonic layers: for example, the pitch material of the pre-recorded electronics emphasises the four pitches of the scale

[143] Gopala K. Koduri, Marius Miron, Julian Serra, and Xavier Serra, 'Computational approaches for the understanding of melody in Carnatic music' *International Society for Music Information Retrieval*, (2011), p. 272.
[144] T. M. Krishna, Vignesh Ishwar, 'Carnatic music: Svara, Gamaka, Motif and Raga identity', *2nd CompMusic Workshop*, Universitat Pompeu Fabra, (2013), p. 18.

Nigamagamini. The second harmonic plan is generated for solo flute is based on an extended scale of raga *Nigamagamini*. It consists of eleven pitches, which are developed to produce most of the chromatic colours that feature throughout the entire piece (see Figure 6.7).

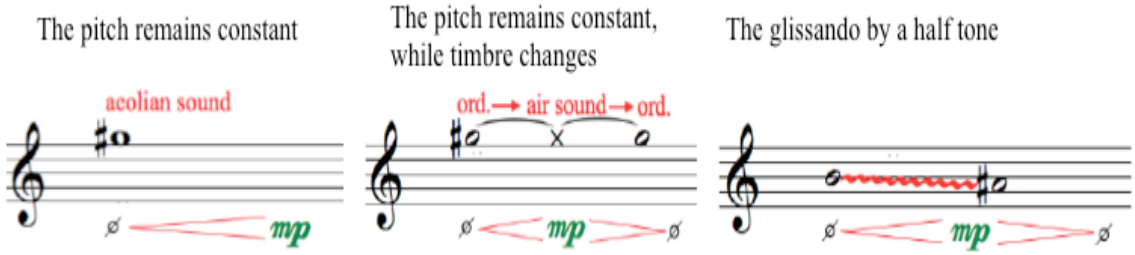
Figure 6.7: (a) A scale for pre-recorded electronics, (b) an extended scale for solo flute.



(a) (b)

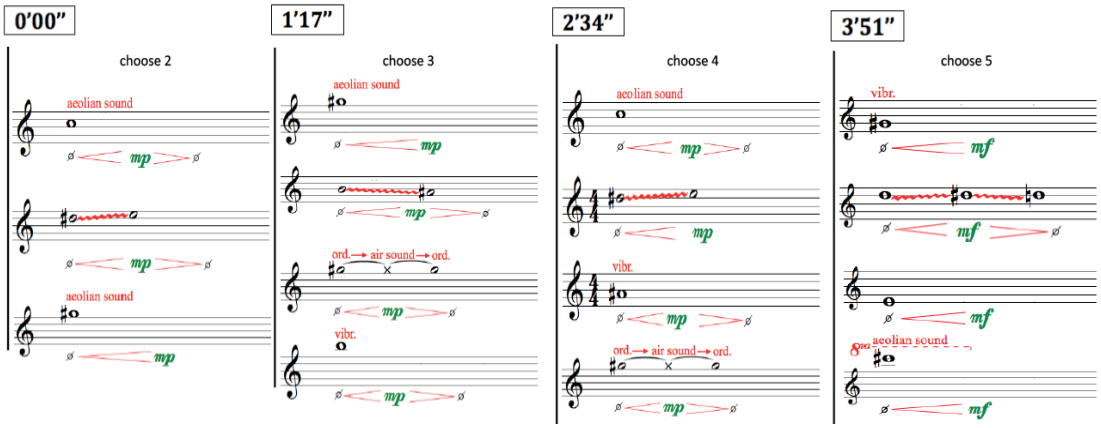
Moreover, there is no sense of directional harmony, melodic development or teleology. Rather, the pitch materials produce a number of sound events, which are developed independently. Mostly the pitches remain unchanged, in spite of their timbral transformations, or they are transposed up or down by a semitone (see Figure 6.8).

Figure 6.8: The different pitch variations throughout the piece.



Each sound event is an extension of the principle of ornamentation, which is present throughout the piece, and has been deliberately taken from Carnatic music. Each section contains a series of independent sound events based on sustained durations, which are woven into the harmonic texture. From this point onwards the music proceeds in a series of frozen "images", featuring static notes with long durations (see Figure 6.9).

Figure 6.9: The example of independent sound event for four sections.



One of the most potent aspects of the *Nigamagamini* raga is its tendency to produce complex ornamentation figurations, as the scale is gradually varied and developed throughout the entire piece. Moreover, the choice of the individual pitches and overlapping harmonic structures gives the work an elegiac, brooding quality, quite similar to the mood of a piece of 'ambient music',[145] which also often deals with atmosphere and harmonic stasis.

Raga *Nigamagamini* provides a framework upon which both the structure and the harmony of the piece are based, defining the consistent stylistic and emotional character of the entire work. Furthermore, the initial pitch considerations become the fundamental and unifying determinants on the overall harmonic/dramatic effects of the solo bass flute and pre-recorded electronics.

6.3 TIMBRE

Timbre, more so than harmony, is where the structural and expressive focus of this piece lies. I have aimed to create a gradual shifting development of timbres over the course of the piece. My intention was to incorporate some metamorphosis of characteristics of Carnatic music, which generate a similar atmosphere through the various timbres in the composition *Nigamagamini*.

[145] Paul Roquet, 'Ambient Landscapes from Brian Eno to Tetsu Inoue', *Journal of Popular Music Studies*, 21, 4 (2009), 364-383, (p.364).

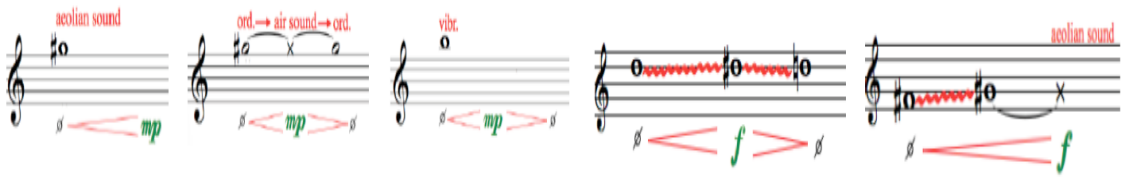
The construction of timbre is based on an exploration of the forms of pitch movements called *gamakaas*, which are an essential feature of Carnatic music: for example, a sliding movement from the one note to another or a vibrato are examples of *gamakaas*.[146] *Gamakaas* are not just decorative items or embellishments, but essential structural constituents of raga.[147]

I have used various timbres, which not only re-create but also reflect the approach of *gamakaas*. The list below indicates specific timbres, which were used in the piece *Nigamagamini*:

1. *Aeolian sound* which produces a breath sound, but with a precise pitch.
2. *Whistle tone* used for high notes in order to achieve a transparent sound.
3. Vibrato which creates a slow modulation of the same pitch.
4. Trills are used for specific pitches only.
5. Natural harmonics.
6. From air to pitched note and backwards.
7. Glissando creating a smooth microtronal transition between two pitches.

There is no defined order for the appearance of specific timbres in each section. My intention was to capture the essential image of the title, where the harmonic and timbral moods are unified in spite of surface differences between each performance. However, the development of timbre is extended to include a transformation from one timbre to another in one sound event, which gradually begins to permeate the flute texture, heightening the expressive tension (see Figure 6.10).

Figure 6.10: The development of timbre throughout the piece.



[146] Gopala K. Koduri, Marius Miron, Julian Serra, and Xavier Serra, 'Computational approaches for the understanding of melody in Carnatic music' *International Society for Music Information Retrieval*, (2011), p. 266.
[147] Gopala K. Koduri, Sankalp Gulati, Preeti Rao, Xavier Serra, 'Rāga Recognition based on Pitch Distribution Methods' *Journal of New Music Research*, 4, 41 (2012), 337-350, (p. 339).

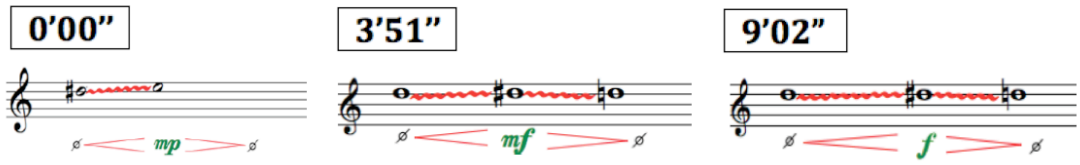
The timbral variations used in this piece were deliberately designed to evoke an 'ambient'[148] effect, which emphasises the emotion of the work.

6.4 RHYTHM / DYNAMICS

Nigamagamini is the only piece in my portfolio, where my intention was to avoid any sense of metrical strictness or defined pulse. Moreover, there is no measured time, which has a close relationship to the textile pattern. The rhythm is based on long-duration notes, where the division of time is based on intuitive decision making, in order to let the performer to concentrate on a quality of different timbres.

Throughout the entire piece, the development of dynamics is achieved by creating a different and augmented crescendo motion for each individual motif: for example, at the beginning of the piece the dynamic of the motif goes from *pp* to *mp*, in the middle section it goes from *pp* to *mf,* and at the end it goes from *pp* to *f* (see Figure 6.11).

Figure 6.11: The development of dynamics throughout the piece.



6.5 SOUND SPATIALISATION

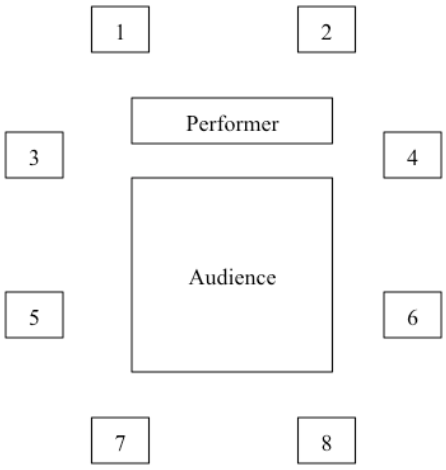
The pre-recorded electronics were built on the same harmonic material as the solo bass flute part. Four different flutists were asked to record their own interpretations for five minutes, and then send their audio recordings to me, which were re-created to drone tones and different timbres using the music software package *Logic Pro*. Over the course of the piece, these drones combine to form expanding textures of sound and timbre, which gradually interweave into one massive textural pattern.

[148] Martha M. Whitehouse, 'Sonic Morphology: Aesthetic Dimensional Auditory Spatial Awareness' (PhD Thesis, Union Institute & University Cincinnati, Ohio, 2007), p. 39.

The pre-recorded electronics involve a simple canonic process. The principal "voice" in this canon is a solo flute, after which other pre-recorded flutes overlap in different ways and individual sound events provide elaborate possibilities for ornamentation. This makes the texture seem even more static and expansive, creating a decorative and atmospheric motion.

During the performance, the pre-recorded material (three additional interpretations) is diffused across an eight-channel surround system, in which all four versions are spatialized and played across different loudspeakers: for example, the speakers 1 & 8 are assigned to the solo performer, speakers 2 & 7 are assigned to the first interpretation, speakers 3 & 6 are assigned to the second interpretation, and speakers 4 & 5 are assigned to the third and fourth interpretations. Special care has to be taken to achieve an even balance between the live amplified bass flute and the pre-recorded materials. The sound spatialisation around the audience allows "voices" to appear from many directions. The speaker configuration is shown below in Figure 6.12.

Figure 6.12: Sound spatialisation for Nigamagamini.



The sound spatialisation generates an additional atmospheric perception by creating the effect of a complex collage of various timbres, produced by the juxtaposition of the static motives and their permutation between the solo bass flute and the pre-recorded four voices.

6.6 SUMMARY

Nigamaganimi has many characteristics which distinguish it from the other pieces in this portfolio. It is a single movement piece based on the scale of the Carnatic raga, which is developed by variations of different timbres, generating an ambient atmosphere throughout the entire piece. In this way, the essential image of the title is captured and a unified harmonic mood is achieved.

Nigamagamini explores repetitive timbral patterns, which requires considerable physiological endeavour. The 'open form' structure, which consists of a number of musical elements, such as Carnatic raga and timbral variations entirely compliments the textile pattern idea by providing a new approach to the mapping of sound parameters into visual material (and vice versa).

The *Nigamagamini* textile pattern was used in order to set-up the structure of the piece and the *Nigamagamini* scale influenced the appearance of the textile pattern. Other parameters, such as the choice and order of timbres are more of a reflection of the Carnatic music tradition, rather than following the rules of the textile pattern.

7. SANDHI PRAKASH

Sandhi Prakash (2013), for string chamber orchestra
Performed by Ruthless Jabiru Ensemble, conducted by Kelly Lovelady (Australia)
Premiere: 31st of May 2014, in Australia & New Zealand Festival of Literature & Arts, London
Duration: approximately 8 minutes

The piece *Sandhi Prakash* has an important role in the development of my approach to compositional technique. In earlier compositions, I had transformed textile patterns into musical parameters, whereas with *Sandhi Prakash* I aimed to explore a reversed technique of transformation, based on the mapping of the musical parameters and structures to a specific textile pattern. Here, the most surprising moment during the transformation of the final textile pattern was that it resembled a painting rather than an ordinary textile pattern, a pattern which a manufactured realization could not achieve.

I have also been exploring different Indian *ragas* for many years, which have lately become an inspiration for a number of pieces. This was especially important in this piece; a textile pattern could not be a starting point so I had to find other external "sources" to help build the main musical structures.

My intention was that the musical approaches of Indian music should not only enable a methodology of transformation, creating a fluctuating motion inspired by *raga*, but could also be an inspiration for generating pre-composed musical structures, which would in turn construct the final textile fabric.

The question of how to relate the musical parameters and structures to the transformation of the textile pattern became a major concern as I started to work on the piece. The mapping process from the musical language to textile pattern was established through various pre-composed musical structures, both constructive and

intuitive. Moreover, an overall template of the piece, involving pre-composed structures of harmony, rhythm and timbre was used to organize, develop and transform it into the final textile fabric.

The title of the composition is derived directly from the Indian raga's title *Sandhi Prakash,* perceived as the junction of day and night.[149] This period happens twice within 24 hours: once at Sunrise and again at Sunset, each lasting three hours, from 4 to 7.[150] This title was chosen to represent an idea of lightness and darkness. Moreover, the identification in the colour scheme of two natural processes, illustrated by black and white colours, closely relates to the system of warp and weft in the weaving process.

7.1 STRUCTURE

The overall structure of *Sandhi Prakash* is sectional – a symmetrical ABA' ternary[151] form in which the section A and A' develop by expansion into three parts, while section B contains one part. The three-part form related to my main compositional idea, creating connections between rhythmic and melodic repetitions, and to the methodology of the construction of the textile fabric.

Furthermore, the partition of each section into equal amounts of fifteen measures represents two different approaches, relating both to the gradual transformation from brightness to darkness and back again, using shadows of white and black colours, and to the division of the instruments; see Table 7.1.

Table 7.1: The overall structure of Sandhi Prakash.

Sections	A			B	A'		
Number of subsections	1	2	3	1	1	2	3
Number of measures	15	15	15	15	15	15	15
Colour scheme of transformation							

[149] Alain Daniélou, *The Ragas of Northern Indian Music* (New Delhi: Munshiram Manoharlal Publishers Pvt. Ltd, 2007), p. 96.
[150] Sobhana Nayar, *Bhatkhande's Contribution to Music*: *A Historical Perspective* (New Delhi: Mehra Offset Press, 1989), p. 147.
[151] *Harvard Dictionary of Music*, ed. by Willi Apel., (Cambridge: The Belknap Press of Harvard University Press, 2nd ed. 1969), p. 95.

This structure became the main framework of the piece which, as Hugo Leichtentritt used to say, "…gives rise to musical compositions like seeds dropped into fertile soil…growing and ripening into larger plants or trees, bearing fragrant flowers and delicious fruits".[152]

The symmetrical construction of the ternary form forms the main musical structure, combining two contrasting compositional approaches: the middle section B is the most substantial section, expressing an idea of 'silence' through very low and transparent sounds, whereas the outer sections A and A' are, in comparison, restrained, providing a gradual transformation of sounds.

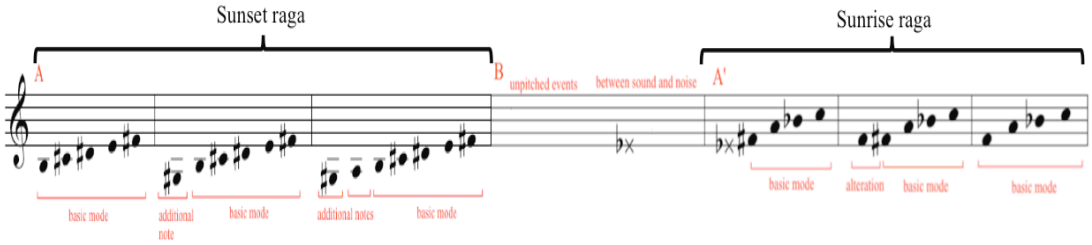
7.2 HARMONY

The influence of certain traditions of Indian music is notable in the piece *Sandhi Prakash*. I have used two different modes of the Indian *raga*, which are played during two particular periods of time: during Sunset and Sunrise. Moreover, I have created a pulsating drone, which is performed by cellos and double basses and which is intended to resemble *tanpura*[153] performance.

The construction of the fundamental pitch material of section A is based on one five-note mode ("basic") constructed from two tones, one half tone and one tone respectively, reflecting the Sunset *raga*. Section B relates to the idea of silence or night atmosphere created by a number of extended string techniques, whereas section A' has more in connection with section A, presenting an Indian raga played during the Sunrise, constructed from a major third, one half tone and one tone respectively. During the piece, two scales were developed on different levels appearing in varied forms; for example, through expansion by adding additional notes in almost every subsequent part of the section (see Figure 7.1).

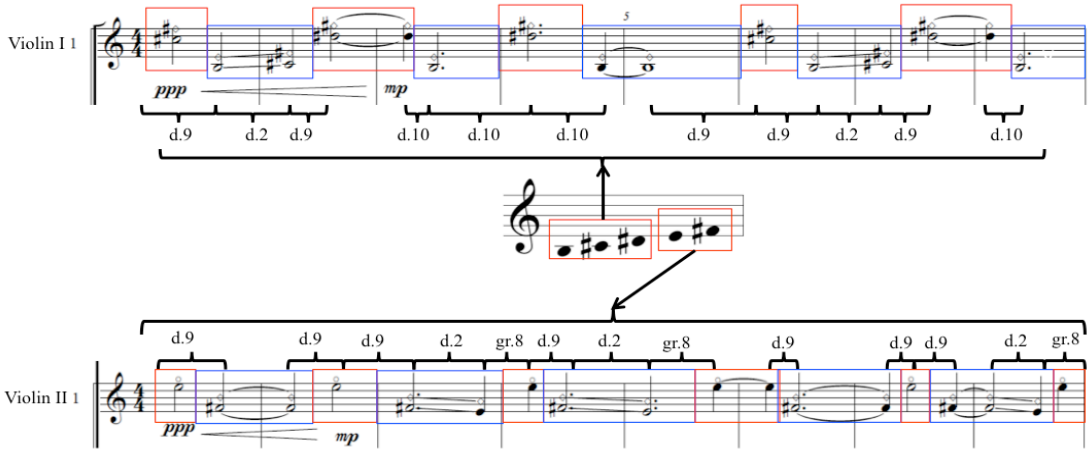
[152] Monroe C. Beardsley and Herbert M. Schueller, *Aesthetic Inquiry: Essays on Art Criticism and the Philosophy of Art* (California: Dickenson Publishing Co., Inc., 1996), p. 67.
[153] Lee Higgins and Patricia S. Campbell, *Free to Be Musical: Group Improvisation in Music* (Plymouth: Rowman & Littlefield Education, 2010), p. 48.

Figure 7.1: The fundamental pitch material.



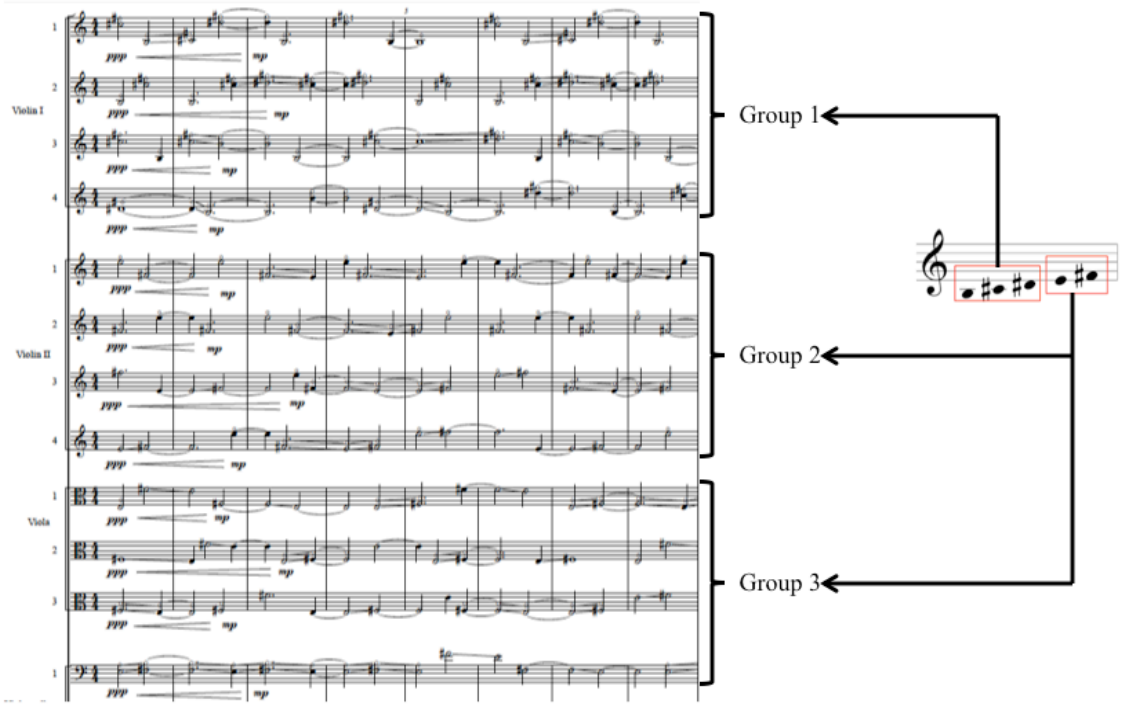
In the weaving process, the system of warps and wefts creates the shaping of two-dimensional space. In order to achieve a similar connection between different sounds, I decided to use a polyphonic layout by inverting the intervals of the raga, to produce distinct compound intervals, such as major ninths or major tenths, throughout the entire piece. This harmonic shift creates inner motion within the harmonic layout by introducing pitches in two distinct registers. Figure 7.2 illustrates the compound intervals for violin I 1 and violins II 1, where the red indicates pitches in the higher register, and blue the pitches in the lower register.

Figure 7.2: An example of compound intervals for violin I 1 and violin II 1.



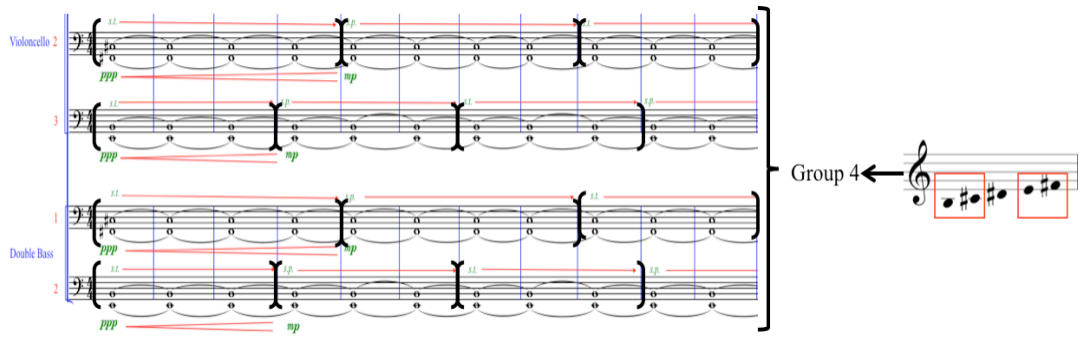
In order to achieve a dense and multi-dimensional harmonic layout, the same harmonic movement is assigned for each particular group of the strings. Each group consists of four instruments, which maintain the same harmony, and are rhythmically overlapped, e.g. Group 1 (violin I 1-4), Group 2 (violin II 1-4), Group 3 (viola 1-3 and violoncello 1), and Group 4 (violoncello 2-3 and double bass 1-2) (see Figure 7.3)

Figure 7.3: Multi-dimensional harmonic layout for groups violin I, violin II, and viola.



The fourth group highlights the pulsating drone, which is achieved by using *crescendi* of different lengths, creating the effect of overlapped breathing based on the interval of a perfect fifth. The sustained harmony also resembles *tanpura* performance, which provides a rich harmonic texture in Indian music[154] (see Figure 7.4).

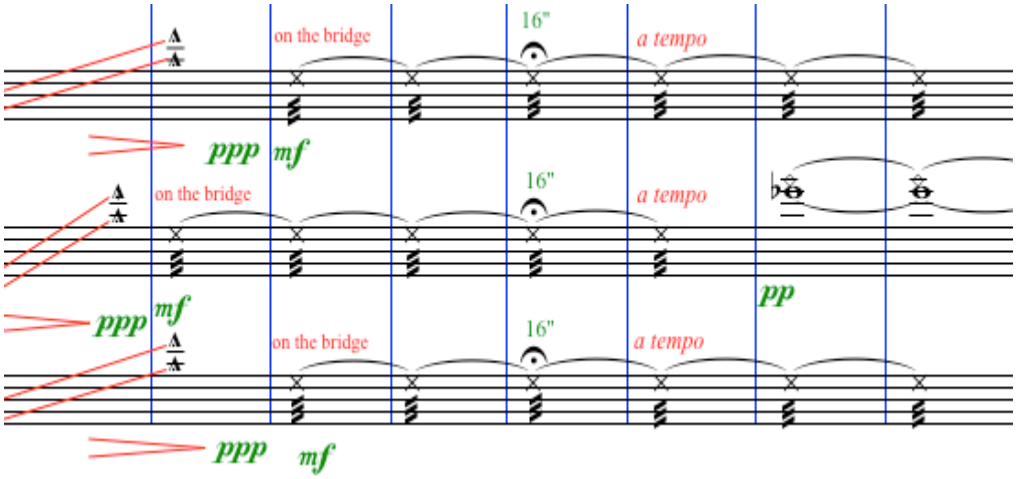
Figure 7.4: Different length drone by violoncellos and double basses (group 4).



[154] Chatziioannou Vasileios and van Walstijn Maarten 'Energy conserving schemes for the simulation of musical instrument contact dynamics, *Journal of Sound and Vibration*, 339, (2015), 262-279 (p. 274).

The harmonic structure, which is explained earlier (see Figure 7.1) remains throughout sections A and A', while in section B the harmony is undermined by the use of various noisy and/or un-pitched sounds, which generate static, mysterious, and pulsating recurring motifs, providing the unusual textural background (see Figure 7.5).

Figure 7.5:The 'harmony' for section B.



The harmony of *Sandhi Prakash* relies on the two Indian ragas, in which different pitches of scale are assigned to four groups of the strings, each maintaining its own harmonic structure. The harmony extends and is supported by drone music in order to create a dense harmonic texture. Similar ideas for the construction of harmony and its modification are used later in *Textile_5* for symphony orchestra.

7.3 RHYTHM

The rhythmic construction of my music is also an attempt to create a physicality maintaining a sense of weight of the rhythmical cycles, which consist of repetitive patterns of differing lengths, evoking the variability of rhythm.

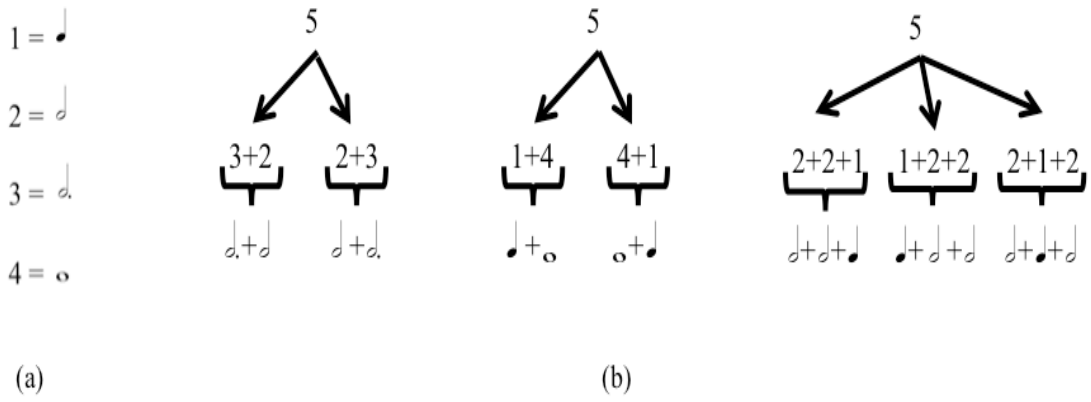
In order to set up individual repetitive rhythmic patterns, I developed an internal subdivision based on Indian music's rhythmic organization,[155] which could retain the sensation of the multiple layering of process and textures. For example,

[155] Martin Clayton, *Time in Indian Music: Rhythm, Metre, and Form in North Indian Rāg Performance* (Oxford: Oxford University Press, 2000), p. 161.

three *talas* have the same amount of beats (14), but tala *Dhamar* is divided into 5+5+4, tala *Chanchar* is divided into 3+4+3+4, and another tala *Ada Chautal* has the same number of beats, but is divided 2+4+4+4.[156]

The rhythm of *Sandhi Prakash* is based on the internal subdivisions of the number five, generating contrasting rhythmic patterns. However, I mapped the numbers into distinct rhythmic durations, in which the number one equals one crochet, the number two a minim, the number three a dotted minim, and the number four a semibreve. The mapping process, from numbers into rhythmic values, and the subdivisions of different pulses, are summarized in Figure 7.6.

Figure 7.6: (a) Mapping the numbers into rhythmic values, (b) various rhythmical patterns, which are based on the subdivisions of number five.



By using different rhythmic cycles the aim is to generate the illusion of regular and irregular overlapping multi-layers which cross each other throughout the entire piece. The establishment of a rhythmic polyphony relies on the different lengths of rhythmic patterns, which are combined with the monochrome timbre of the strings. In addition, this process maintains the feeling of pulse rather than a precise rhythmic structure (see Table 7.2).

[156] http://www.ravishankar.org/-music.html (last accessed 16 April 2015).

Table 7.2: The rhythmic cycle of section A.

Instrument	Rhythmical Cycle in measures	Instrument	Rhythm Cycle in measures	Instrument	Rhythm Cycle in measures	Instrument	Rhythm Cycle in measures
Vln. I-1	5	Vln. II-1	10	Vla. 1	10	Vc.1	6
Vln. I-2	4	Vln. II-2	5	Vla.2	13	Vc. 2	4
Vln. I-3	5	Vln. II-3	7	Vla. 3	Never	Vc.3	3
Vln. I-4	10	Vln. II-4	8			Cb. 1	4
Vln. II-1	10					Cb. 2	3

Moreover, the different rhythmic cycles in sections A and A' maintain multiple layers of constant repetitive reinvention, whereas section B freezes development in a static and transparent movement through the use of drone sounds.

Each string instrument repeatedly plays the same harmonic motifs. Although they are repeating, any perceptual sense of repetitiveness is avoided since each is of different durational length, and some motifs transform themselves and develop quite independently, while others remain constant throughout.

7.4 DYNAMICS

Dynamics are another important musical feature in determining the general emotion of the entire piece and they precisely match the development of repetitive harmonic patterns and rhythmic cycles. Moreover, the organisation of dynamics is arranged for each individual instrument not only to produce two processes of *crescendo* organized by different steps, but also to correspond to the idea of a smooth transformation between lightness and darkness (see Table 7.3).

Table 7.3: Construction of dynamics.

Section	A			B	A'		
Number of subsections	1	2	3	1	1	2	3
Dynamics	***ppp***	***mf***	***f***	***ppp***	***pp***	***p***	***mf***

7.5 TIMBRE:

In *Sandhi Prakash* timbre is mostly organized through the use of the string playing and extended techniques, and often works as an additive coloristic effect rather than as melodic line. A similar approach can be found in Penderecki's *Threnody for the victims of Hiroshima* (1959-60) for 52 strings, in which a number of playing techniques create different textural sonorities; however, my intention was to work with the timbral interpolation of techniques, so that one sonority transforms into another, transcending the conventional timbre of strings.

Timbral aspects developed in *Sandhi Prakash* include playing techniques of strings such as *glissando*, playing on the tailpiece, and un-pitched events were used to create an atmospheric sonic canvas to establish the aesthetic direction of the work. The smooth timbral transformation from pitched sounds to near inaudibility, achieved by different playing techniques, also relates to the idea of brightness to darkness and vice versa (see Table 7.4).

Table 7.4: General plan of playing techniques.

Sections	**A**			**B**	**A'**		
Number of parts	1	2	3	1	1	2	3
Playing techniques	*Sul tasto*	*Sul tasto* *Sul ponticello*	*Sul tasto* *Sul ponticello* *Tremolo*	Playing on the tailpiece Playing on the bridge Un-pitched sounds	*Sul tasto*	*Sul tasto* *Sul ponticello* *Tremolo*	*Sul tasto* *Sul ponticello* *Tremolo*
Colour scheme							

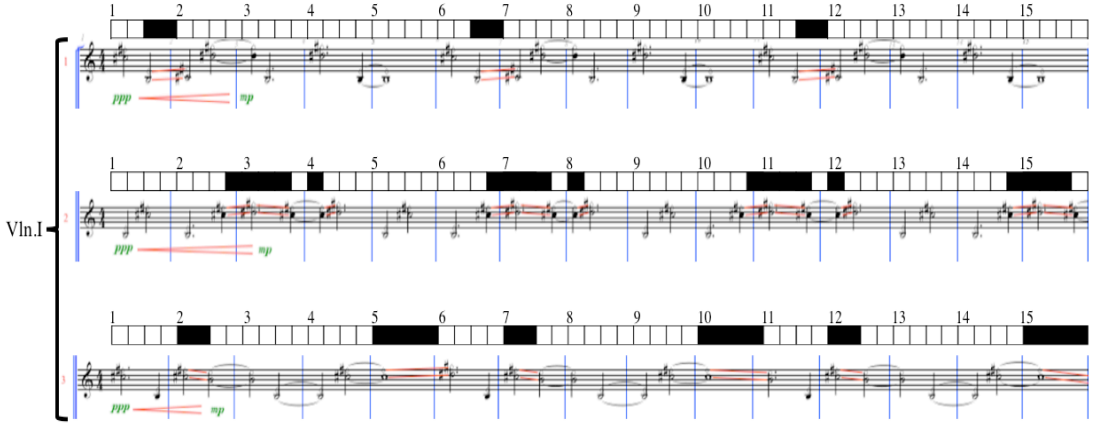
In section A, repetitions of pitches were constantly emphasized by playing them in different parts of the string such as *sul tasto* or *sul ponticello*. Later, the violoncellos and double basses set up a rumble in preparation for the glissando, starting from the bass and spreading slowly upwards through the violins and violas, creating a transformation of sounds to un-pitched events.

The stasis of section B, indicated by the fermata sign in the score, creates a sense of stillness and immutability. The tailpiece effect performed by low instruments and the pitches at the edge of audibility were notated without any change in dynamics or *crescendo*, allowing the performers to concentrate on finding and sustaining the sound rather than making a change within it.

The *glissando* idea is the most significant and evocative element in the piece and is therefore the most important since it, most of all, captures the essence of fluctuation of the pitch, which is central to the character and message of the work. The *glissando* belongs to one of fifteen types of *gamakaa*, which specify the raga of Carnatic music.[157]

Furthermore, the *glissando* effect functioned as the main tool for mapping musical elements to the final textile fabric. Each part consists of fifteen measures of four crotchets, which are mapped to a total of sixty empty squares (15 measures x 4 crotchets = 60 squares). The duration of glissando of any string instrument is equivalent to the equal amount of black squares. For example, in violin I 1, the glissando appears in the first bar lasting two minims, which assign to two black squares after two empty squares (see Figure 7.7).

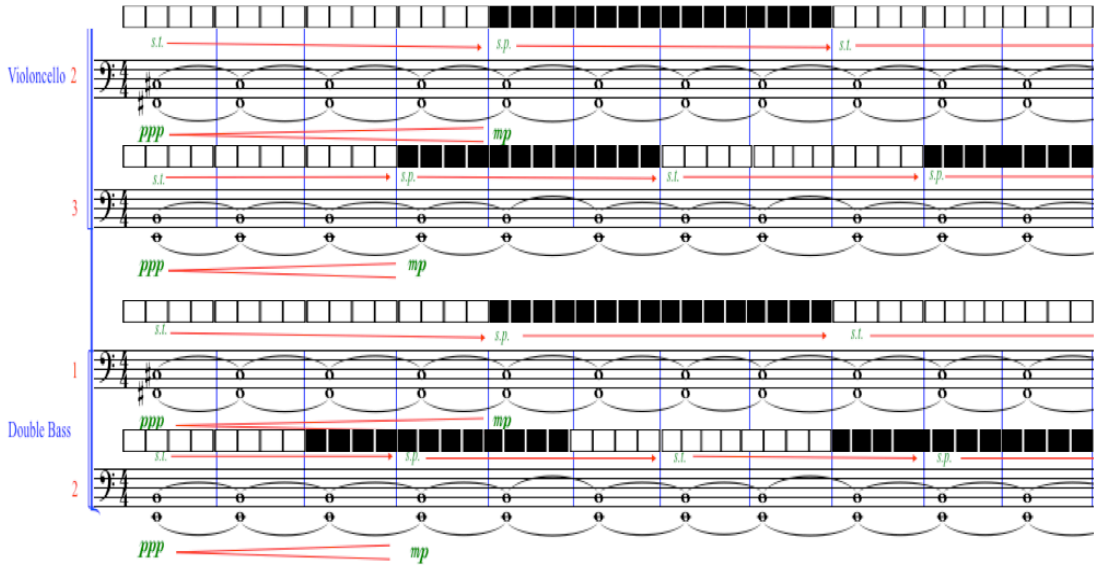
Figure 7.7: Transformation from glissando effect to the textile pattern.



[157] Koduri and others, 'Computational approaches for the understanding of melody in Carnatic music' *International Society for Music Information Retrieval*, (2011), p. 266.

The movement from *sul ponticello* to *sul tasto* in the drone line (violoncello 2 and 3, and double basses 1 and 2) is mapped to the equal amount of black squares (see Figure 7.8).

Figure 7.8: Mapping the drone line into textile pattern.



The use of the extended techniques and the glissando effect create a multi-dimensional atmospheric motion based upon the pre-composed structures of harmony and rhythm. In turn this became the principal feature of the final textile fabric.

7.6 SUMMARY

Sandhi Prakash represents a clear, introductory example of the transformation of the pre-composed musical parameters into textile fabric patterns, combining different aspects of my compositional style.

There are many connections with, and influences from Indian music, which became the main source for pre-composed structures in harmony, rhythm, and timbre. The harmony derives from the two Indian ragas scale, the drone music resembling the use of *tanpura*. The subdivision of rhythm resembles the internal subdivision of Indian rhythm, and glissando belongs to *gamakaas*. My compositional intention was not to present Indian music culture, but to pick up some important tools and ideas

with which I could expand my creative horizons and develop such ideas into sounding textile compositions.

Sandhi Prakash explores the subtlest nuances of the timbres of string instruments, which create the perception of a sustained, continuous atmospheric motion. The ternary structure of the work corresponds to the main idea of the transformation of brightness to darkness and backwards.

The overall process of transforming musical language to textile pattern lies at the heart of my own creativity as a composer and textile designer.

8. TEXTILE_5

Textile_5 (2014), for symphony orchestra
Duration: approximately 30 minutes

Textile_5 was composed during the third and final year of my studies and it is the last work in my portfolio. It can be considered a synthesis of various methods of transformation of textile patterns into the musical parameters as evaluated in earlier pieces: the idea of the micro-macro structure and rhythmic organisation has a certain resemblance to *Textile_3*; the processes of timbral transformation are similar to the compositions *Habotai, Moorchana* and *Nigamagamini*; the pitch organization is similar to that of *Sandhi Prakash*, and the use of the overlapped layers of timbres bear resemblance with the layers of tempi in *Textile_4.*

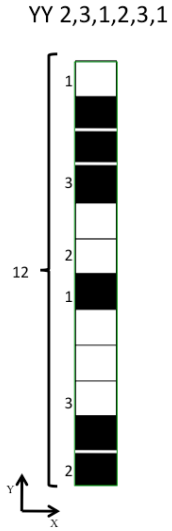
Textile_5 for symphony orchestra lasts approximately 30 minutes. I should point out here that *Textile_5* is the longest piece I have written as a composer so far. In the early stage of the compositional process, I had to deal with challenging approaches that refer to the organisation of the pre-composed harmonic material, rhythm, overall structure and timbre, all of which would support the foundation of the lengthy duration. In order to achieve this, I used one particular textile pattern to create an underlying exploration of symmetrical/asymmetrical structures, diverse timbral layouts, and inconspicuous changes of tempo and harmony, resulting in a continuous motion.

Textile _5 highlights the mapping process from textile weave into music in such a way that *all* musical parameters derive primarily from the textile pattern, whilst in earlier works – for example, in *Moorchana*, *Habotai*, or *Nigamagamini* – the distinct definitions of the Indian raga became an inspiration for the derivation of the rhythm, or for the structure of the textile pattern and musical composition. In *Textile _5,* the structure of the primary weave and the overall textile pattern correspond to my

musical idea of mapping all musical parameters in connection to the number 12 and its multiplications, thus denoting the musical characteristics, such as the number of pages (24), or smaller units such as measures (24) in micro-macro structures; the division of the orchestra into twelve groups, the scale of harmony (12 pitches) derived from the structure of the primary weave; the overlapping timbres are also mapped from the overall textile pattern. In addition, *Textile _5* explores the symmetry of the micro-macrostructure, which originates from the primary weave.

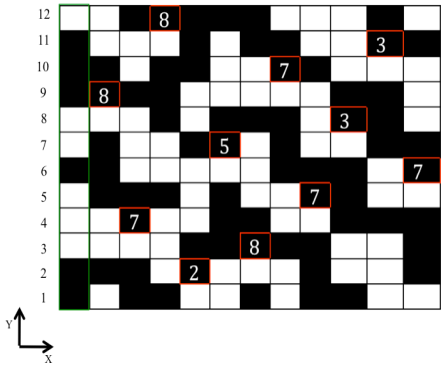
I have chosen a primary weave consisting of the number 12 divided into diagonal steps: 2+3+1+2+3+1. In figure 1 the primary weaves is orientated vertically and indicated with a green border (see Figure 8.1).

Figure 8.1: The primary weave for Textile_5.



There are a number of possibilities for generating the overall textile pattern for this particular composition. In order to amalgamate two distinctive approaches in which a symmetrical structure produces asymmetrical layers, I shifted the starting point of the primary weave to different positions that are not repeated: position 8, 7, 8, 2, 5, 8, 7, 7, 3, 3, and 7. This principle resulted in pulsating and unpredictable repetitions of the overall textile pattern, while achieving the impression of an uneven surface created by varying thicknesses of threads. The green border denotes the primary weave, and the red coloured border indicates each new beginning of the primary weave in every line (see Figure 8.2).

Figure 8.2: Transformation of the primary weave into different steps.

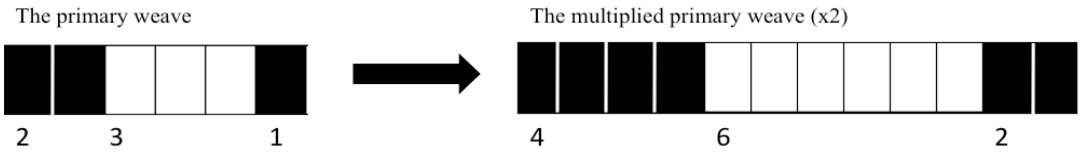


Textile_5 shows a number of musical applications, serving different functions, all based on this particular textile pattern. A combination of these compositional processes enabled me to establish a balance between two-dimensional elements, whilst employing the appropriate tools and methods that would not only represent the overall textile pattern, but also formulate my musical style and expand my musical language.

8.1 STRUCTURE

As mentioned earlier, the compositions *Textile_3* and *Textile_5* employ the same approach of the construction of the micro-macrostructure. The macrostructure is based entirely on the multiplied primary weave pattern 4-6-2 (see Figure 8.3).

Figure 8.3: The primary and multiplied primary weaves.



Symmetry may emerge in different ways, inasmuch as the textile or musical motifs can be organized in patterns producing a regularly repeating design.[158] In *Textile_5*, the symmetrical primary weave defines both the symmetrical overall structure and the format of each single page of the composition. The macrostructure

[158] Clare E. Horne, *Geometric Symmetry in Patterns and Tilings* (Cambridge: Woodhead Publishing Limited, 2000), p. 2.

comprises of five sections (sections A to E) based on the division of the multiplied primary weave, generating a structure with symmetrical qualities. In addition, the macrostructure consists of twenty-four pages, with section A, C and E comprising four pages, whilst section B and D make up six pages each (see Table 8.1).

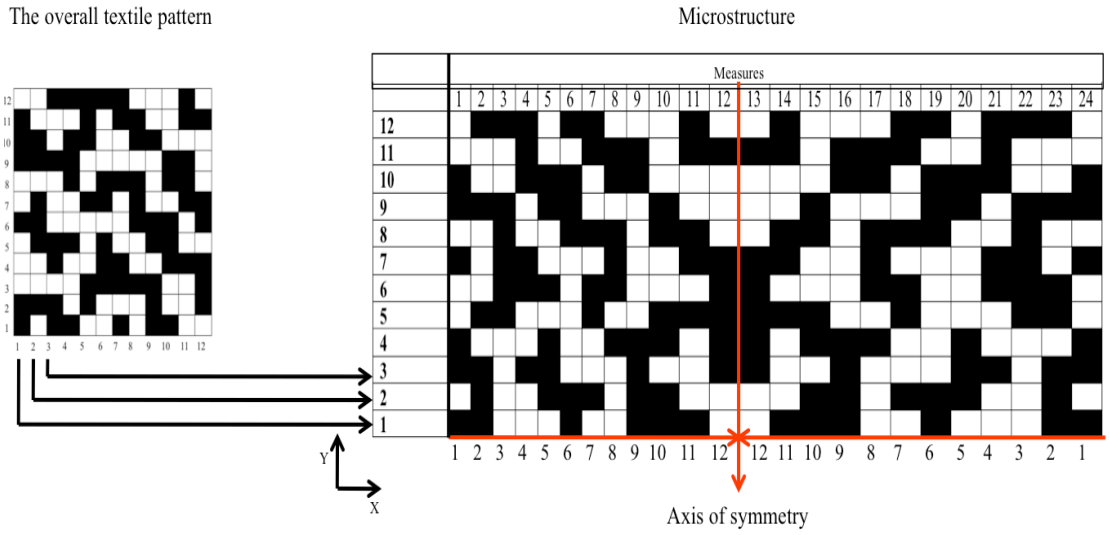
Table 8.1: The macrostructure of the piece.

Number of pages	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Sections	A				B						C				D						E			
The multiplied primary weave	■	■	■	■							■	■	■	■							■	■	■	■
The length of the sections	4				6						4				6						4			

Axis of Symmetry

The microstructure is mapped from the fundamental textile pattern, which consists of a total of twelve white and black squares. In order to establish a symmetrical structure of twenty-four measures, each single line of the overall textile pattern is retrograded in x-axis, producing a symmetry over the length of twenty-four measures (see Figure 8.4).

Figure 8.4: The symmetrical microstructure.



The microstructure consists of subdivisions throughout twenty-four measures, based on the mapping of the amount of black and white squares of the primary textile

pattern into actual amount of measures. A black cell within the textile pattern indicates ‘sound’, whereas a white space represents silence. Moreover, each line of the textile pattern is being assigned to a group of three identical instruments: e.g. 3 flutes, 3 oboes, etc. In Figure 8.5 and Figure 8.6, the microstructure of the first group (fl.1-2-3) assigned the third line of the textile pattern; the second group (ob.1-2-3) matches the tenth line of the textile pattern, and so on.

Figure 8.5: The symmetrical microstructure of the groups 1-6 for 24 measures.

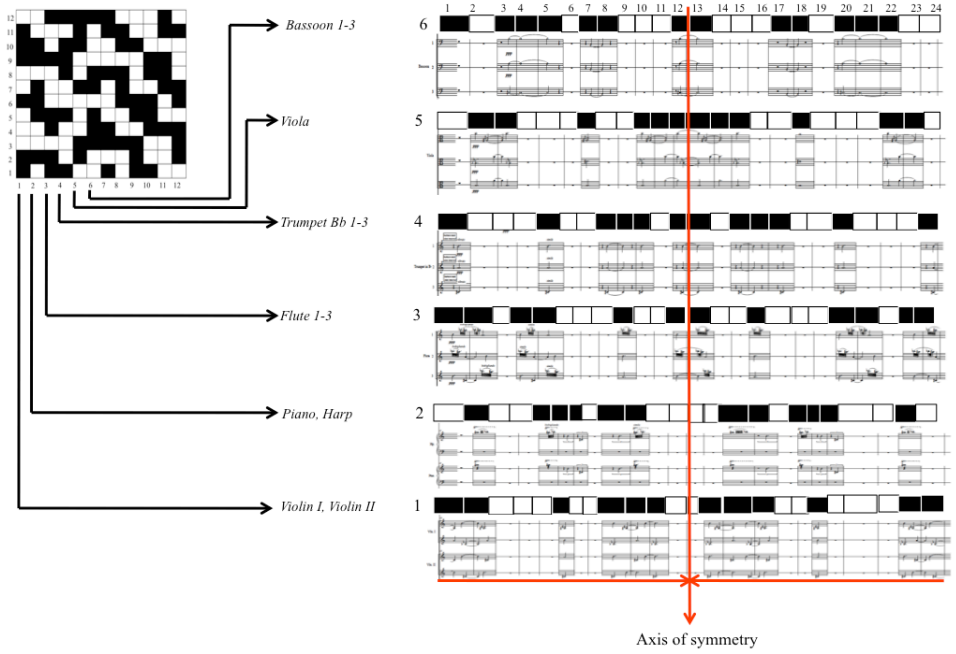
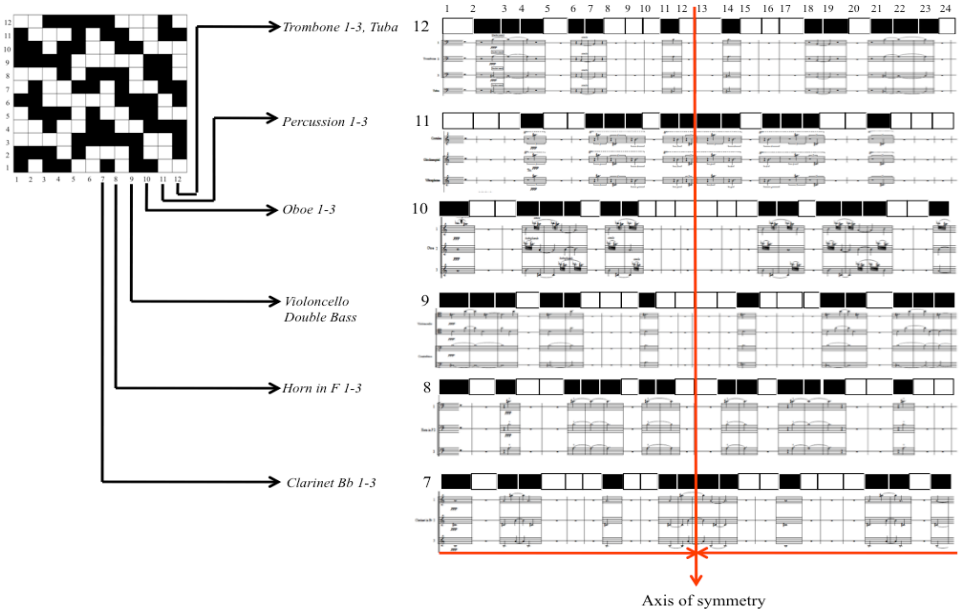
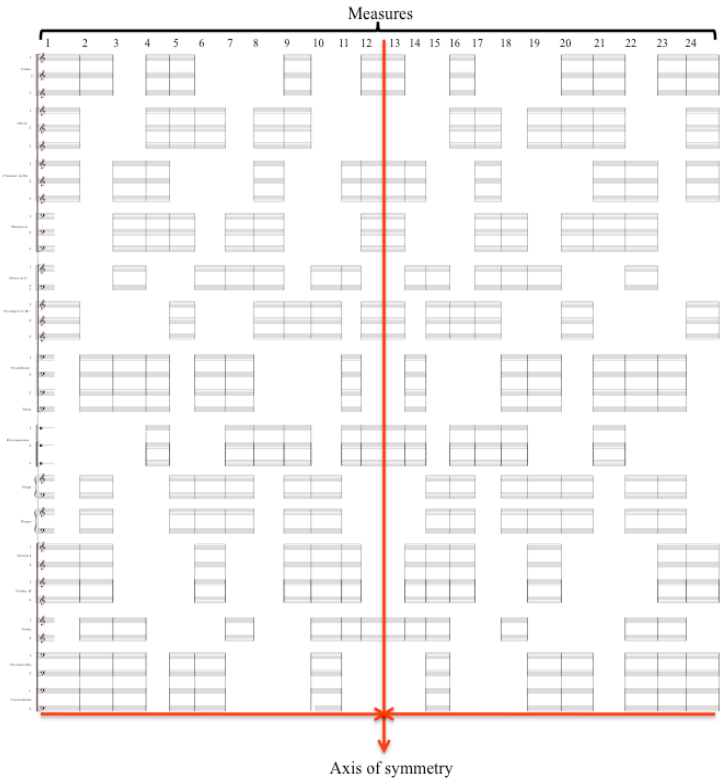


Figure 8.6: The symmetrical microstructure of the groups 7-12 for 24 measures.



The mapping of elements, such as the division of groups and their order, generate the overall microstructure, which remains unchanged for twenty-four pages (see Figure 8.7).

Figure 8.7: The microstructure for each page.



Micro-macrostructures are symmetrical, where the number twenty-four, represents the total amount of pages in the macrostructure, and the amount of measures in the microstructure. The macrostructure derives from mapping the multiplied primary weave, articulating a musical form and microstructure that corresponds to the structure of the overall textile pattern, generating musical elements referring to the division of the orchestra, the structure and the order of the groups. Different layers of micro-macrostructures in the music collaborate, accompany, blend, and contrast with one another, resulting in the rich vertical textures and depth of the music.[159] A micro-macrostructure based on the primary weave and the overall textile pattern not only satisfied my expectations, but also provided the work's originality.

[159] Wing-Yi Chan, Huamin Qu, and Wai-Ho Mak 'Visualising the Semantic Structure in Classical Music Works' *IEEE Transactions on Visualization and Computer Graphics*, 16, 1, (2010), 161-173, (pp. 166-7).

8.2 HARMONY

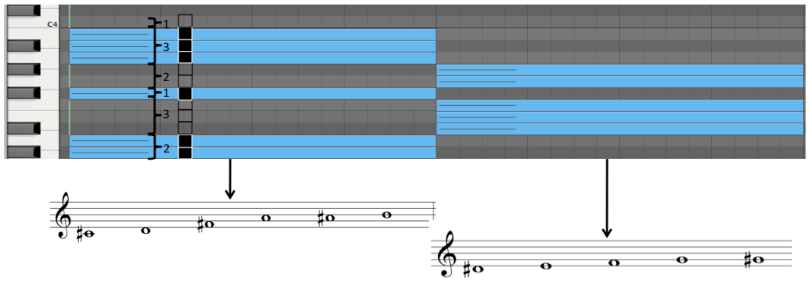
"My whole generation was hung up on the 20- to 25-minute piece. It was our clock. We all got to know it, and how to handle it. As soon as you leave the 20- to 25-minute piece behind, in a one-movement work, different problems arise. Up to one hour you think about form, but after an hour and a half it's scale. Form is easy: just the division of things into parts. But scale is another matter. You have to have control of the piece - it requires a heightened kind of concentration. Before, my pieces were like objects; now, they're like evolving things."[160]

The quotation above, featuring Morton Feldman's idea of the perception of sound, largely inspired me to create a work based on independent pitch patterns in tight connection with time perception.

Earlier pieces, such as *Textile_3, Habotai, Moorchana, Textile_4, Nigamagamini,* and *Sandhi Prakash* explore interpretations of a number of Indian *raga's*. However, in *Textile_5* the fundamental intention behind my conception of pitch was to use a series of repetitive sounds, and clusters, which are entirely based on the primary weave generating an emotion of a single continuum.

The pitches derive from mapping the black and white squares of the primary weave into a MIDI sequencer producing two scales. The first scale originates from mapping the black squares, containing the pitches C#, D, F#, A, A# and B. The second scale reads D#, E, F, G and G#, and responds to mapping the white squares (see Figure 8.8). This transformation enabled me to produce not only determined pitches, but also some kind of consistency of musical language across the whole duration of the piece.

Figure 8.8: Mapping the basic textile pattern in MIDI and the resulting two scales.

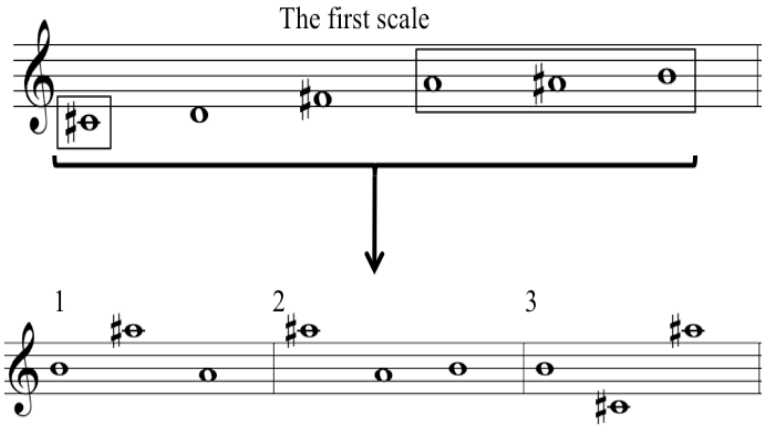


[160] Cole Gagne and Tracy Caras, *Interviews with American Composers* (New Jersey: The Scarecrow Press Inc, 1982), pp. 164-177.

Despite the fact that the derivation of the basic pitches is a precise process, defined by the appearance of the primary textile pattern, the actual use, order, rotation and repetition of the pitches were determined intuitively, mostly by ear.

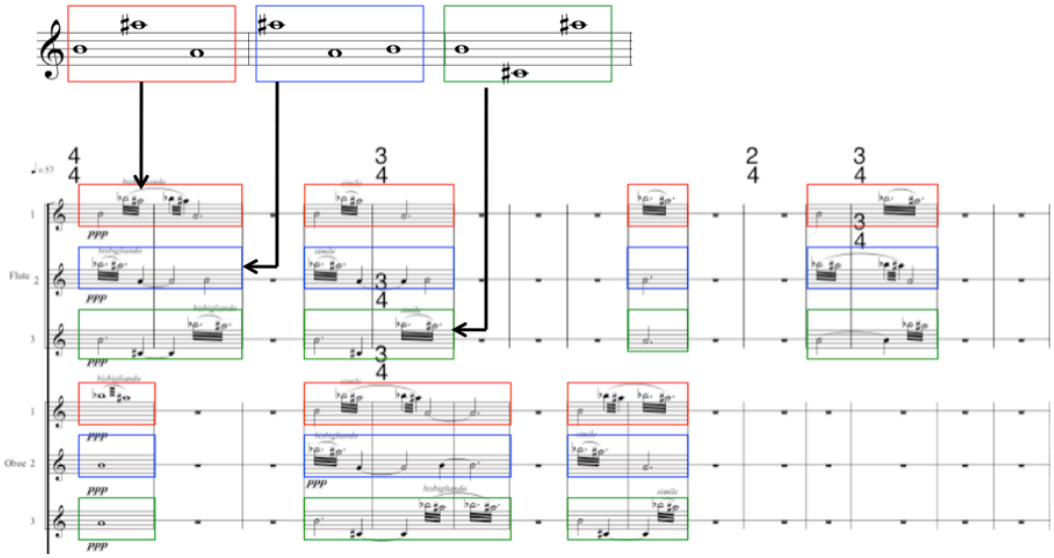
I designed the series of pitches revolving around particular intervals, such as minor/major seventh or compound intervals that are explored throughout the entirety of piece. There are twenty-four different repetitions of the series of pitches, distributed according to the registers of every individual instrument, which expand or compress during the five sections (*Appendix B and Appendix C*). Figure 8.9 illustrates the six series of pitches, which derive from the first scale. The construction of repetitions is similar to my approach in the piece *Sandhi Prakash* as discussed earlier.

Figure 8.9: The series of pitches for section A.



In order to establish the connection between pitch and timbre, every single repetition is performed by carefully chosen groups of instruments, specific to a particular section of the work. For example, the first rising repetition (red colour), involving pitches B, A# and A is performed by two different instruments groups (fl.1 and ob.1) in order to maintain timbral variety. The second series, which consists of pitches A#, A, and B (blue colour) is played by fl.2 and ob.2. The set of pitches B, C# and A# (green colour) is performed by fl.3 and ob.3 (see Figure 8.10).

Figure 8.10: The same pitch series performed by different group of instruments (flute 1 and oboe 1) in page 1 of the score (measures 1-15).



8.3 RHYTHM

Textile_5 is the only composition in the portfolio exploring constantly changing time signatures during the duration of the entire piece. In earlier compositions, time signatures remain unchanged (for example, *Textile_3* is in 9/8 from beginning till end, *Habotai* in 4/4, *Moorchana* in 5/4, *Sandhi Prakash* in 4/4, and *Nigamagamini* has no time signature at all).

The organisation of rhythm and time signature are realized through two approaches: (1) a structure of time signatures derives from the multiplied primary weave, and (2) the choice of time signatures and free repetition of the rhythmical cycles is determined by intuition.

The time signatures were chosen intuitively in order to produce variations of time change in an unpredictable order. Each section of the piece has a different approach to metrical structuring. For example, section A employs very simple and regular pulsations (4/4, 3/4, and 2/4), whereas section B depends on the subdivisions of irregular durations (5/4, 7/8, and 3/4); section C relies on extended durational values and sections D and E have a symmetrical relationship to sections B and A in

terms of their structuring. Table 3 illustrates the organization of the time signatures in sections A-E.

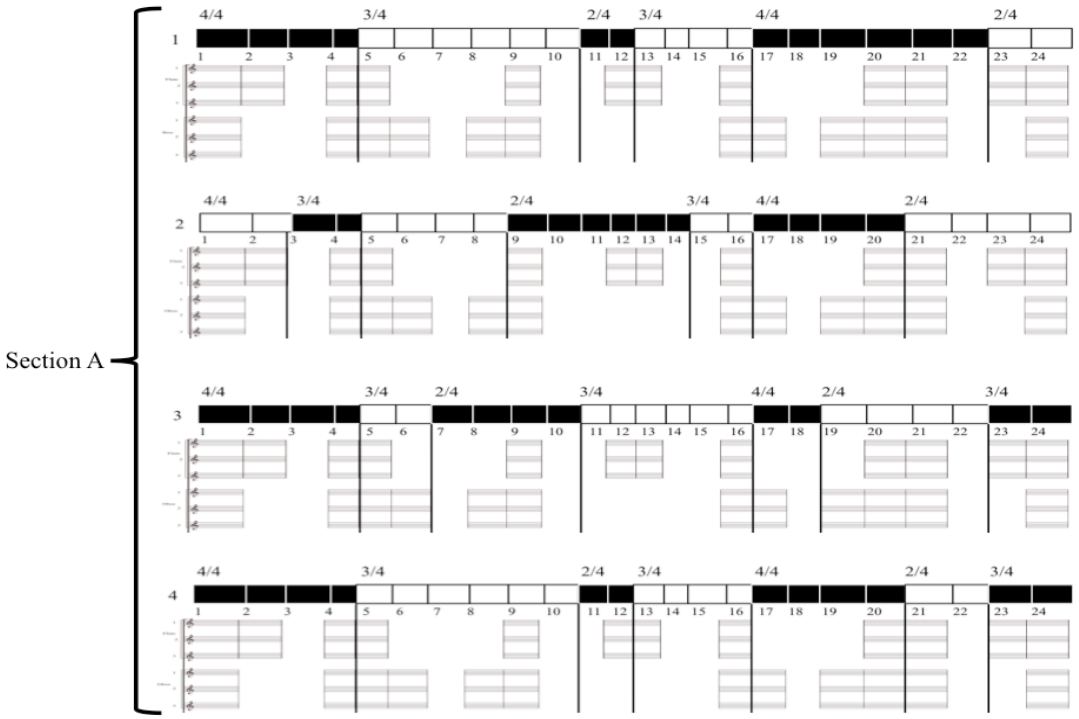
Table 8.2: Symmetrical organization of time signature of the sections A-E.

Section	Time Signature
A	4/4, 3/4/, 2/4
B	5/4, 7/8, 3/4
C	3/2, 2/4, 4/4
D	5/4, 7/8, 3/4
E	4/4, 3/4/, 2/4

Axis of Symmetry

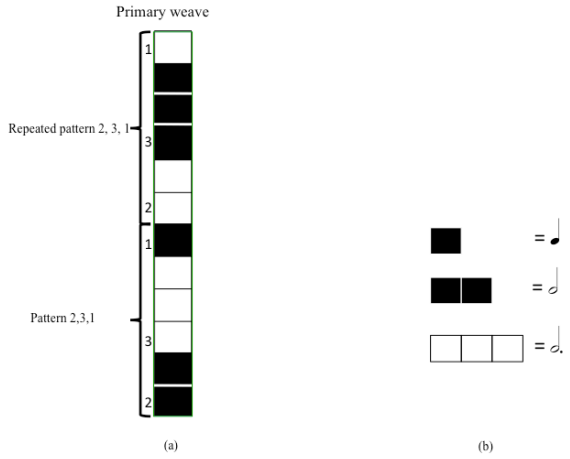
The order of the time signatures is relying on the subdivisions of the multiplied primary weave during twenty-four measures, matching the structure of this particular textile line. Figure 8.11 illustrates the constant change of time signatures for section A. The constant, reordering and rhythmical subdivision of time signatures generated continuity without sudden changes, a motion in which the organization of pitch and timbre creates an atmosphere of contemplation. Such permutation processes maintain a constant reconfiguration of orchestral layers and pitch structures, keeping the texture in constant flux, in spite of the high level of repetition.

Figure 8.11: An illustration of the division of time signature for section A.



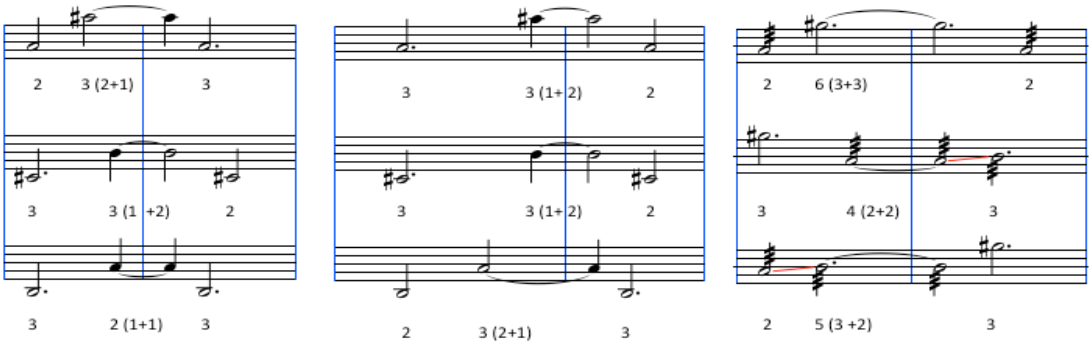
The structure of the basic rhythmical pattern derives from mapping the division of the primary weave 2–3–1. One black square equals one crotchet, two black squares are assigned to one minim, and three white squares are equivalent to one dotted minim (see Figure 8.12).

Figure 8.12: (a) The division of the primary weave into sequence 2, 3 and 1, (b) the mapping the rhythmical values from the primary weave.



I intuitively created and used various rhythmical cycles based on the durations of the basic rhythmical pattern, where the order and values of notes were set up randomly, a transformation that continues through entire piece (see Figure 8.13).

Figure 8.13: Representation of the construction of the rhythmical cycles based on the division of the primary weave.



The creation of an extended process through rhythmical repetitions means not only that the larger scale structure is self-similar throughout, so that no one moment of the piece is more distinctive than any other, but that at the same time enough of the

original contour of the piece is retained to allow the perception of the rhythmical repetitions to sink in to create a monolithic soundscape.

8.4 TIMBRE

The most crucial aspect of *Textile_5*, presenting me with a real challenge as a composer, relied not only on the exploration of timbre as a "colour of sound",[161] but also in dealing with the perception of "united textures" and sound synthesis.[162] My intention was to achieve an inseparable connection between timbre and pitch, one in which the boundaries between these parameters disappear, referred to by György Ligeti as *permeability*.[163]

In writing my portfolio I explored many pieces – though I wish to mention only a selection – where the organization and perception of timbre becomes the main goal. Some composers have a totally different approach, for example, the Polish composer Krzysztof Penderecki in *Polymorphia* (1961), which is written for 48 string instruments, explores timbre as a function of expression and reflects ideas of *Sonority*.[164] Another relevant work is György Ligeti's *Atmosphères* (1961), which shows a primary preoccupation with texture and timbre, in that other dimensions of music such as harmony, melody and rhythm are less significant.[165]

These two examples persuaded me to explore timbre as *micropolyphonic*[166] texture that is created by overlapped layers, density and clusters of sound. In order to create polyphonic textures and achieve a diversity of multiple timbral layers, I decided to divide the orchestra into twelve groups, based on the mapping of the structure of the primary weave, resulting into orchestration rules and achieving the various mixtures of timbres (see Figure 8.5 and Figure 8.6).

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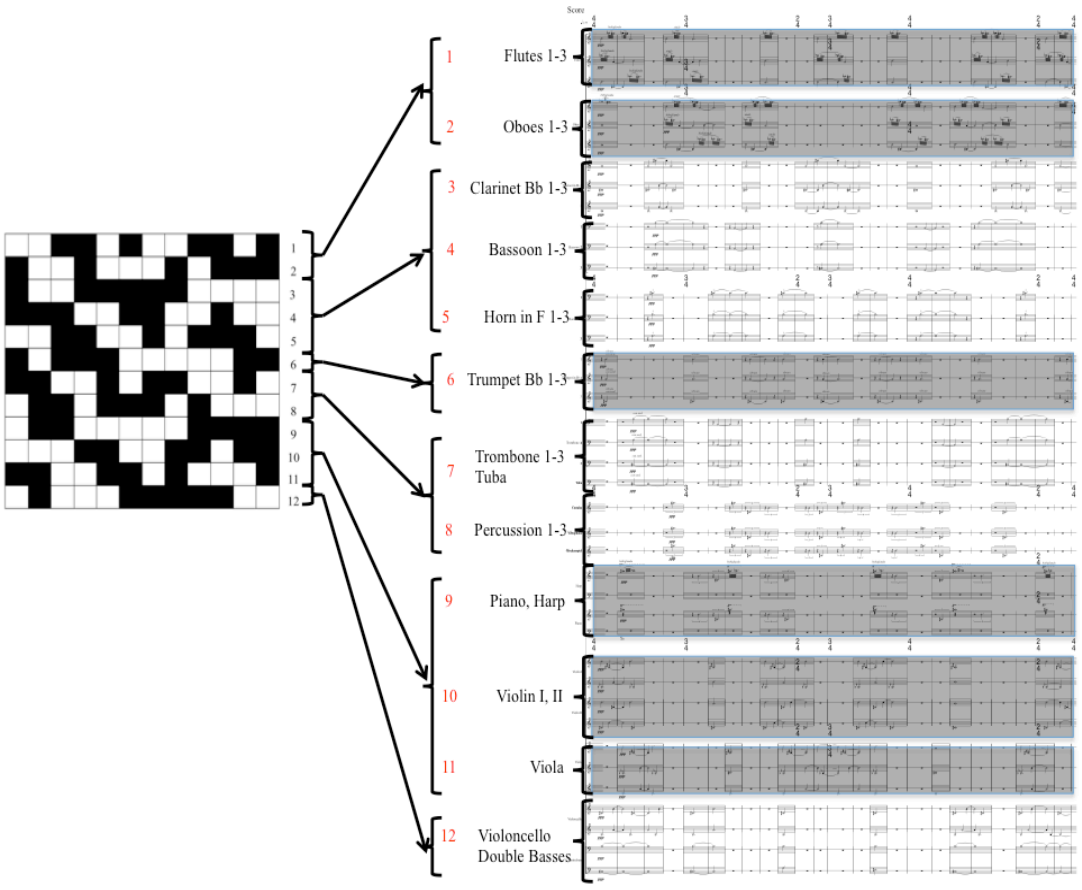
[161] Robert Jourdain, *Music, the Brain, and Ecstasy: How Music Captures Our Imagination* (New York: Avon Books, 1997), pp. 324-6.
[162] Pierre Boulez, 'Timbre and Composition – Timbre and Language' trans. by R.Robinson, *Contemporary Music Review*, 2, (1987), 161-171 (pp.164-9).
[163] György Ligeti, *Metamorphoses of Musical Form*. *Die Reihe*, ed. K.Stockhausen and H.Eimert, trans. by C. Cardew (Bryn Mawr: Theodore Presser, 1965), pp. 5-11.
[164] Christine Lee Gengaro, *Listening to Stanley Kubrick: The Music in His Films* (Lanham, MD: Scarecrow Press 2013), p. 208.
[165] Michael D. Searb, *Ligeti's Stylistic Crisis: Transformation in His Musical Style 1974-1985* (Lanham, MD: Scarecrow Press, 2010), p. 6.
[166] Ibid., p. 7.

In order to establish an additional horizontal timbral layer, each square of the overall textile pattern is assigned to the twelve groups within orchestra. For example, the first square corresponds to group 1 (fl.1-3); the second is assigned to group 2 (ob.1-3), and so on. White squares indicate that the timbre remains unchanged, and black squares indicate an additional timbral layer that defines the change of timbre for groups 1-2, 6, 9, 10, and 11. The grey colour in the score indicates the additional timbral layer that is mapped from top to bottom (see Figure 8.14). Subsequently, the timbral change for the second page is based on the second line of the overall textile pattern, following the same mapping rules.

Figure 8.14: The additional timbral multi-layer based on the first line of the overall textile pattern for the first page.



The additional timbral layer is adorned by means of extended instrumental techniques, generating a specific timbral sonority for each specific group. For example, flutes 1-3, and oboes 1-3 perform *timbral trills* of the highest note (A#),

whilst at the same time this timbral change is complemented in trumpets 1-3 by applying *harmonic mute* for all pitches; harp perform *bisbigliando* of the highest note A#, and the string section (violin I & II, and viola) perform *harmonics* of the same pitch (see Figures 8.15 and 8.16).

Figure 8.15: The timbral change for flutes 1-3, oboes 1-3, and trumpets 1-3.

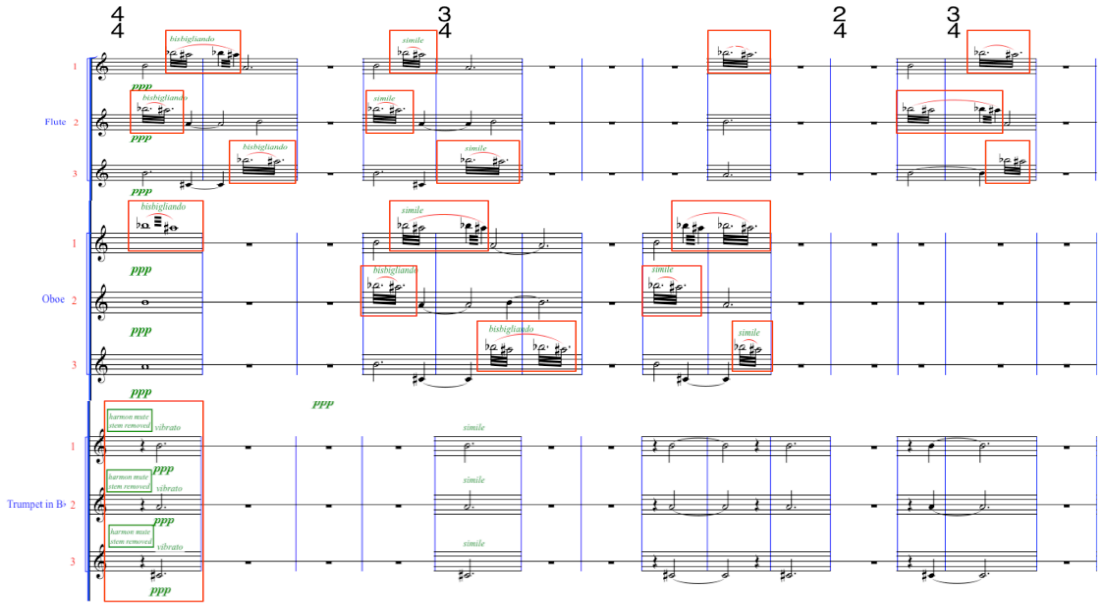
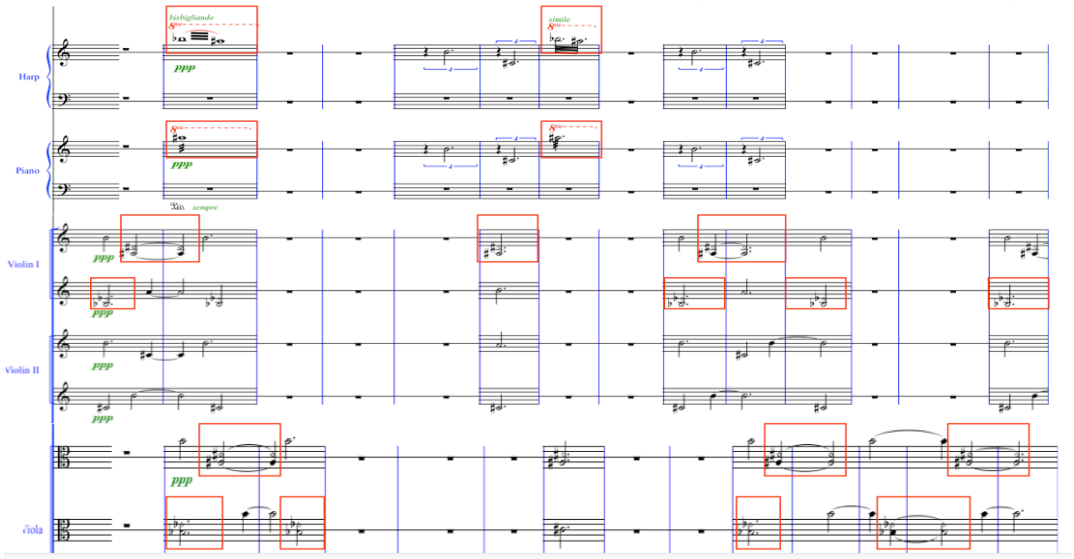


Figure 8.16: The timbral changes for piano, harp, violin I- II, and viola.



The variations in timbre are organised by the original textile pattern, enforcing the various polyphonic textures, developing additional layers and generating a number of repetitions. Moreover, the connection between pitch and timbre created gestures

that move from relative stability to instability, i.e. by establishing oppositions based on basic binary distinctions (e.g. order-disorder, diatonic-chromatic, static-floating, etc.). The modification of timbral sound sources, but also their fusion into larger formations, is something that I was consciously investigating and trying to implement into my personal musical language.

8.5 DYNAMICS / TEMPO

It was very important to achieve a smooth transition throughout the entire piece with regard to dynamics and tempo. I made a decision at the end of the compositional process to retain the dynamics and tempo proportions between the five section by using graduated steps, thus creating two processes of *crescendo* and *accelerando*, marking at corresponding structural points in the piece (see Table 8.3).

Table 8.3: Development of dynamics.

Section	**A**	**B**	**C**	**D**	**E**
Pages	1- 4	5 -10	11 - 14	15 - 20	21 - 24
Dynamics	*ppp*	*pp*	*p*	*mp*	*mf*
Tempo	♩= 58	♩= 63	♩= 69	♩= 76	♩= 81

8.6 SUMMARY

Textile_5 is a symphonic work with a contemplative musical landscape, emphasizing the development of all musical parameters throughout repetitions of pitches, textures, and rhythmical transformations.

Textile_5 is a single movement structure emphasizing aural phenomena, whilst displaying an essentially slow and transparent character, achieved by multi-layered textural repetitions and multidimensional layouts. The structuring of the timbre came about by continuous elements in the instrumentation, adding coloristic effect rather than as a melodic line. In *Textile_5* the use of the textile transformations mapped to

different timbral perspectives not only constructed different aspects of the musical discourse, resulting in micro-macro levels and harmony resemblances, but also enabled timbral surface layers of constant reinvention.

Textile_5 is the result of a resumptive research, summarizing previous explorations of mapping the textile patterns into a musical idiom.

9. CONCLUSION

The seven compositions included in this PhD commentary identify the theoretical, methodological, and creative aspects of my work through a mapping of textile patterns into sonic experience drawing upon the fields of minimal and "algorithmic" compositions. The aim of each composition was to examine and to develop conceptual commonalities through establishing a vocabulary of analogous techniques between the weaving and music in order to inform new music practises, providing a platform of continuous research.

Furthermore, for me as a composer, the most important aspect of translating textiles patterns into music is to convey weaving processes in such a way that music could express the meaning and definition of particular textile fabric throughout specific rhythmical patterns, timbre, dynamics, harmony and structure. Moreover, my fascination about the similarities between the meaning of the *rasa*,[167] and the design of textile fabrics inspired to combine weaving and Indian ragas in order to generate one monochrome soundscape, which could express 'emotion' or aesthetical qualities of textile design.

The historical background commented on in the introduction serves to illustrate distinct aspects of the use of the textile fabric in different audiovisual and interdisciplinary projects, research, and scholarly literature. Compared to previous projects,[168] my PhD commentary highlights common features between textile fabric and sound by means of analysis of the design of textile patterns and musical ideas.

[167] Walter Kaufmann, 'Rasa, Rāga-Mālā and Performance Times in North Indian Rāgas', *Ethnomusicology*, 9, 4 (1965), 272-291 (p. 272).
[168] Nigel Morgan and others, 'Music and Textiles Interact', *Craft Research*, 1, 1 (2010), 39-61.

Generally speaking, most research on creative audiovisual projects concerns collaboration between individual composers and visual artists. However, in this self-reflexive research project I fulfil the three roles of visual artist, composer and researcher, reflecting upon the transformation of ideas from one artistic practice to another. As mentioned above (p.15), all textile patterns and weaves referred to in the commentary are my own original designs following my training in textile engineering.

Despite the fact that the process of transforming the textile designs into musical patterns seems pretty straightforward, the main compositional issue I had to solve was how the textile fabrics could be transformed into musical patterning; which element of the textile fabric could correspond "best" to the structure of the rhythm, harmony, timbre, or the overall form of the composition? I have demonstrated that the choice of these elements, that generated the patterns of rhythm, harmony, timbre, or of the overall structure demanded revisions, particularly in *Moorchana*, in which I was forced to search for different strategies in order to combine the timbres of the five different instruments. The research of the mapping was a "manual" process, mostly created without use of the computer.

Each of the works presented in this portfolio explore the boundaries and possibilities of finding creatively productive structural relationships between visual art and music. That this is a fertile field of research and practice can be seen not only as demonstrated in my own work, but also in the diverse practices of people like Manolete Mora,[169] Andrea M. Heckman,[170] and Gabriel Pareyón.[171] Generally speaking, the mapping process encouraged me to be imaginative and creative, setting up the predefined musical structures that are based on underlying concepts of the textile structure, bearing in mind that a textile object can be perceived as an entity or as abstraction of its internal structure.[172]

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[169] Manolete Mora, 'Tune and Textile: Interrelatedness in the Music and Weaving Arts of the T'boli', *UP Diliman Journals*, 9, 2 (2012), p. 3.
[170] Andrea M. Heckman, *Woven Stories: Andean Textiles and Rituals* (Albuquerque: University of New Mexico Press, 2003), p. 47.
[171] Gabriel Pareyón, *On Musical Self-similarity: Intersemiosis as Synecdoche and Analogy* (Yliopistopaino: The International Semiotic Institute, 2011), p. 129.
[172] Andy C. Long, *Design and Manufacture of Textile Composites* (Cambridge: Woodhead Publishing Limited, 2005), p. 1.

With the exception of *Textile_5*, all works explore contrasting Indian music modes. They have a huge impact on my musical aesthetic, in particular the concept of the *raga* and *rasa*, the division of *tala*, and melodic ornamentation, see for example, Alain Danielou (2007), Martin Clayton (2008) and Bigamudre C. Deva (1981). In *Nigamagamini* and *Sandhi Prakash*, the musical idea derives from the description of the raga, while *Textile_3*, *Moorchana*, *Textile_4* and *Textile_5* highlight the connection between specific textile patterns and Indian raga.

Methods of mapping have varied across the portfolio. However, an overview reveals that there are common mapping procedures that can be categorized and related to the compositional techniques associated with *Serialism* as practiced by Arnold Schoenberg and others, who used distinct series or pre-defined structures in order to control musical parameters.[173] In each of the seven compositions described in this commentary, the pre-defined musical structures are mapped: the appearance of the overall textile fabric, the division of the primary weave, the count of warps and weft, the total amount of the primary weave and overall textile, followed by a mapping process demonstrating a one-to-one correspondence, specific to each musical composition. The features of a particular textile design are linked to a specific composition, for example:

(1) ***The overall structure*** derives from mapping the total number of black or white squares (see Figure 2.4, Figure 3.5, Figure 4.3, Figure 5.3, and Table 8.1); ***the division into sections and subsections*** depends on the inner structure of the textile patterns for particular composition (see Figure 2.5, Figure 2.6, Figure 3.6, and Figure 6.5).

(2) ***The patterns or cycles of rhythm***, which are mapped from the particular amount of warp and weft of the primary weave. This is particularly evident in all works, except *Nigamagamini*. The method of mapping rhythmic patterns follows a consistent linear progression of condensation, followed by proportions of white and

[173] Robin Maconie, *Other Planets: The Music of Karlheinz Stockhausen* (Oxford: Scarecrow Press, 2005), pp. 235-6.

black squares, which are mapped into distinct values of duration (see Figure 2.9, Figure 3.17, Figure 4.6, and Figure 8.12).

(3) ***The structure of timbre***, where structural blueprints derive from the division of white and black squares in the composition *Habotai*, and the establishment of an extra horizontal timbral layer, where each square of the overall textile pattern is distributed among one of the twelve groups of the orchestra in *Textile_5* (see Table 2.1, Figure 3.14, Figure 5.12, and Figure 8.14).

(4) ***The structure of harmony*** derives from mapping the primary weave into a MIDI sequence, where the spacing of a weave relate to the spacing of a chord or durations of chord sequences. Such a technique is utilised in *Textile_5* (see Figure 8.8)

(5) ***The structure of dynamics***, the use of which varies in each composition, emerging its individual aesthetics and atmosphere. For example, in *Textile_3*, dynamic markings are assigned to each individual instrument, in *Habotai*, and *Sandhi Prakash* dynamics follow the gradual development of the structure, and in *Textile_5* the mapping and development of dynamics is related to tempo changes and the division of sections, according to the primary weave (see Figure 1.3, Table 3.2, and Table 7.3).

The aesthetics I have developed as shown in these examples of my musical work reveal an interest in working with monochrome textures in relation with the textile patterns. Each composition highlights distinct outcomes of the transformation from textile patterns to musical language, attempting to highlight my individual experience. Needless to add that there is not just 'one way' how to translate a textile pattern into music. My intention was that each piece would emphasize different structural elements of textile fabric design through analogous parameters. This commentary not only provides an illustrative sample of the research I have done over the last three years, but also forms a document of a continuous artistic trajectory that I have followed along these seven compositions.

The variety of compositional approaches I developed throughout the course of my PhD studies has enabled me to present my work to new audiences, both within academia and in the public domain. *Textile_4* has been performed in the concert series "Orbitos", in Druskininkai, Lithuania in 2013. *Nigamagamini* was performed during Durham Klang 14, the contemporary music festival of Durham University's Music Department of Durham University. *Habotai* was performed by the Ives ensemble in 2012, and *Moorchana* by 7Bridges in 2013. *Sandhi Prakash* for string chamber orchestra was shortlisted as the "Best composition of the year" by the Lithuanian Composers' Union in 2014, and shortlisted for the ISCM World Music Days in 2016 by the Lithuanian Composers' Union.

In years to come, I would like to continue focussing on research in the audio-visual domain, creating compositions that contain both visual and sound media, by exploring immersive environments, using sound and visual technologies. In addition, I would like to adapt and extend the mapping process in the use of live electronics and live visuals in order to create performances that could convincingly bring together two artistic disciplines as a contemporary audiovisual art.

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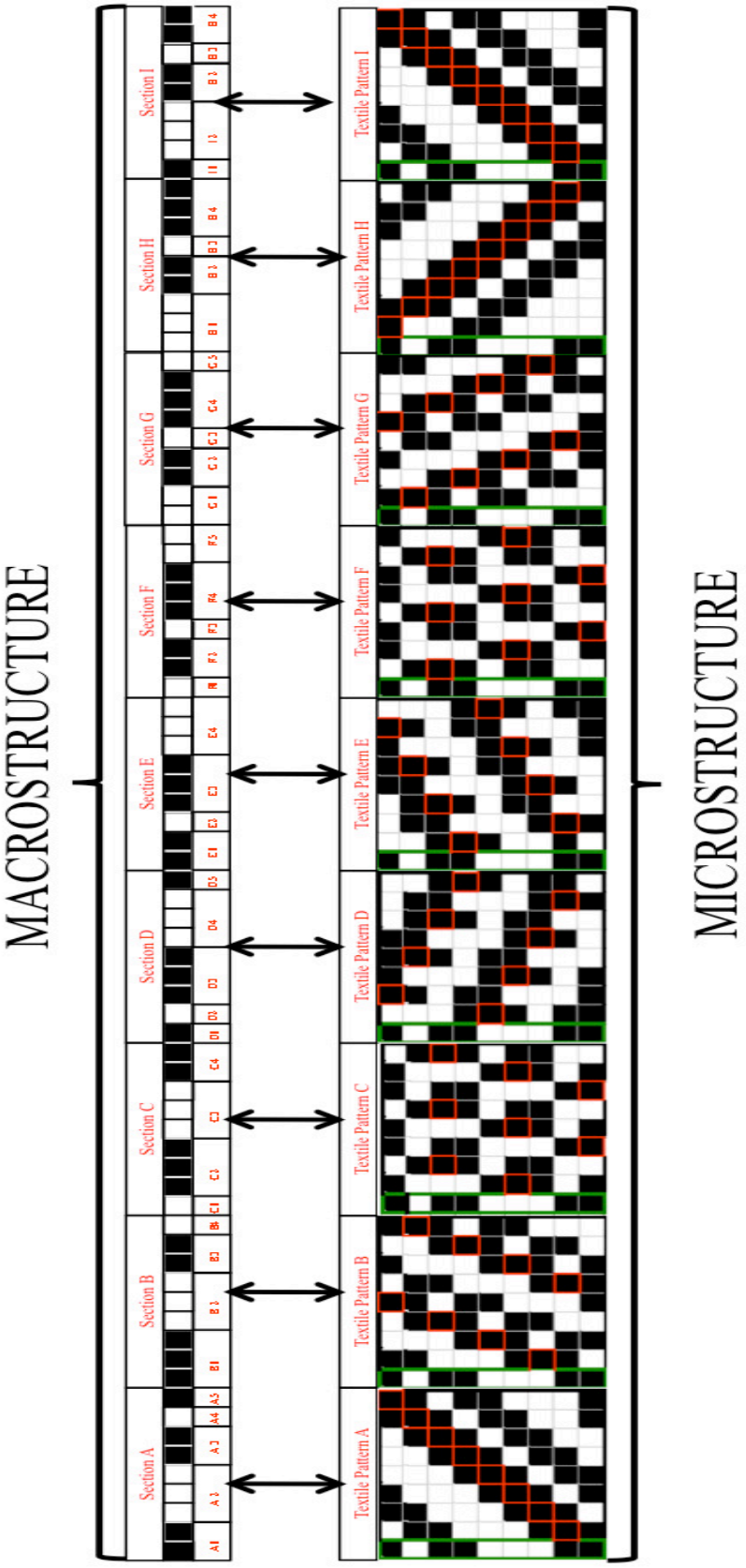
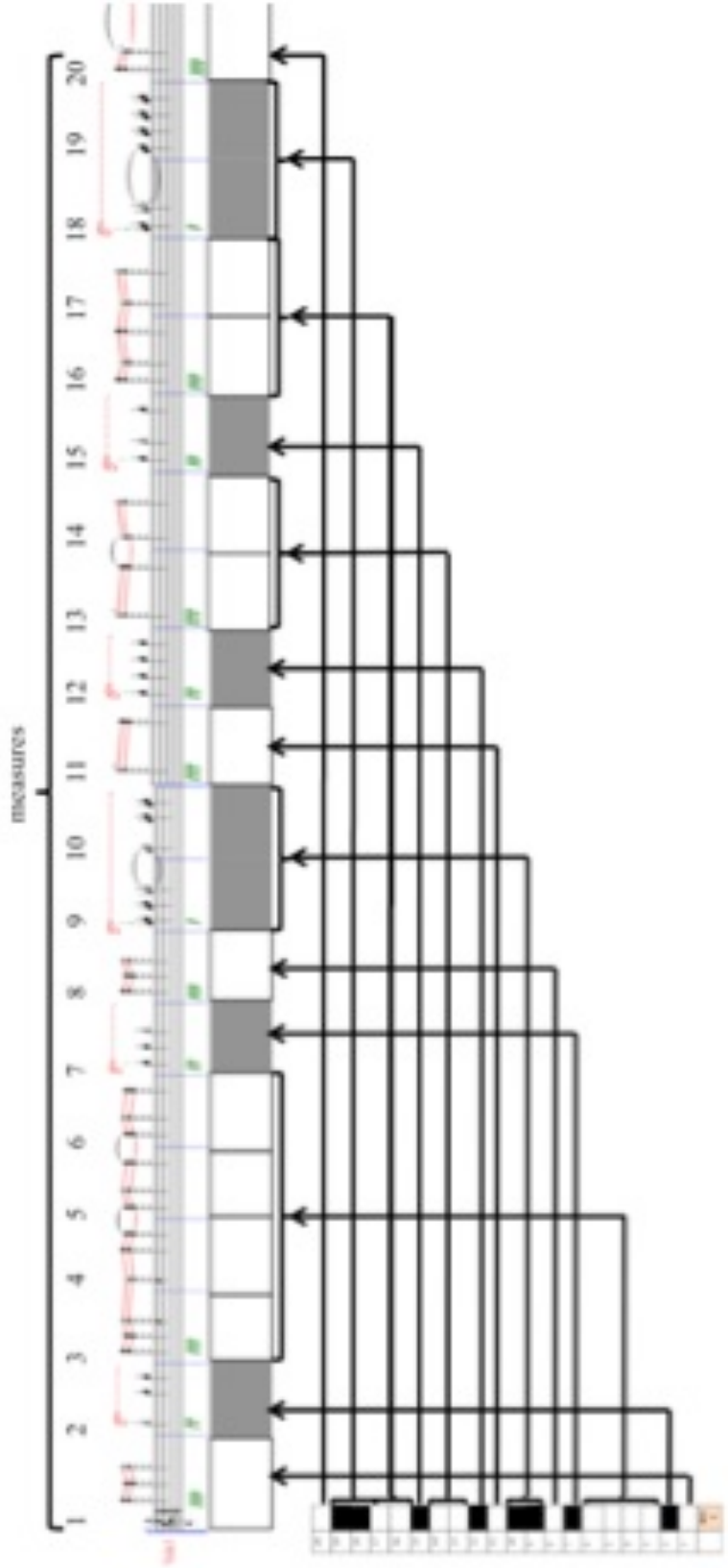
APPENDIX A

Micro-macro structure for *Textile_3*



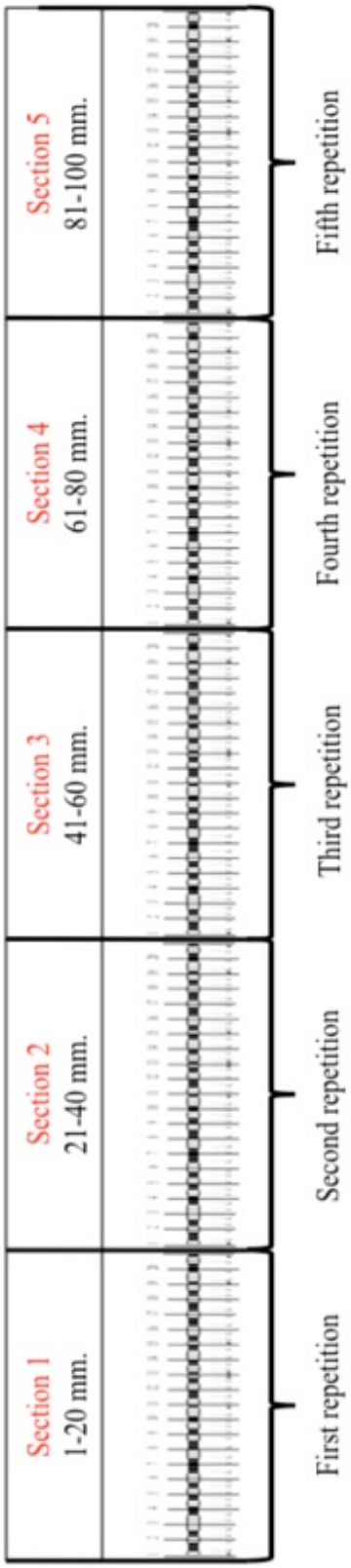
APPENDIX B

The example of mapping natural harmonics and un-pitched events for violin I for *Habotai*



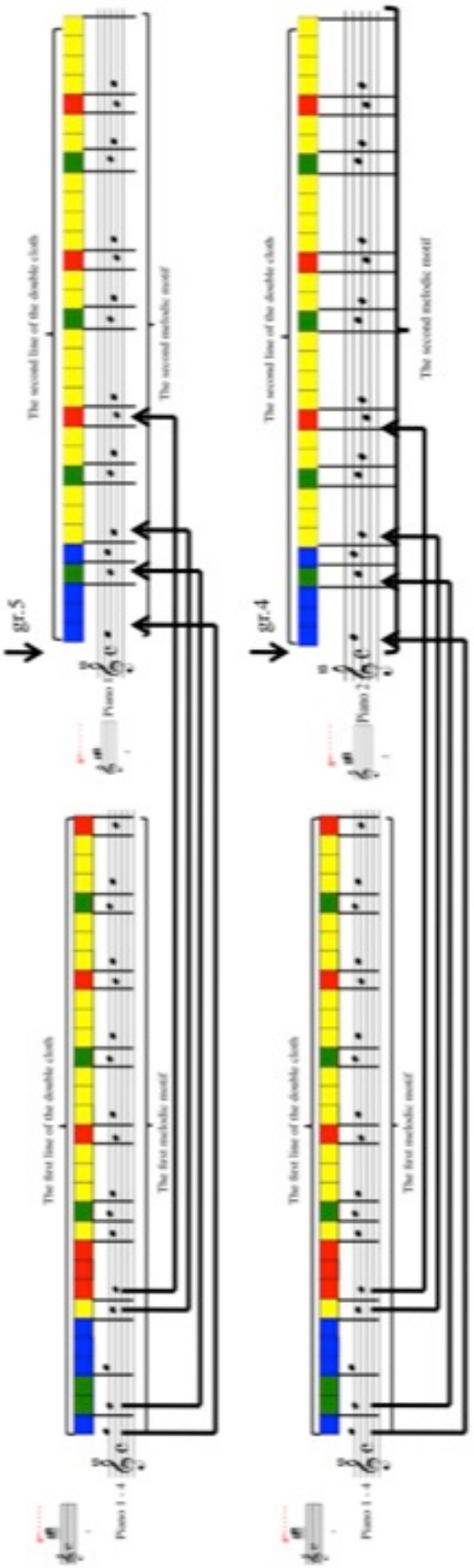
APPENDIX C

The overall structure of *Moorchana*



APPENDIX D

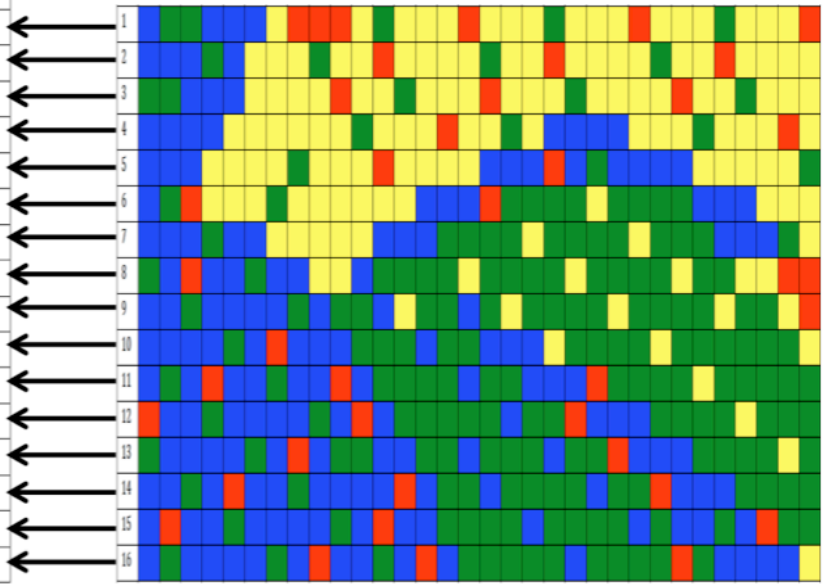
The transposition of second melodic motifs for piano1 and piano 2 for *Textile_4*



APPENDIX E

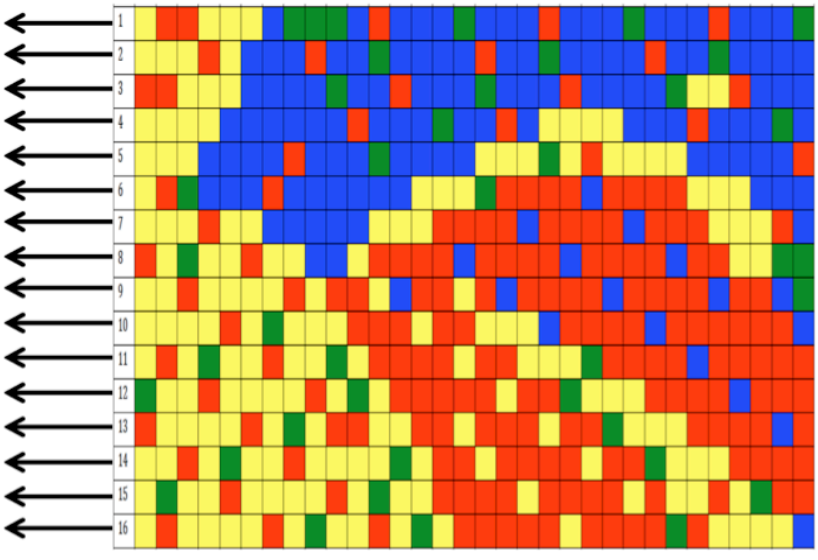
System of different tuning for (a) A side- original, and (b) for side B-reverse for *Textile_4*

The line of the double cloth A	In cents	Multiplication of the number 3.125
A1	+3.125	
A2	+6.26	x 2
A3	+9.375	x 3
A4	+12.5	x 4
A5	+15.625	x 5
A6	+18.75	x 6
A7	+21.875	x 7
A8	+25	x 8
A9	+28.125	x 9
A10	+31.25	x 10
A11	+34.375	x 11
A12	+37.5	x 12
A13	+40.625	x 13
A14	+43.75	x 14
A15	+46.875	x 15
A16	+50	x 16



(a)

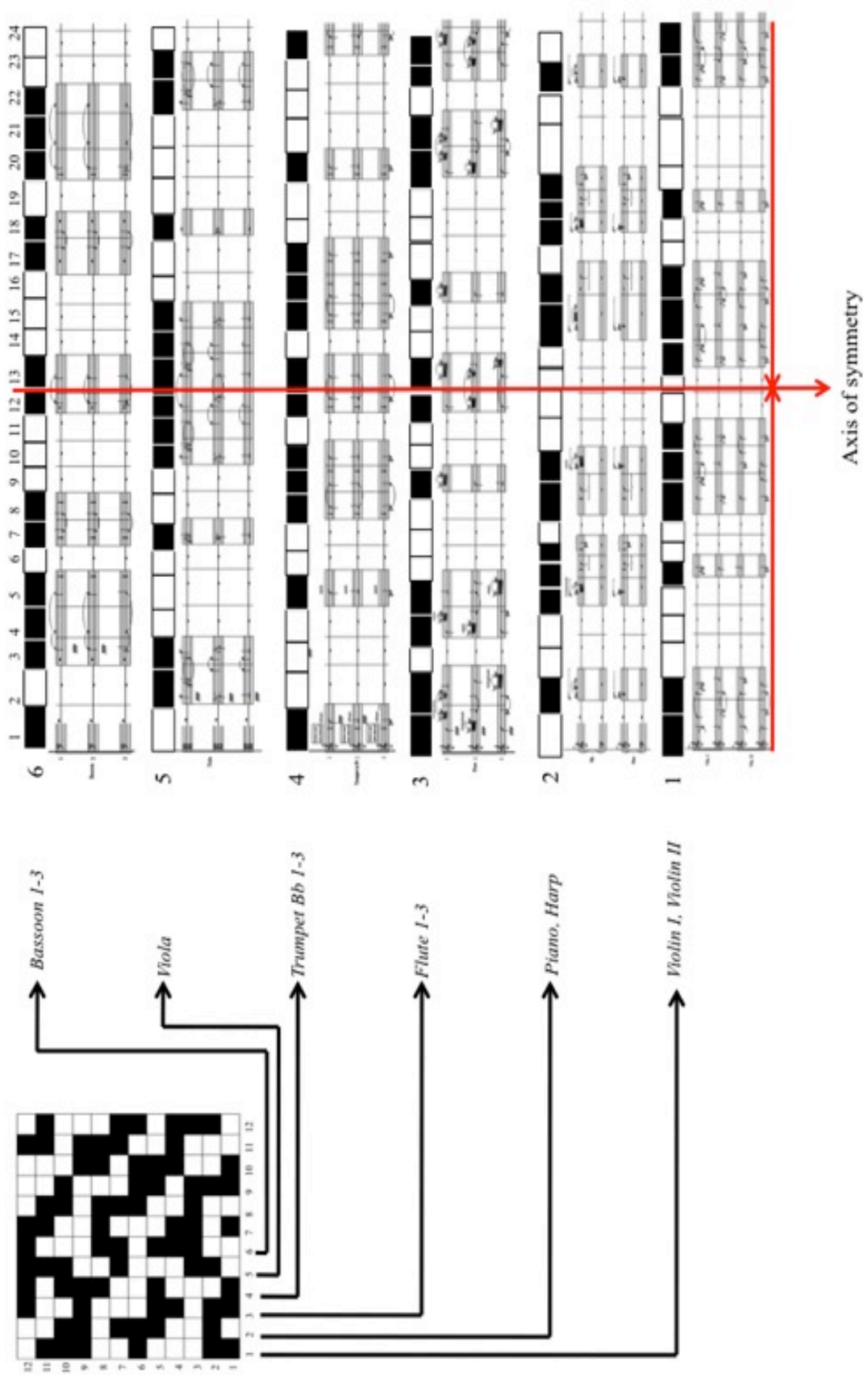
The line of the double cloth B	In cents	Multiplication of the number 3.125
B1	- 3.125	
B2	- 6.26	x 2
B3	-9.375	x 3
B4	-12.5	x 4
B5	-15.625	x 5
B6	-18.75	x 6
B7	-21.875	x 7
B8	-25	x 8
B9	-28.125	x 9
B10	-31.25	x 10
B11	-34.375	x 11
B12	-37.5	x 12
B13	-40.625	x 13
B14	-43.75	x 14
B15	-46.875	x 15
B16	-50	x 16



(b)

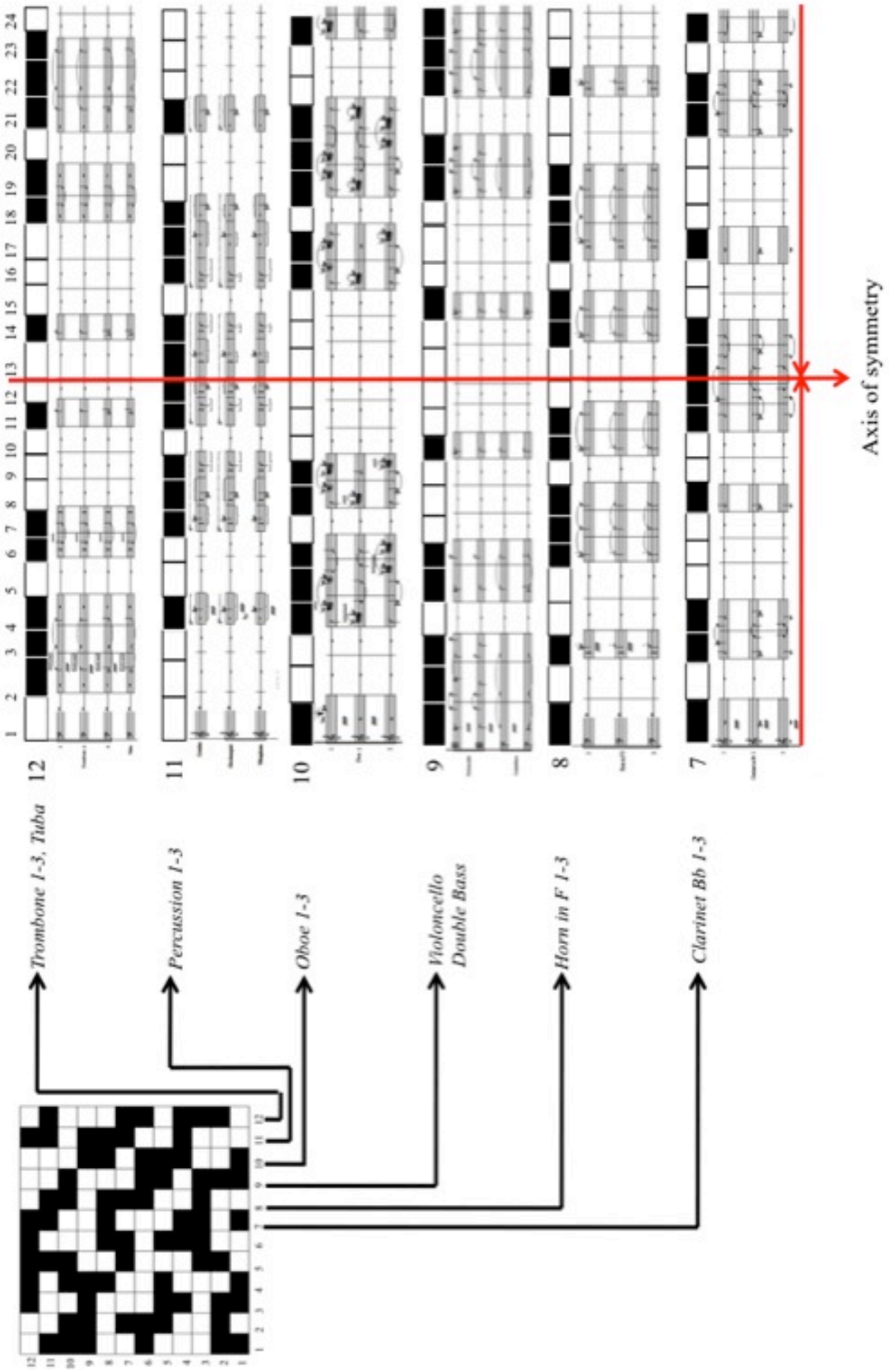
APPENDIX F

The symmetrical microstructure of the groups 1-6 for 24 measures for *Textile_5*



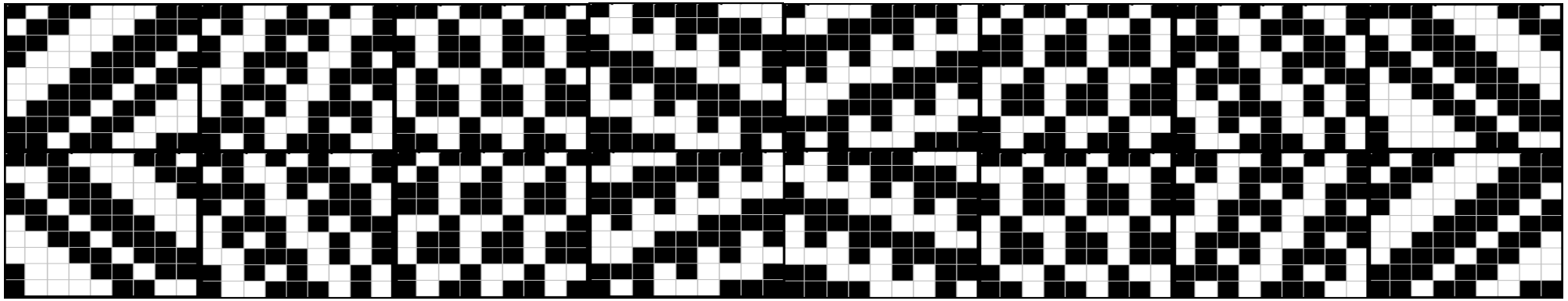
APPENDIX G

The symmetrical microstructure of the groups 7-12 for 24 measures for *Textile_5*



Egidija Medekšaitė

TEXTILE_3



for four percussion players

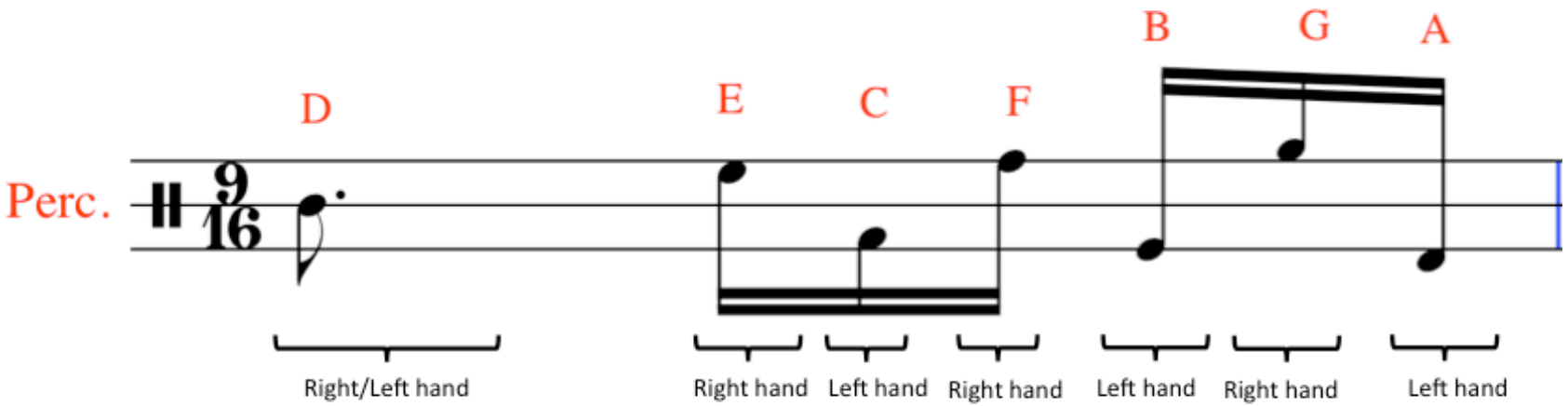
Explanatory notes:

The piece is divided into 9 sections, which have to be played without a break. The instruments for every performer are set up in the same order, and the performers are standing in one line. Each instrument has a “fixed” dynamic.

Set-up of instruments:

A	B	C	D	E	F	G
f - ff	*mf*	*p*	*pp*	*p*	*mf*	*f - ff*

Each player has to perform with two different mallets: left hand - hard, right hand - soft. All notes, which are notated in the top half of the staff (Instrument E, F, and G) are played with the right hand, and all notes notated in the bottom half of the staff (Instrument C, B, and A) are played with the left hand. The middle note (Instrument D) can be played alternately by right and left hand, and freely chosen by performers. The Figure below explains which instrument corresponds with which line of the staff:



There are two options of choosing instruments. One set-up can be as using "traditional" instruments with different pitches, or another – with different surfaces. Your ensemble is free to choose what kind of set-up you would like to use.

FIRST OPTION:

A and G – an extremely high pitch with continuous reverb
B and F – high pitch
C and E – middle pitch
D – very low pitch

SECOND OPTION:

A and G– Glass surface
B and F – Plastic surface
C and E – Wood surface
D – Metal surface

Duration: ± 10 minutes

Textile_3

Egidija Medeksaite

♪. = 100

A1
4 times

A2
6 times

Perc.1
Perc. 2
Perc. 3
Perc. 4

9/16

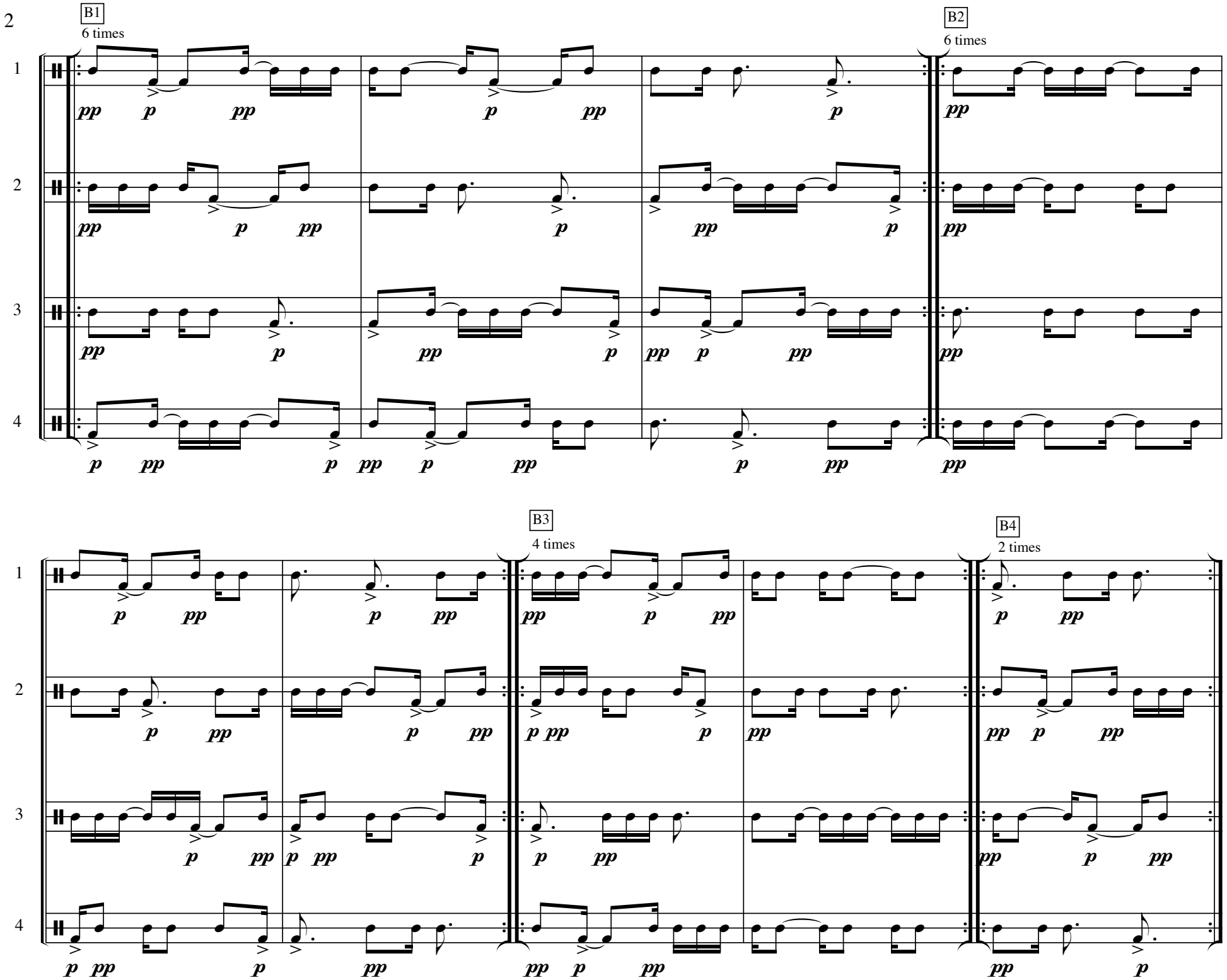
pp

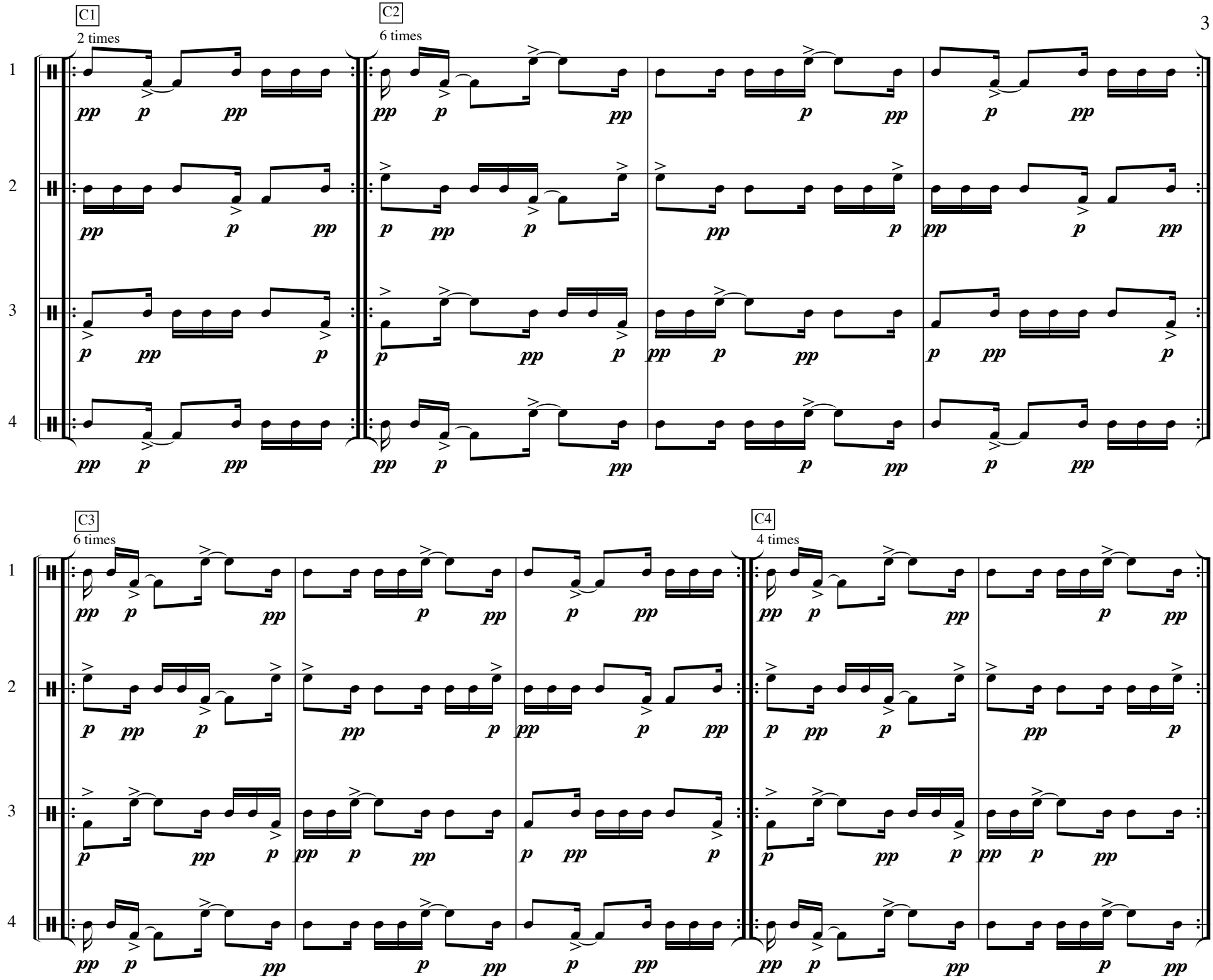
A3
4 times

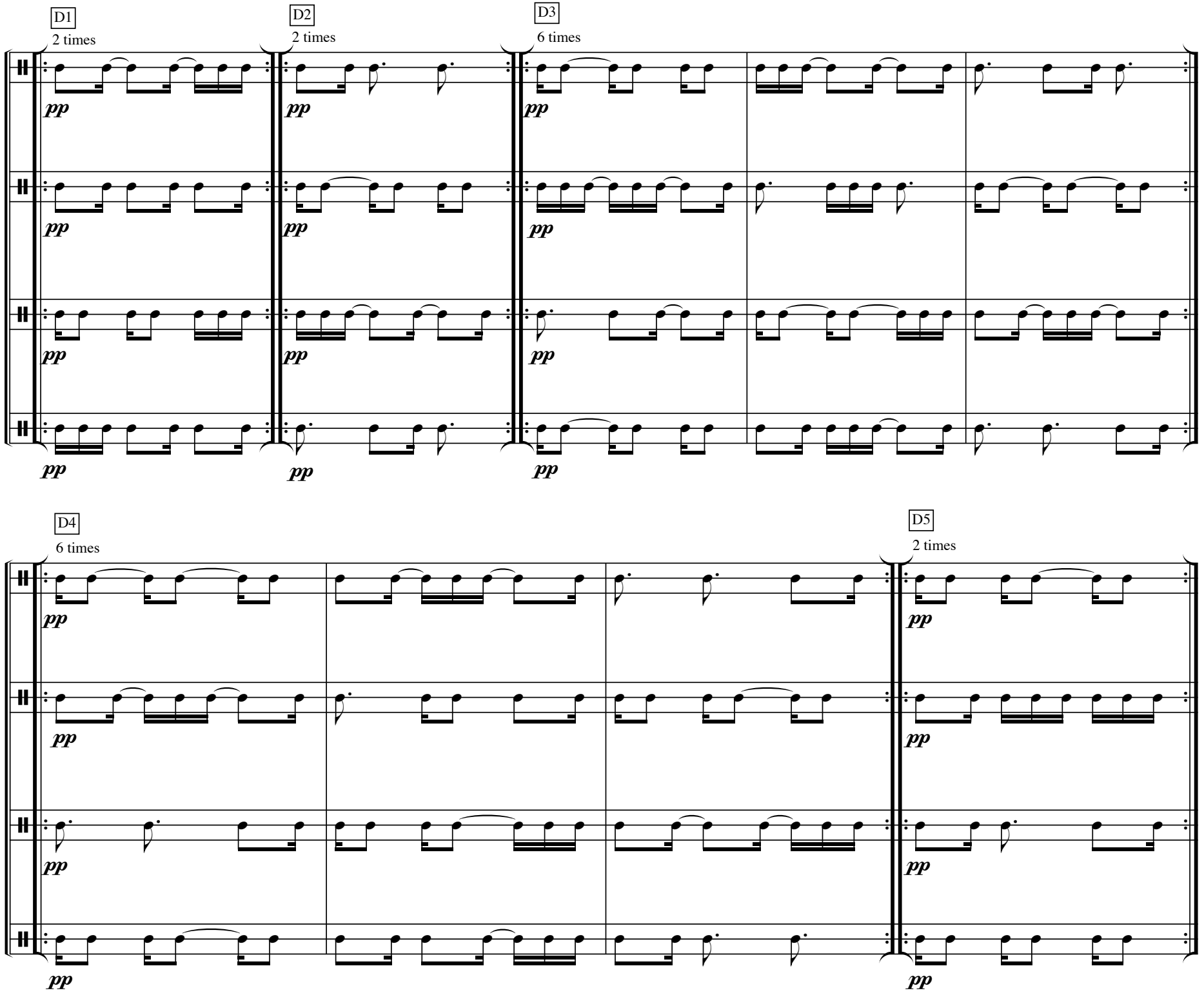
A4
2 times

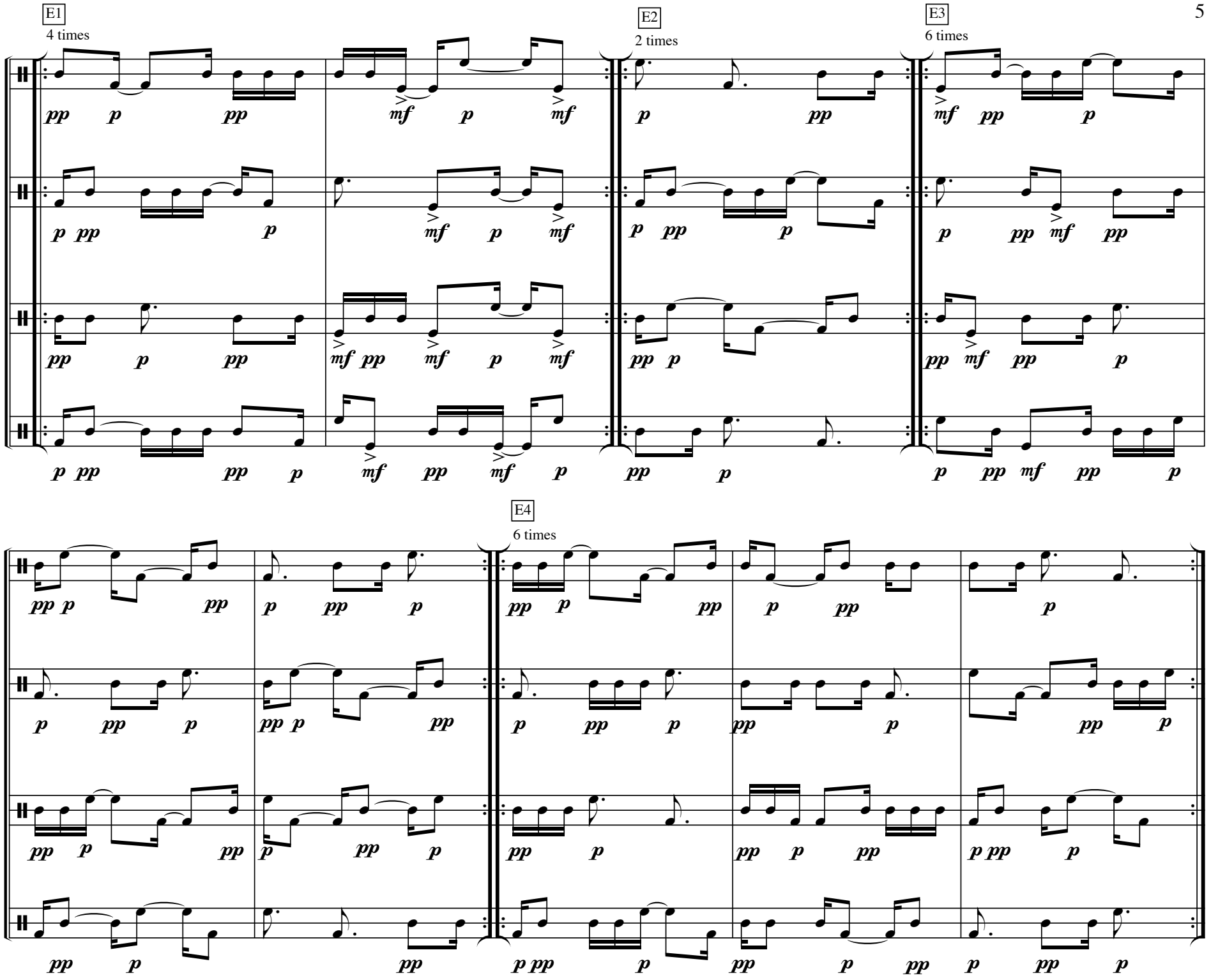
A5
2 times

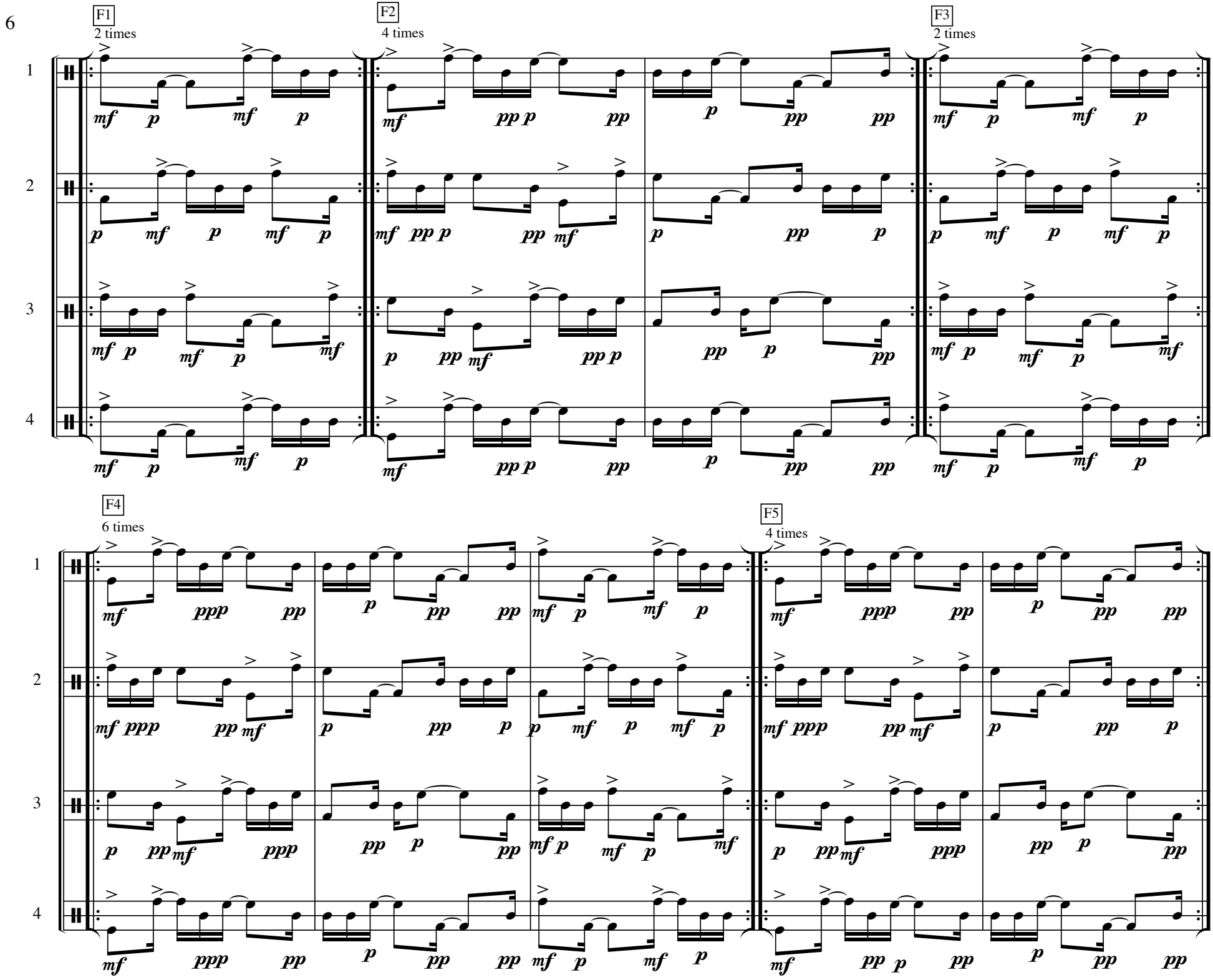
1
2
3
4

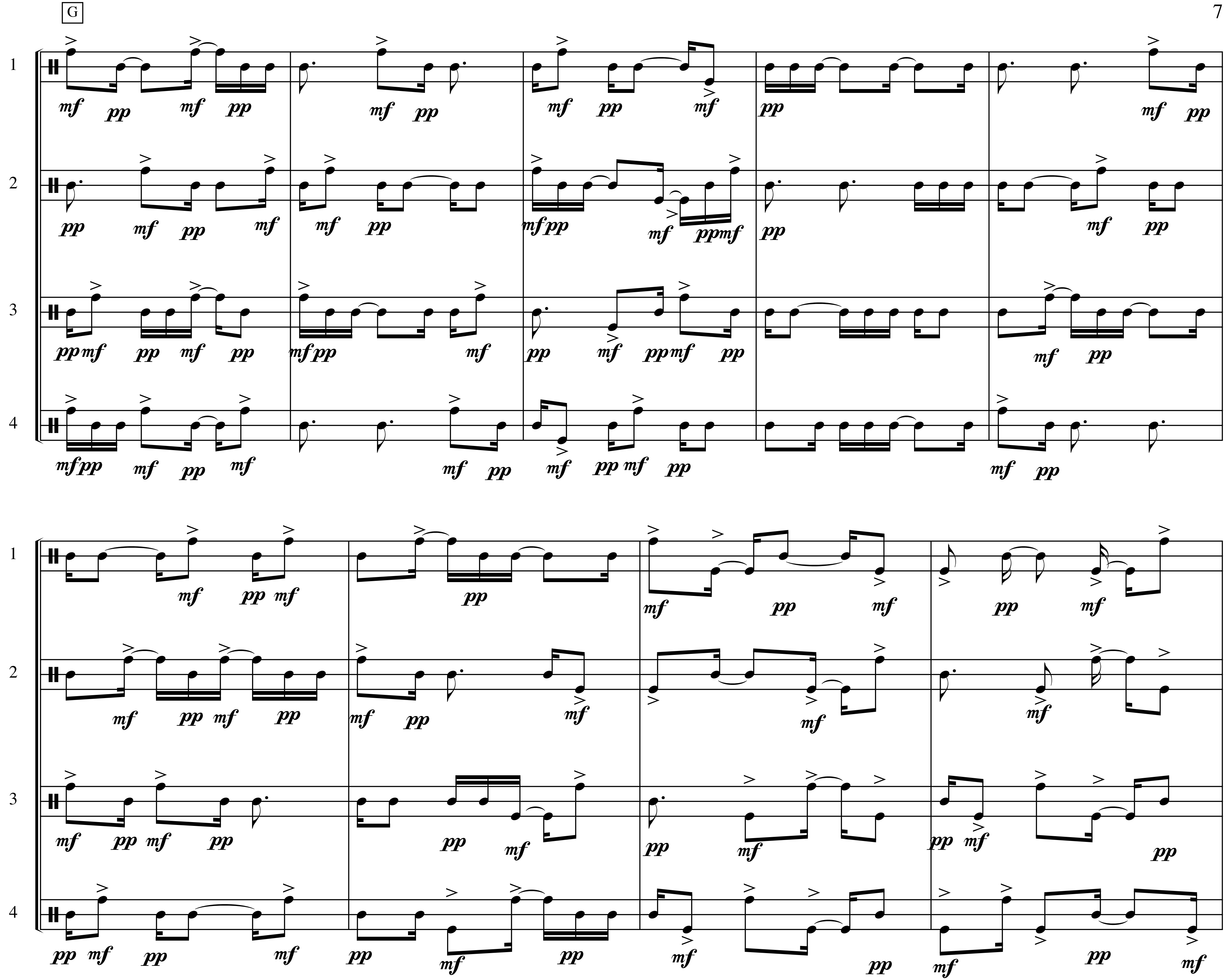

B1
6 times
B2
6 times
B3
4 times
B4
2 times
1
2
3
4

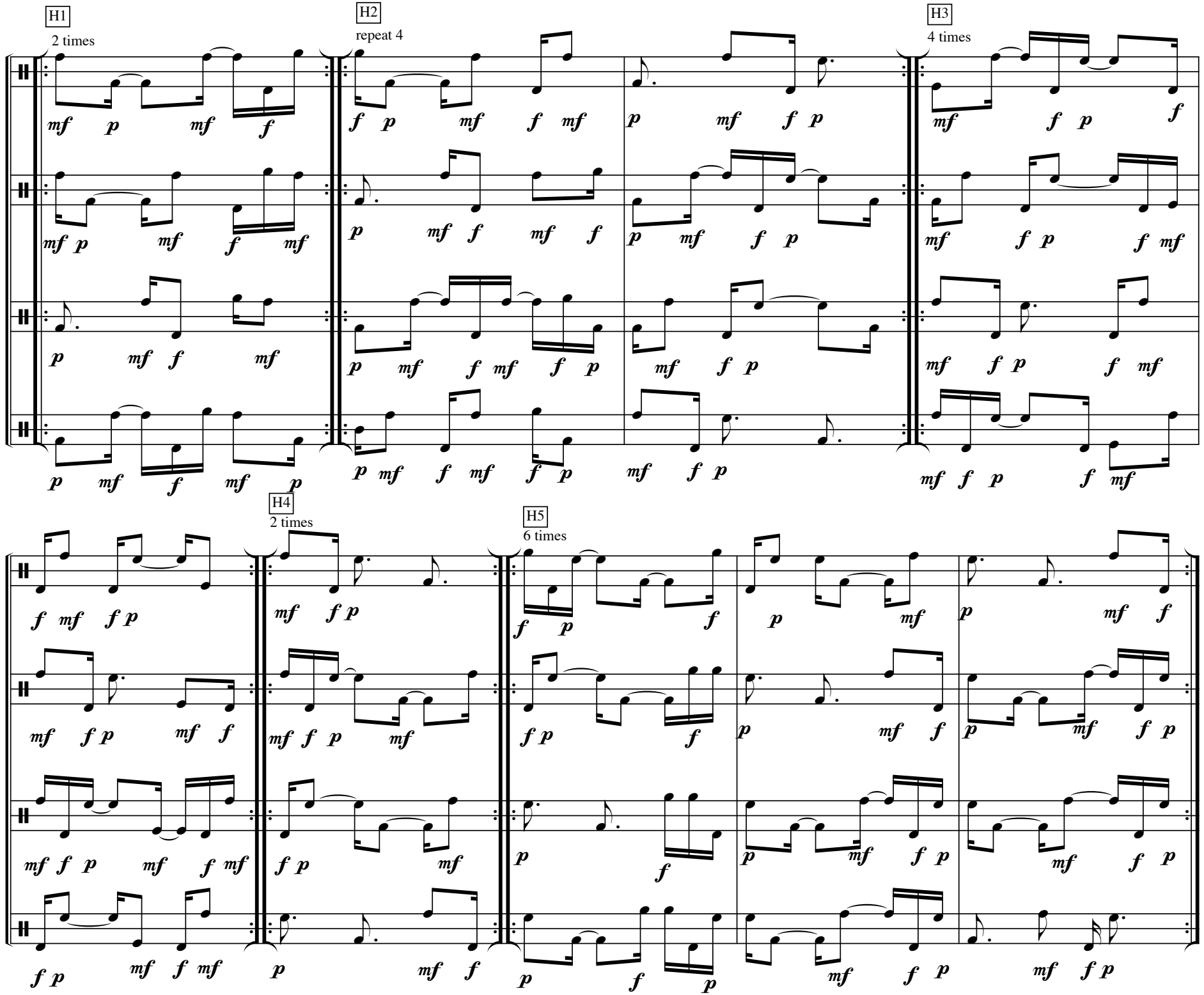

C1
2 times
C2
6 times
C3
6 times
C4
4 times
1
2
3
4

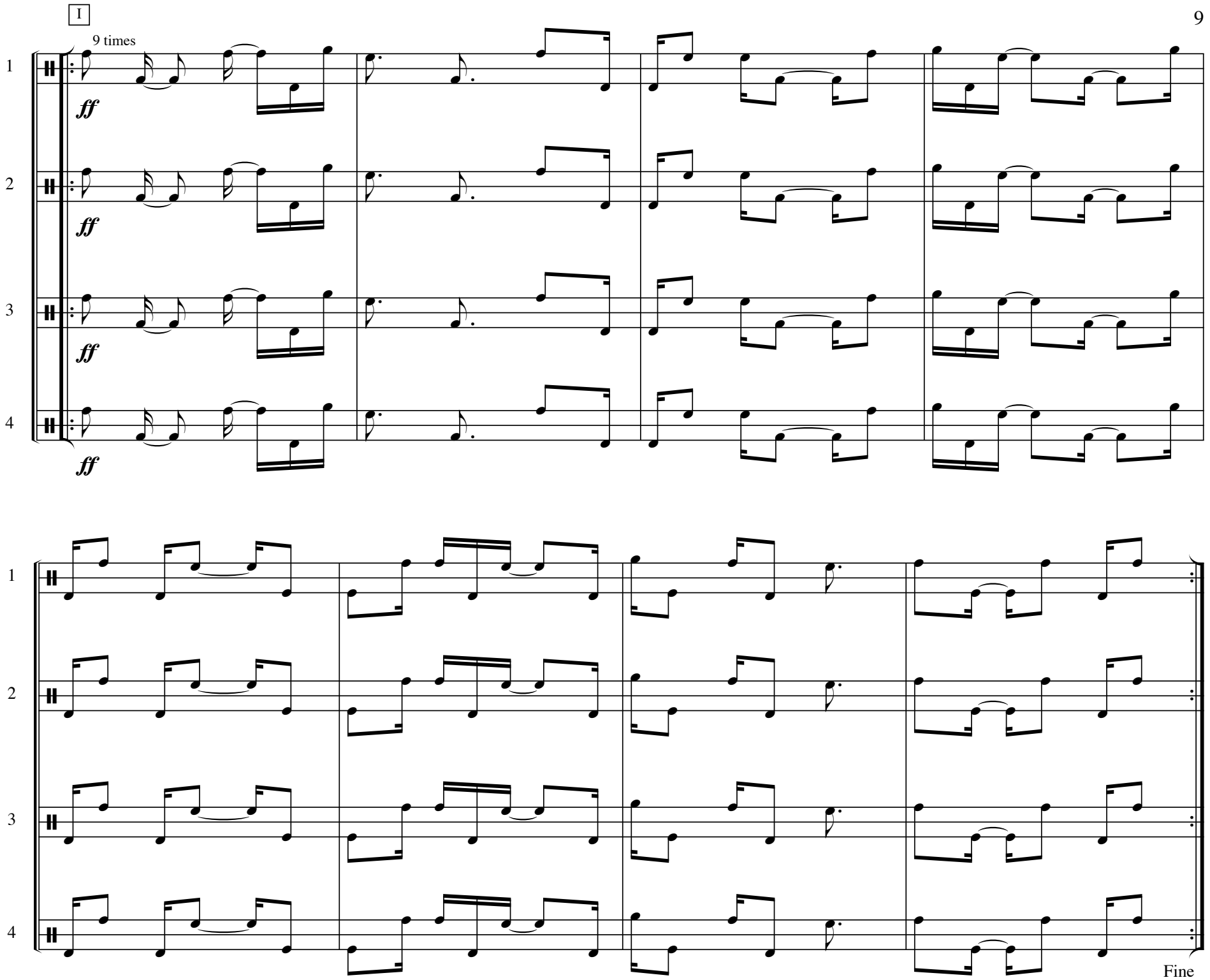

D1
2 times
D2
2 times
D3
6 times
D4
6 times
D5
2 times
1
2
3
4
pp


E1
4 times
E2
2 times
E3
6 times
E4
6 times
1
2
3
4


F1
2 times
F2
4 times
F3
2 times
F4
6 times
F5
4 times
1
2
3
4

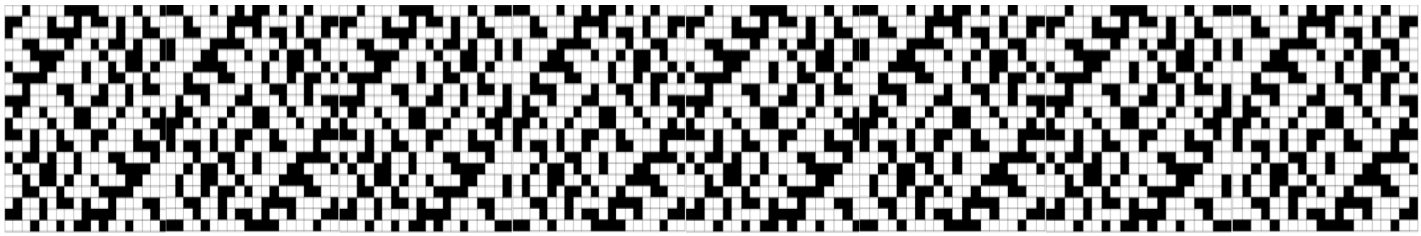

G
1
2
3
4
1
2
3
4


H1
2 times
H2
repeat 4
H3
4 times
H4
2 times
H5
6 times
1
2
3
4


I
9 times
1
2
3
4
ff
Fine

Egidija Medekšaitė

HABOTAI



for String Quartet and Piano

Programme note:

The term Habotai derives from the definition of Chinese silk, and means ‘soft as down’. It signifies a plain-weave fabric with a smooth, lustrous surface that corresponds to silk painting techniques. The composition explores the transparency and fragility of the Habotai pattern through a dichotomy between timbre and harmony. These characteristics derive from the Habotai textile fabric based on a crêpe weave.

Scoring:

Violin I
Violin II
Viola
Violoncello
Piano

Explanatory notes:

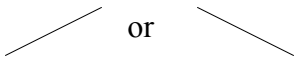
A recurrent feature throughout this work is the use of double-stopped glissandi on harmonics, always played *flautando*, at occasions changing from minor to major thirds and/or visa versa. The intended sound is one in which there is a constant shifting between noise and harmonics.

 - natural harmonics

 - slow tremolo, approximately in quavers

 - medium tremolo, approximately between quavers and semiquavers

 - fast tremolo, approximately between semiquavers and demisequavers

 - glissando up and down

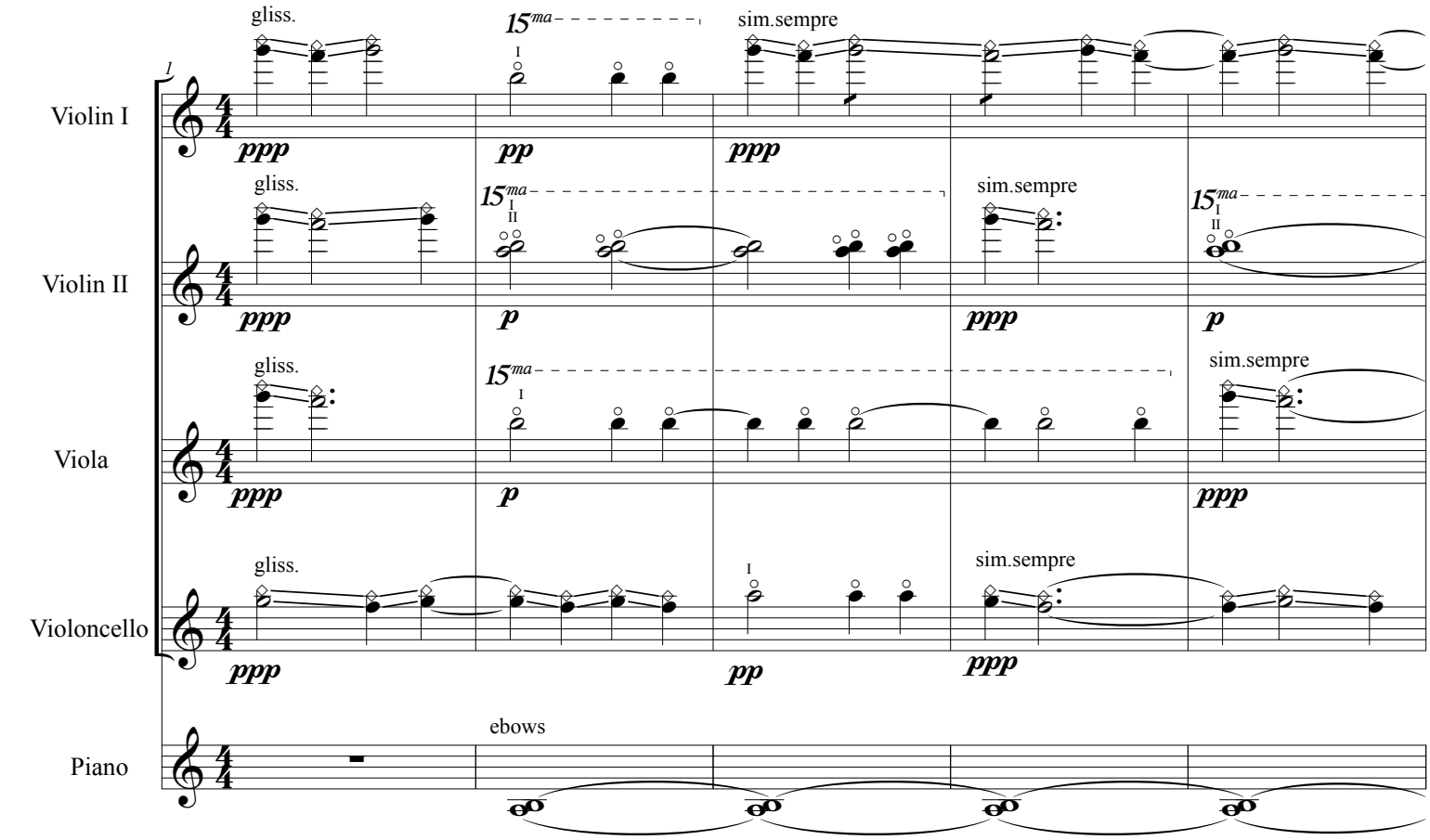
The pianist uses three ebows.

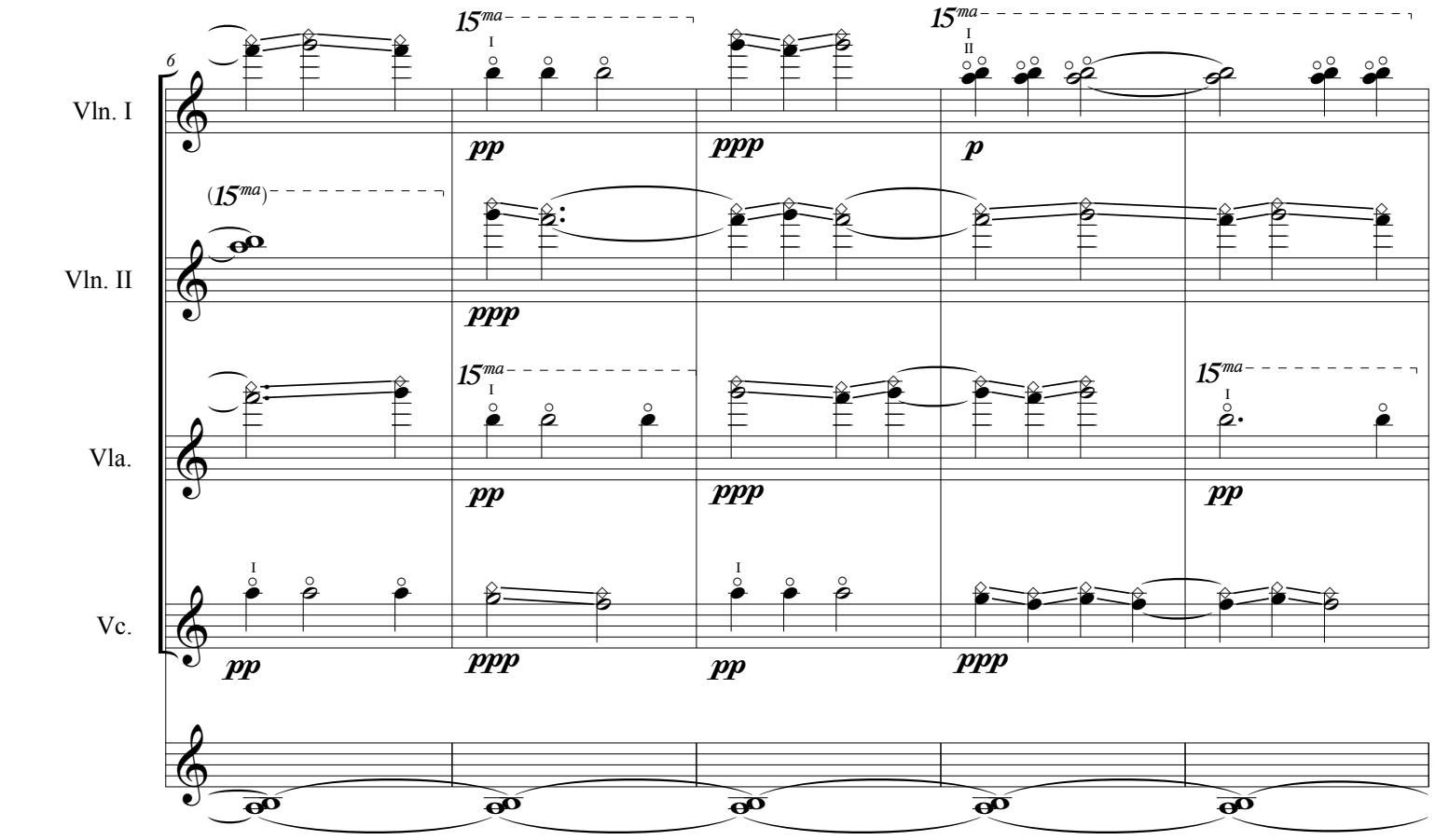
Duration: ± 12 minutes

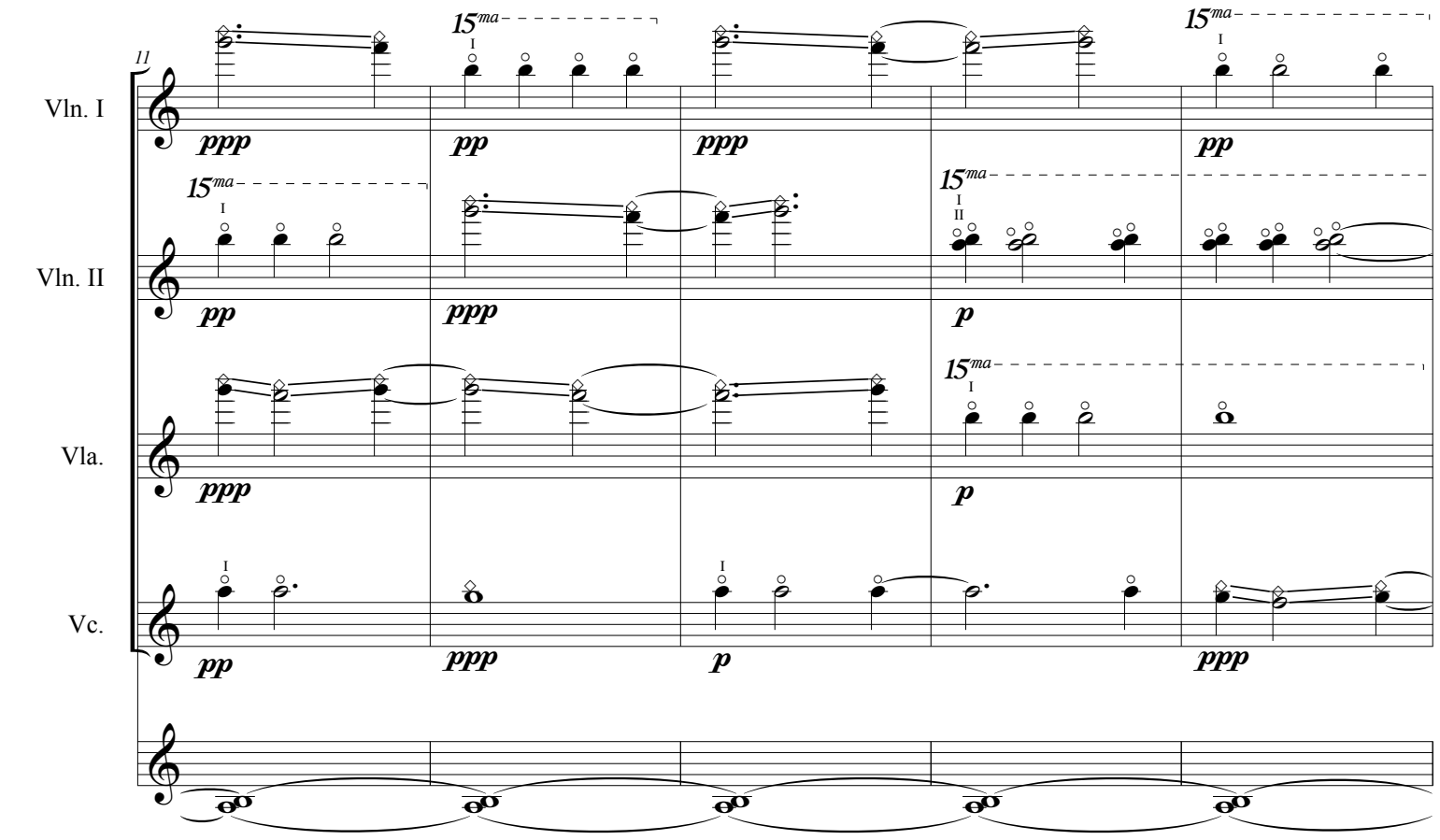
Score ♩ = 48

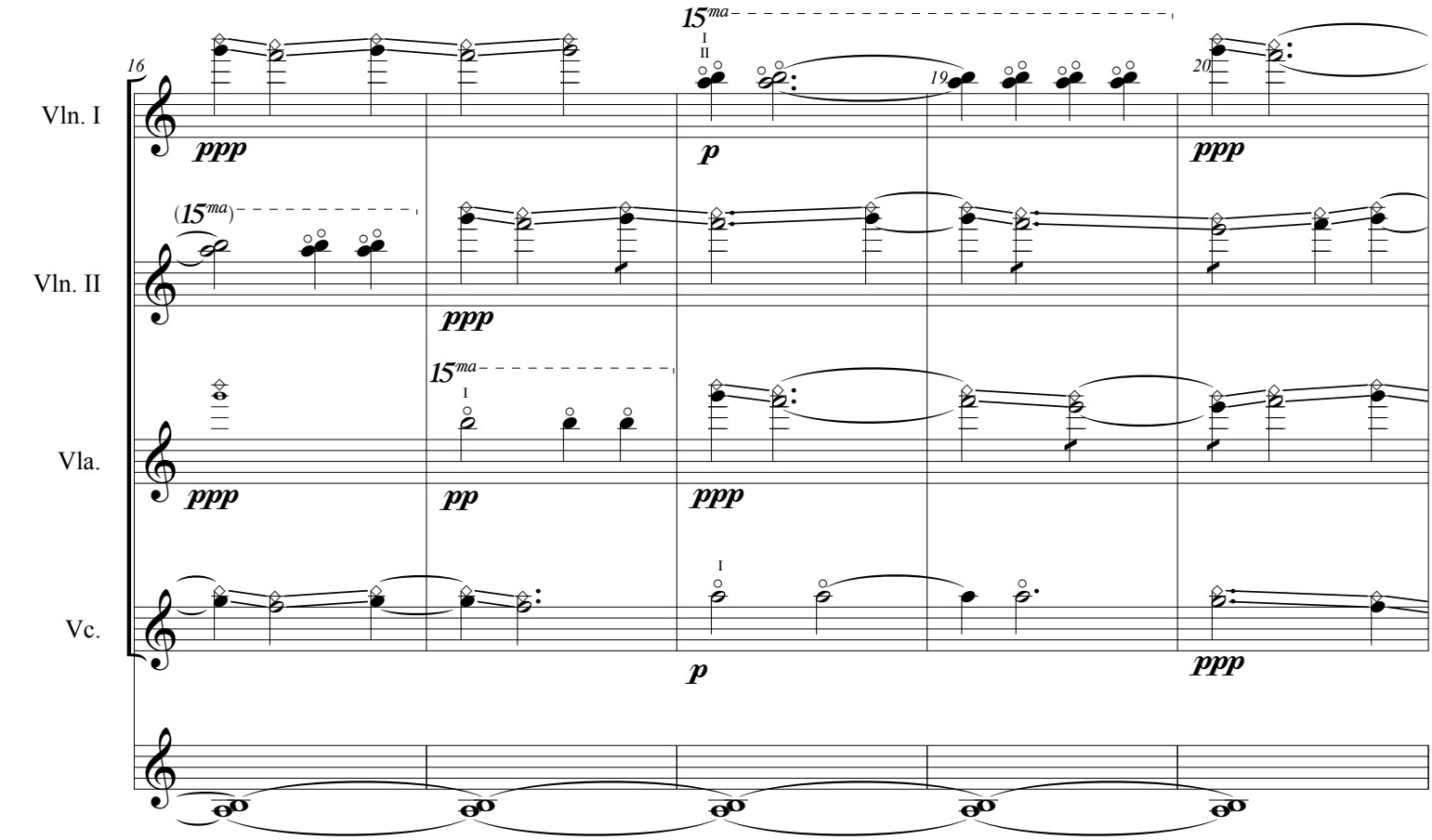
HABOTAI

Egidija Medeksaite (2012)

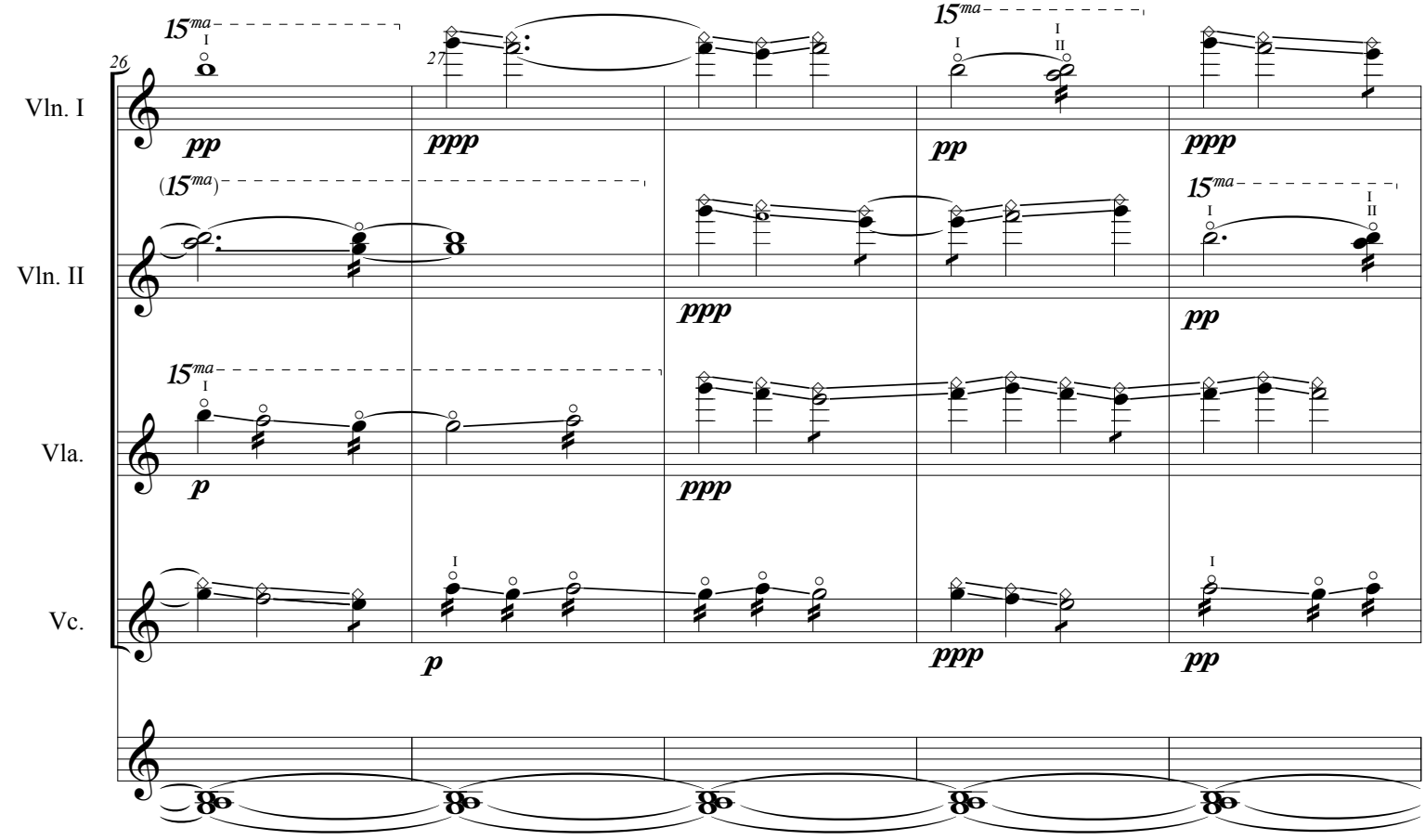


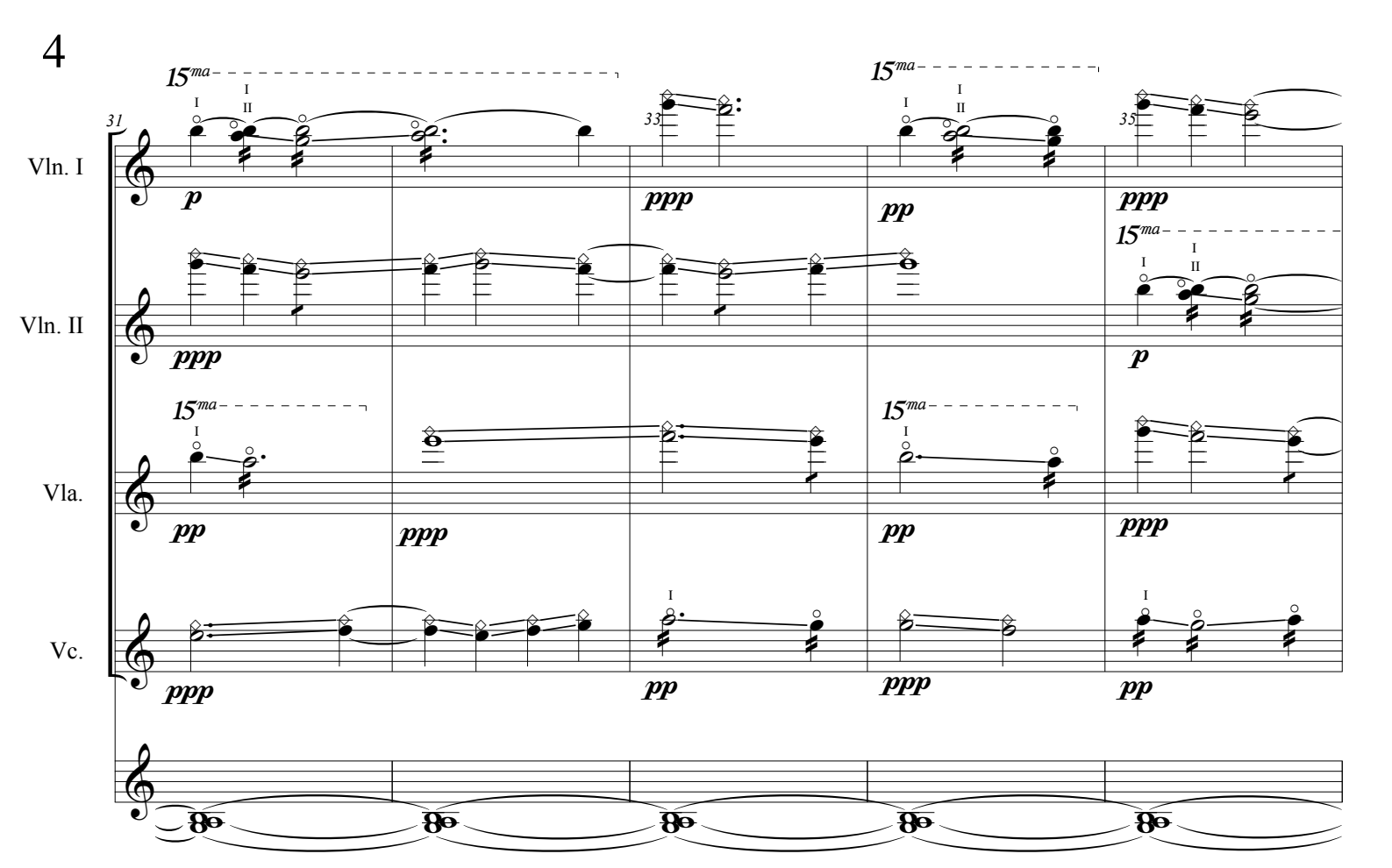


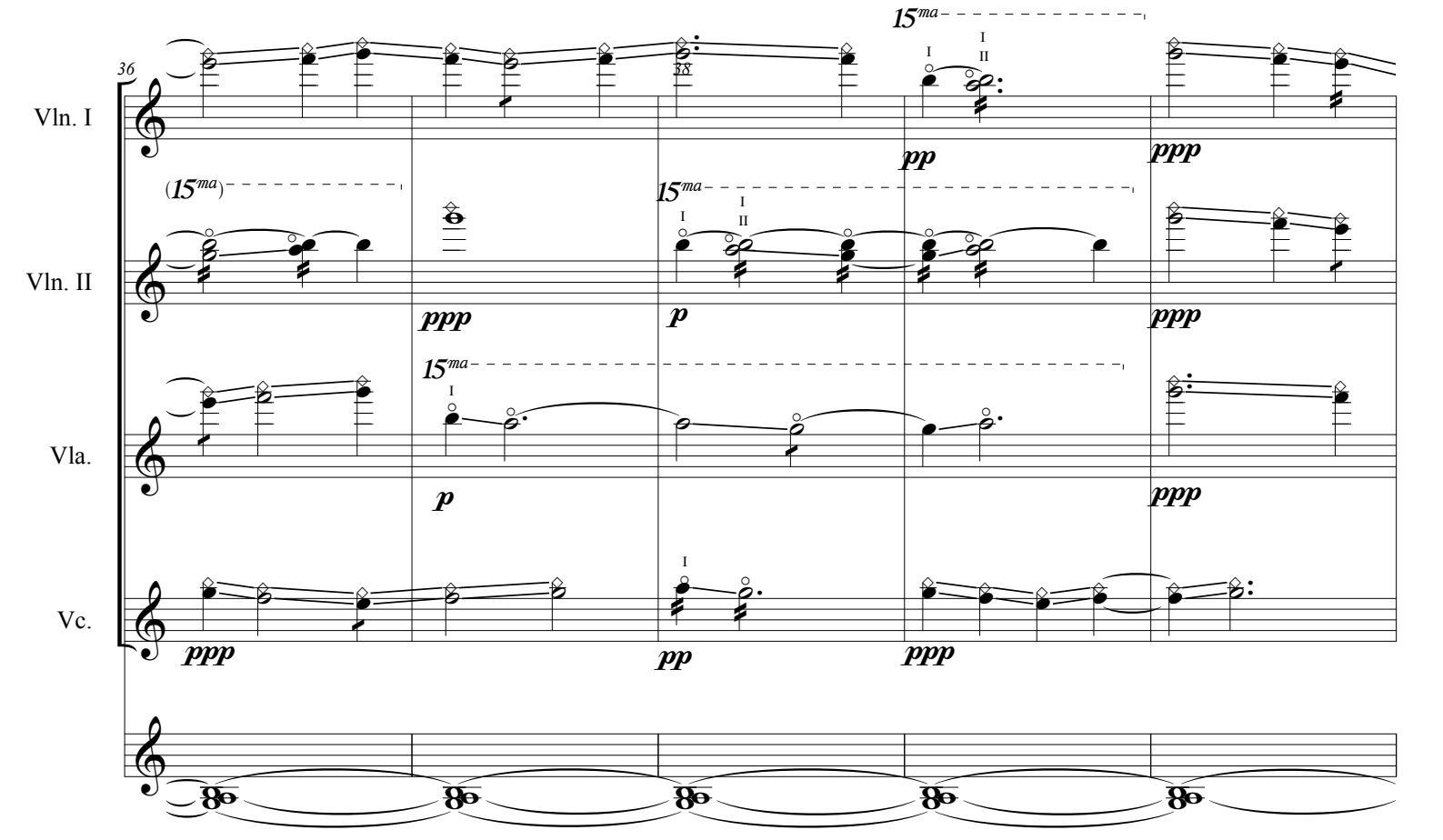

11
Vln. I
Vln. II
Vla.
Vc.
15ma
ppp
pp
p

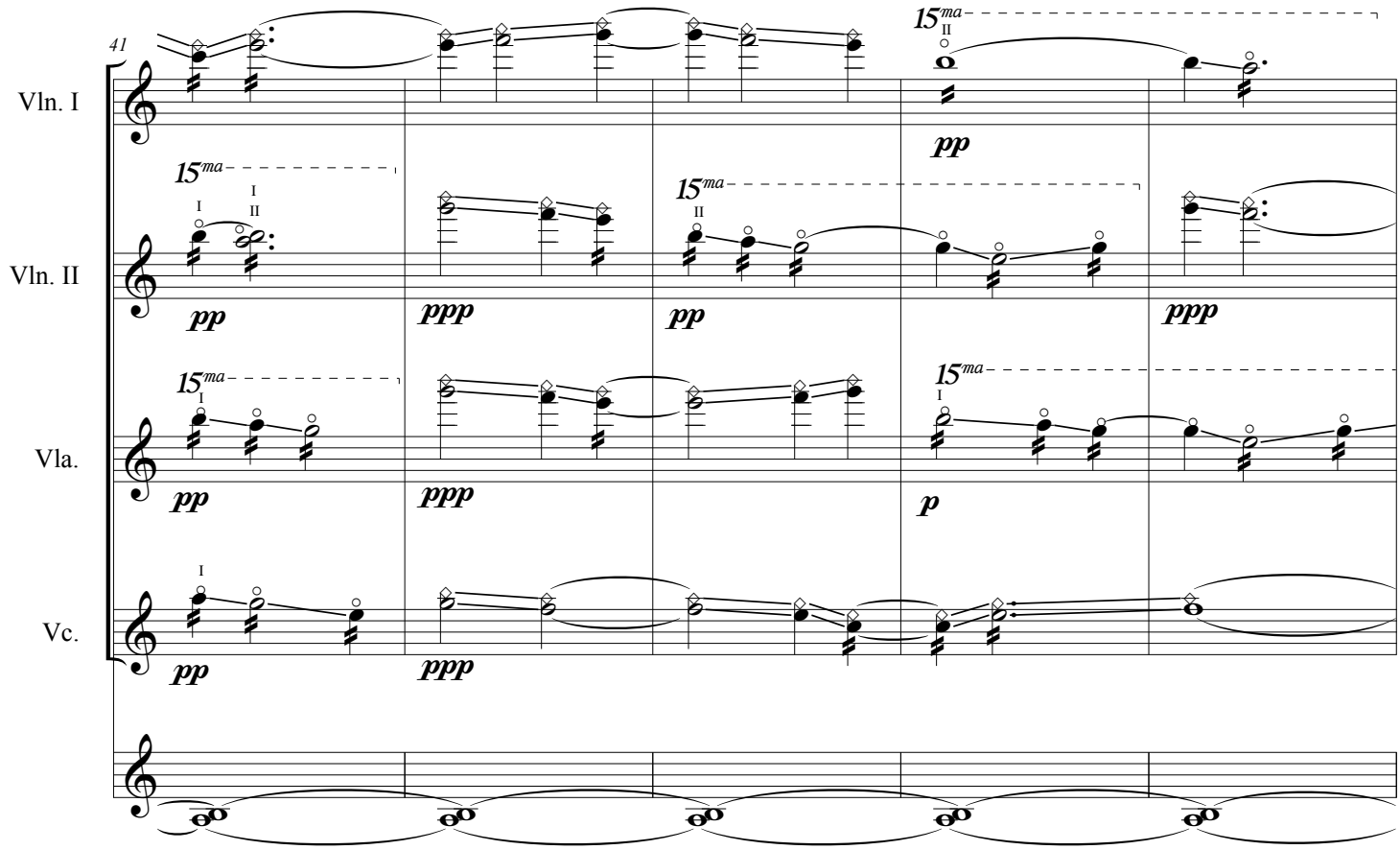

16
19
20
Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
ppp
pp
p

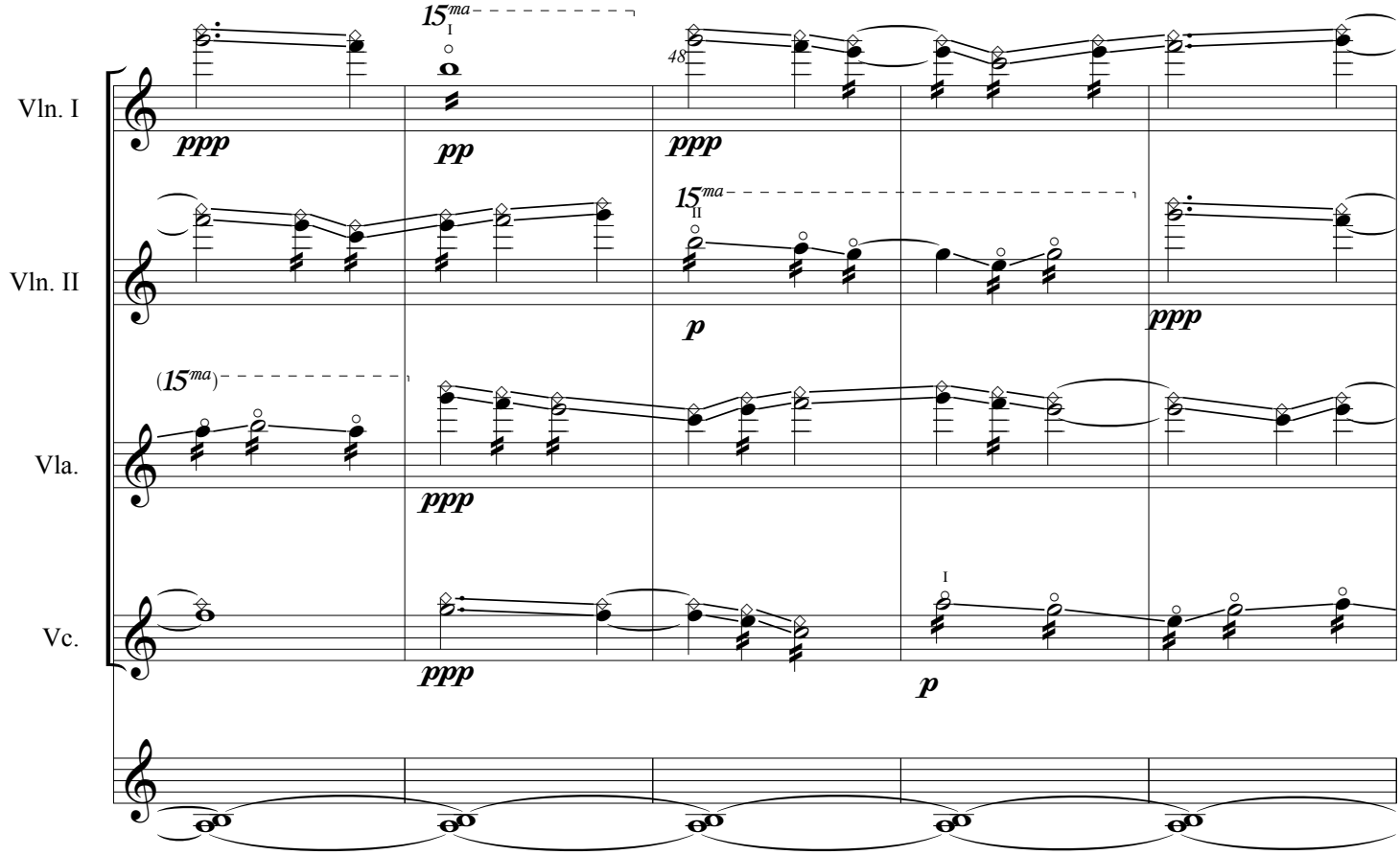

21
24
Vln. I
Vln. II
Vla.
Vc.
15ma
I
II
p
ppp

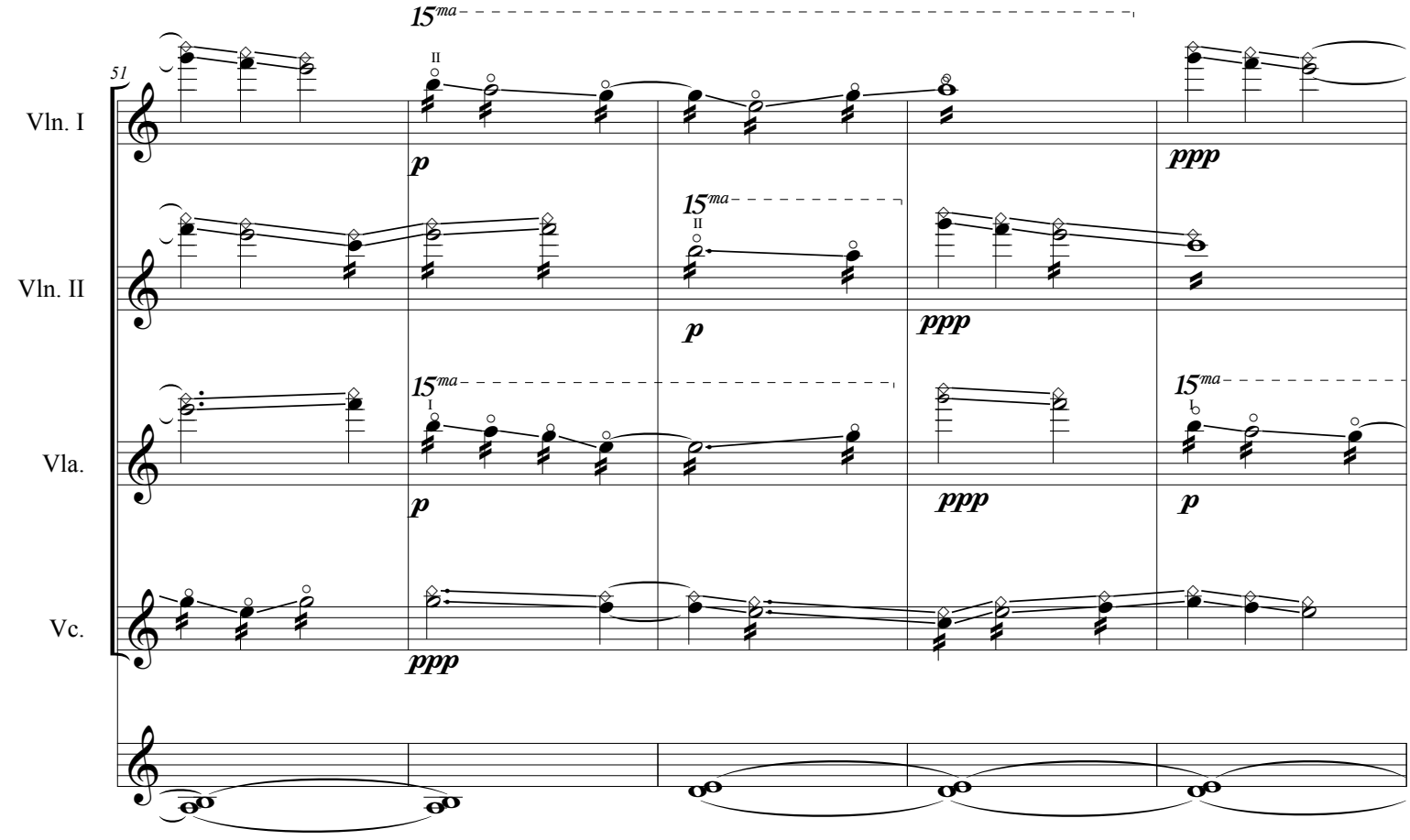

26
27
Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
I
II
pp
ppp
p

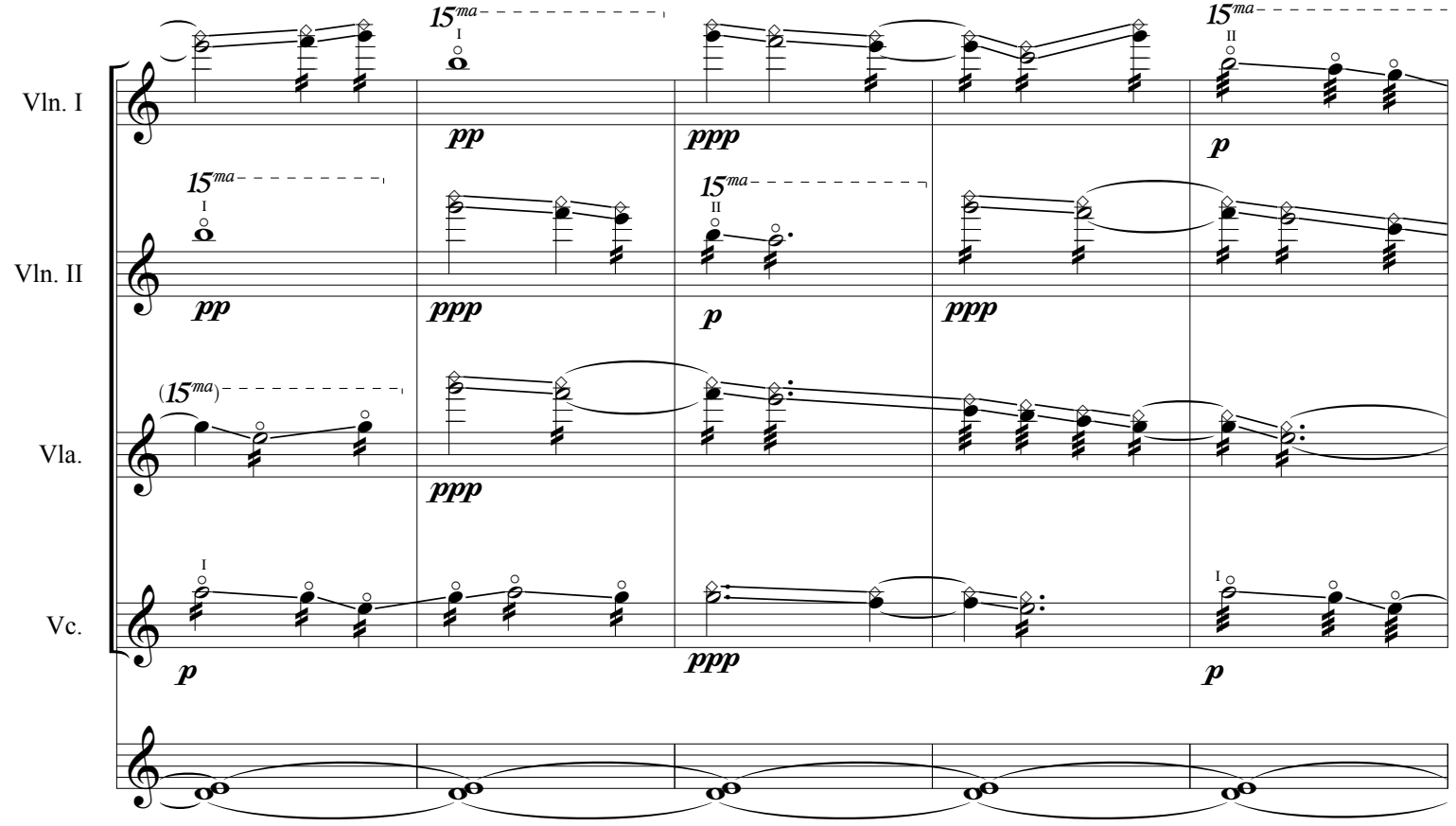

31
33
35
Vln. I
Vln. II
Vla.
Vc.
15ma
p
ppp
pp

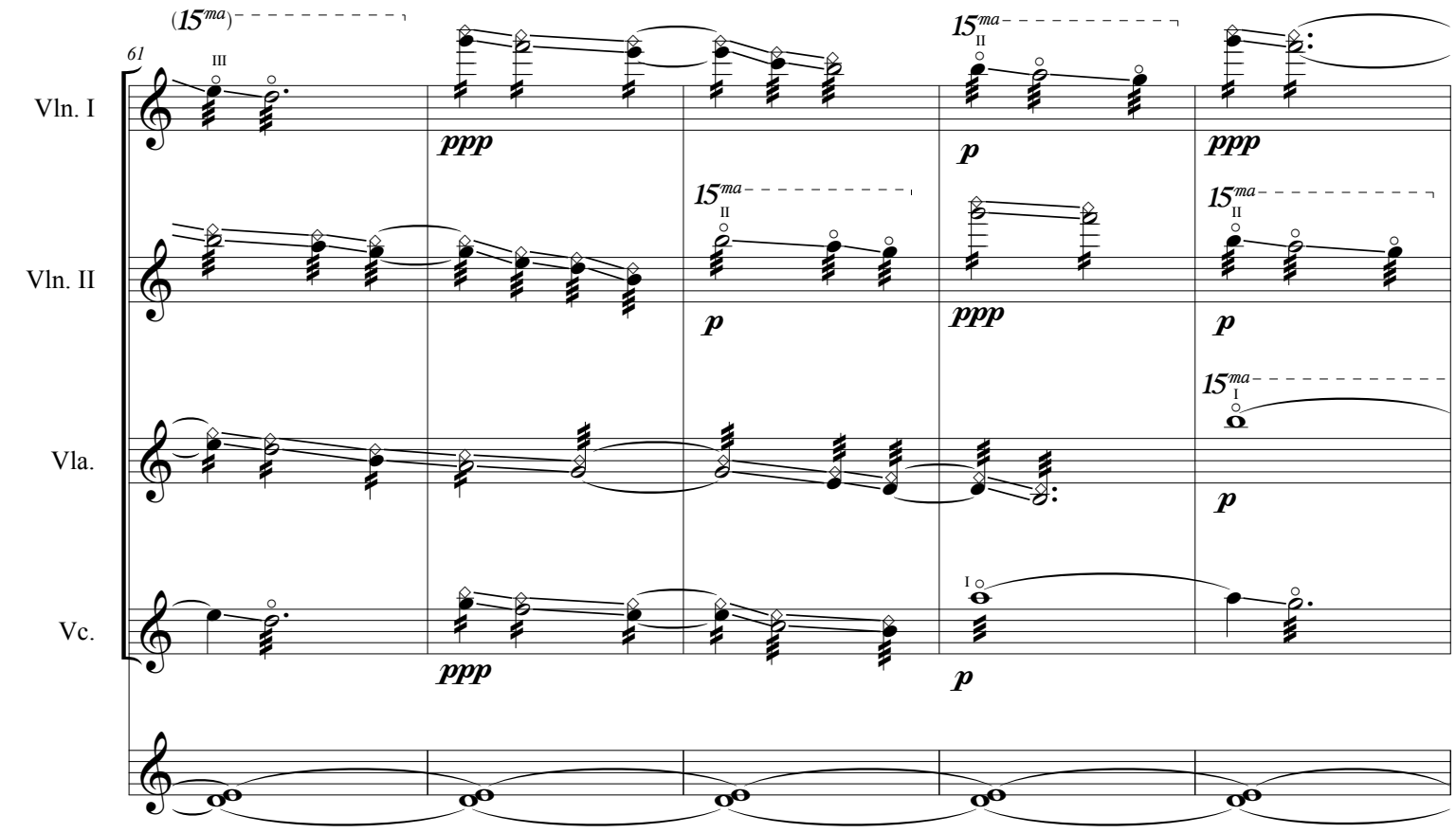

36
38
Vln. I
Vln. II
Vla.
Vc.
(15ma)
15ma
p
ppp
pp

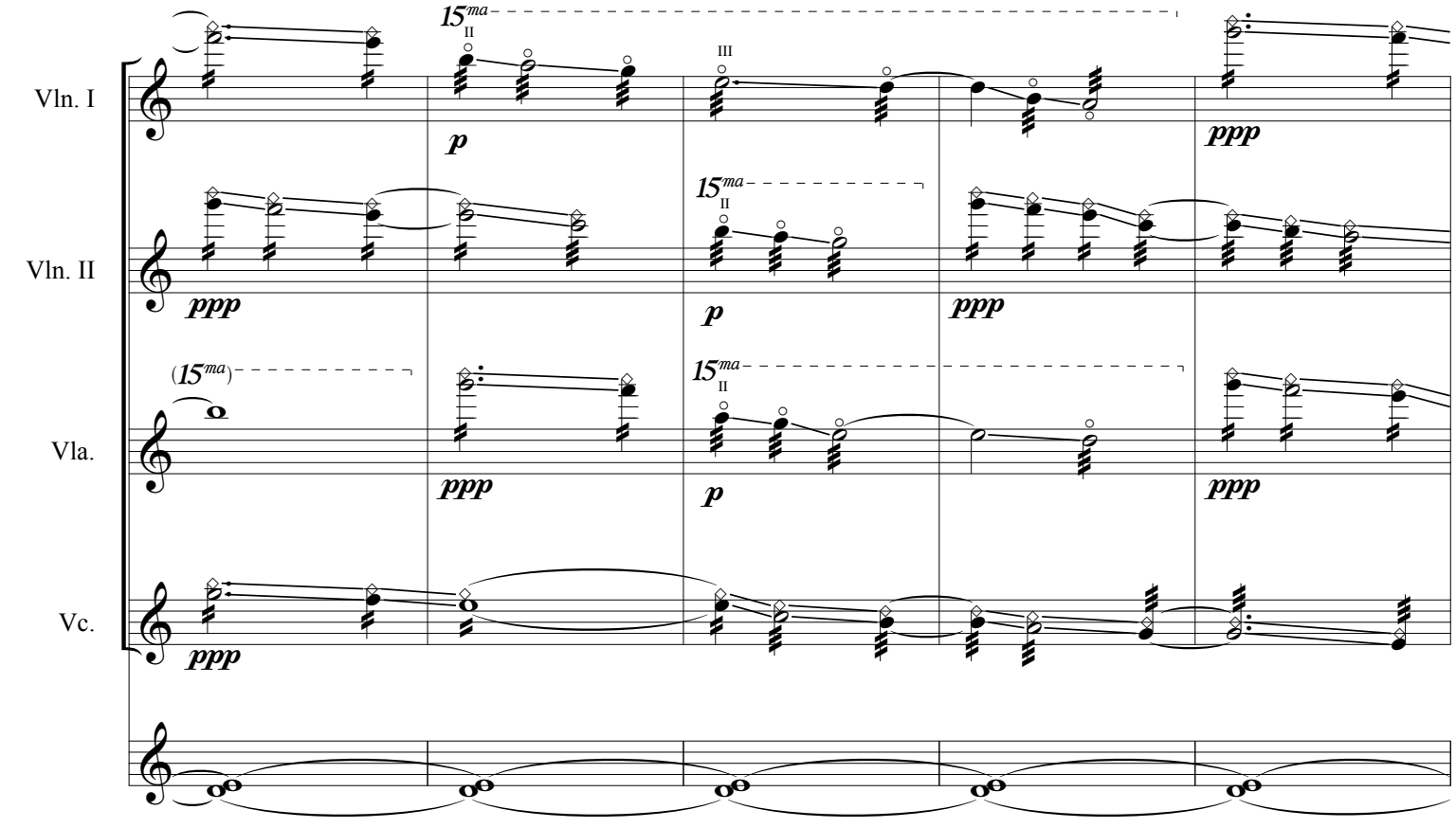

41
Vln. I
Vln. II
Vla.
Vc.
15ma
pp
ppp
p

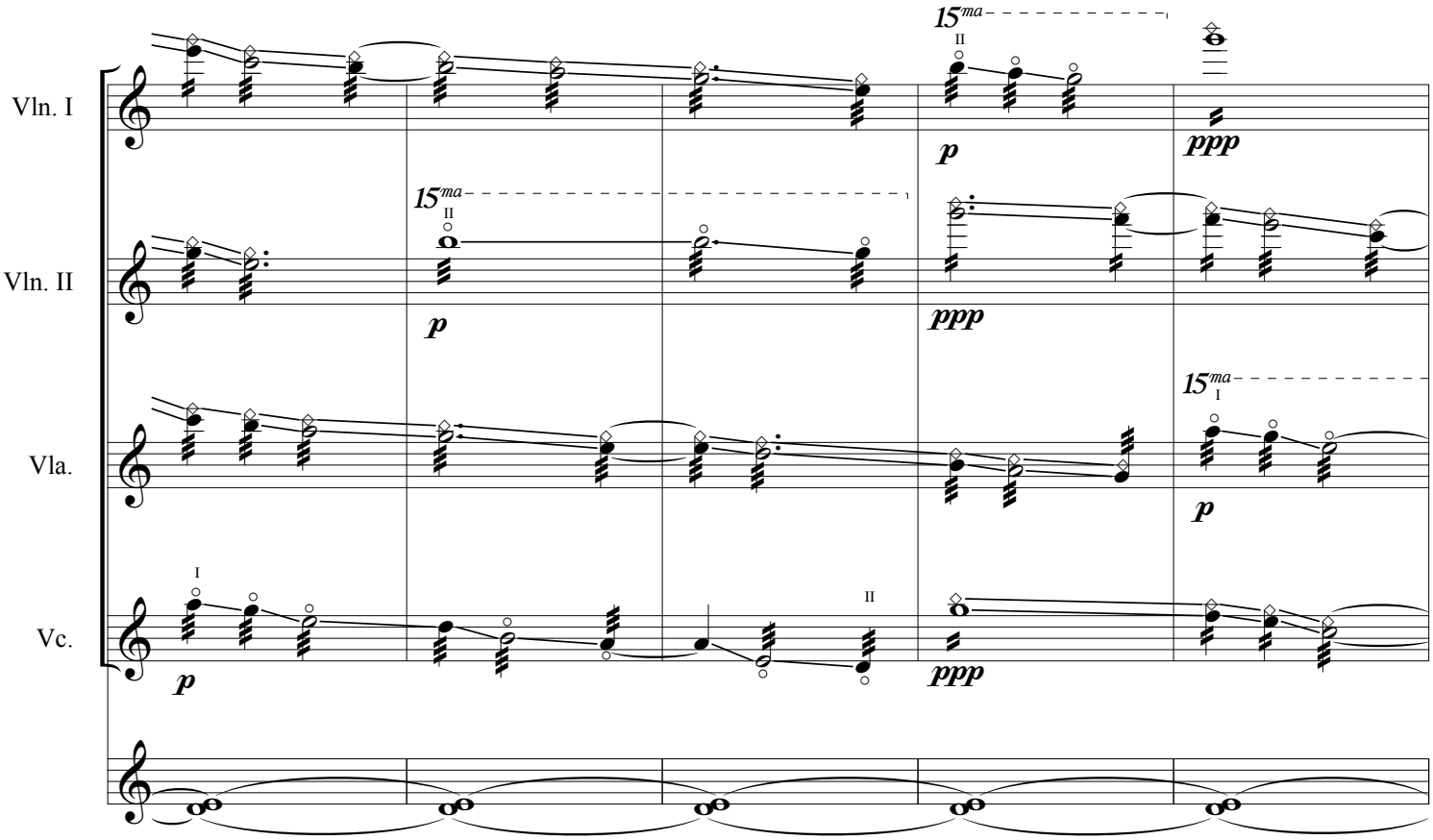

48
Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
ppp
pp
p

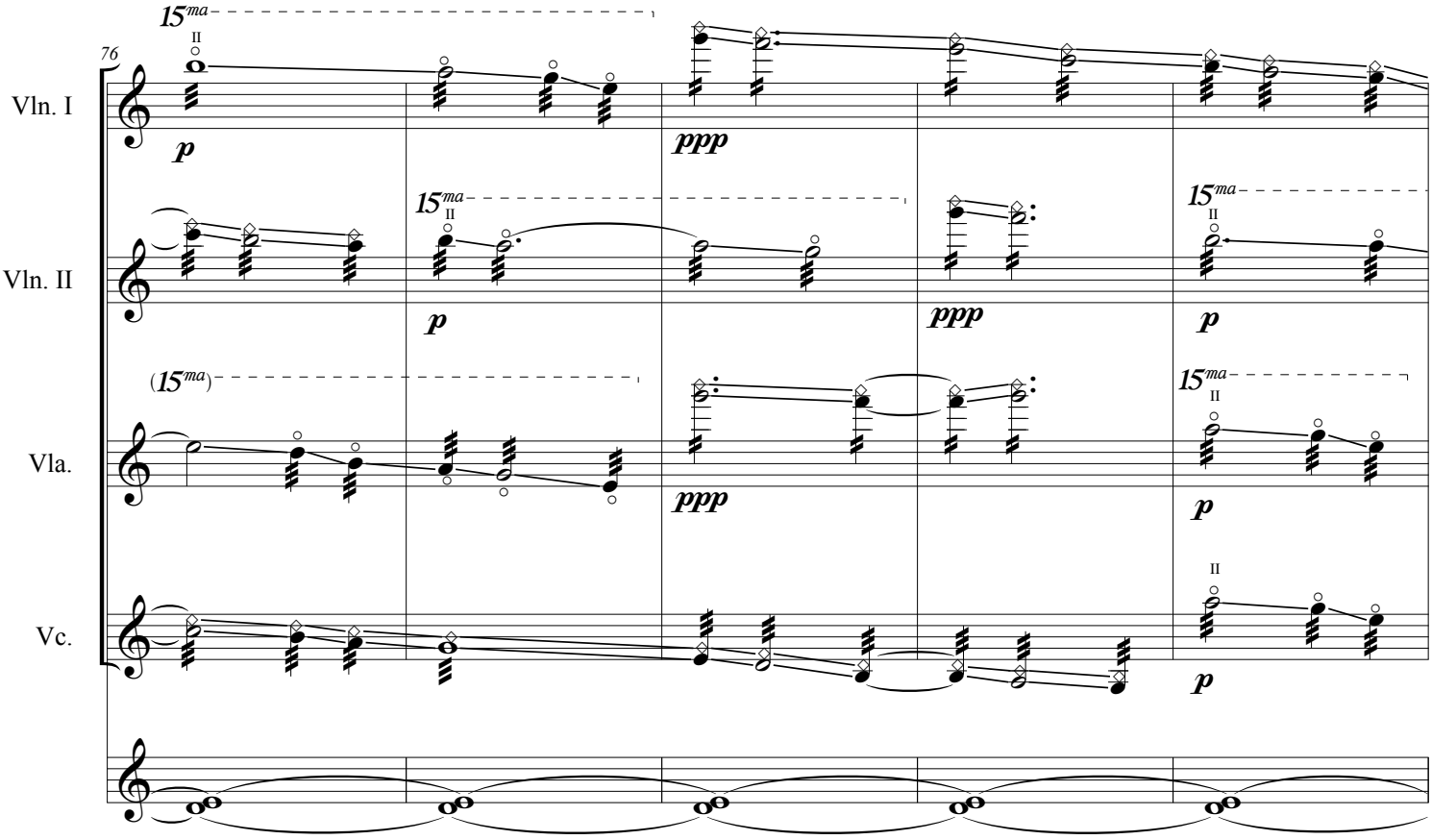

51
Vln. I
Vln. II
Vla.
Vc.
15ma
p
ppp

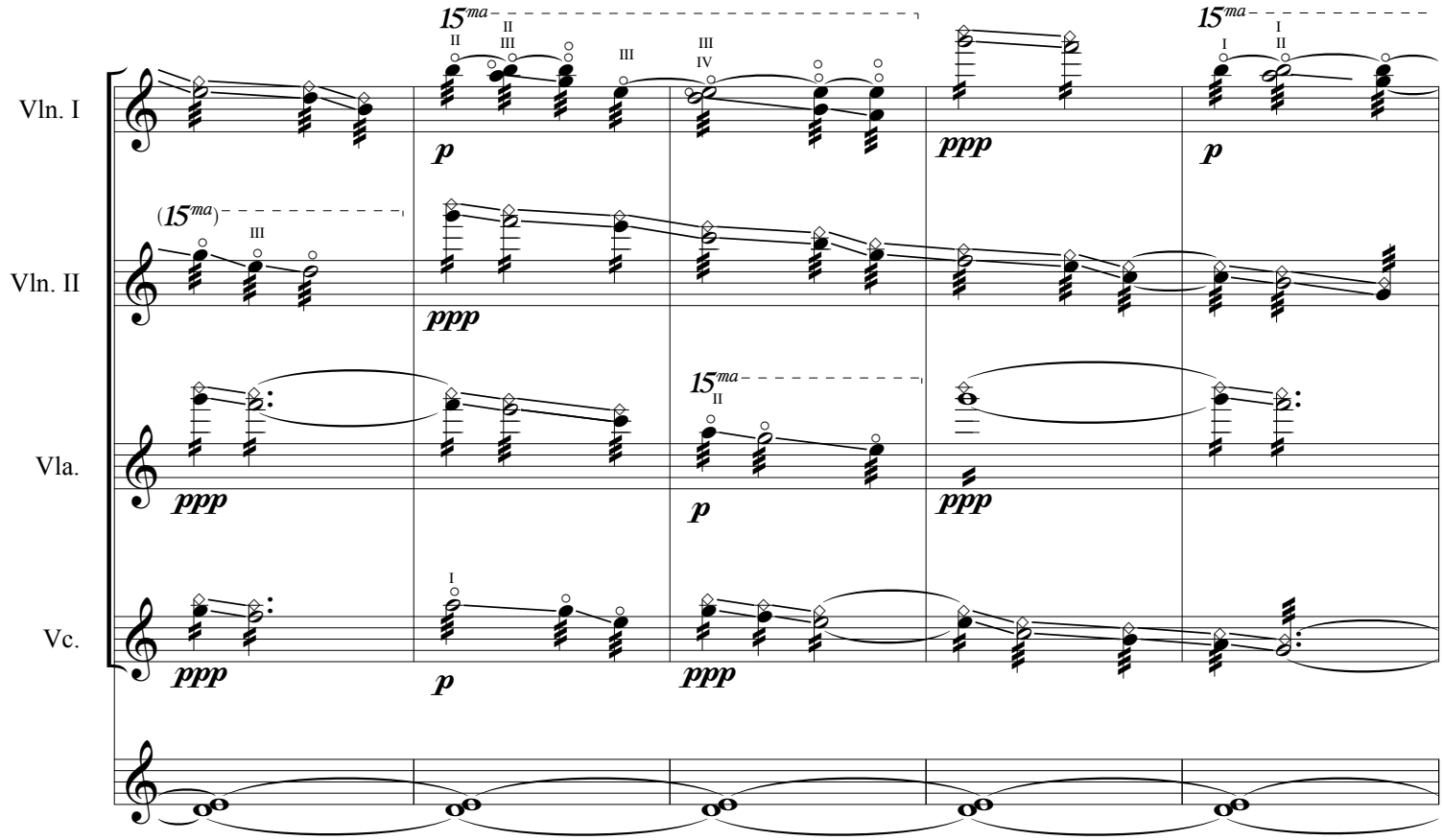

Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
pp
ppp
p

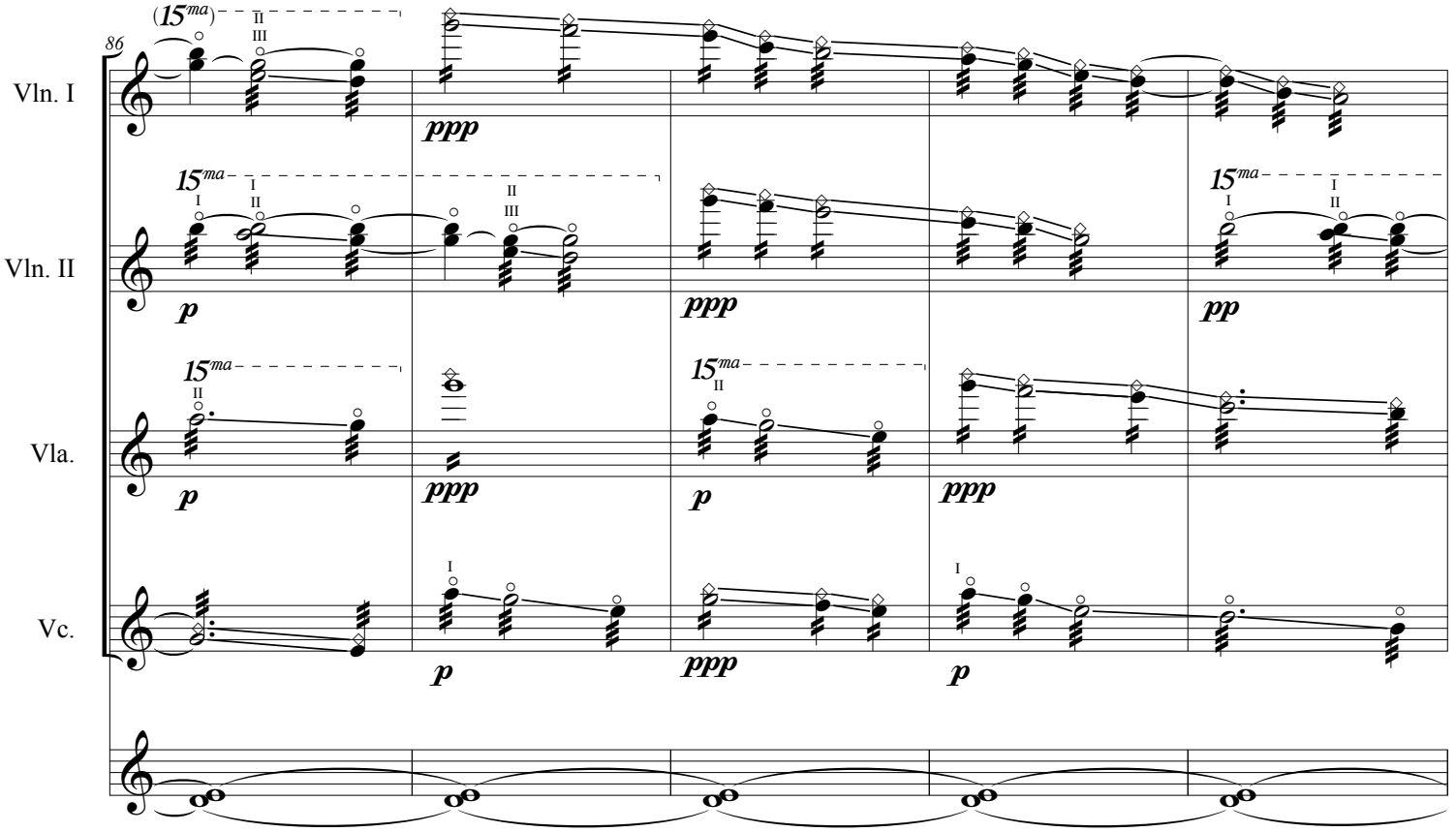

61
Vln. I
Vln. II
Vla.
Vc.
(15ma)
15ma
III
II
I
ppp
p

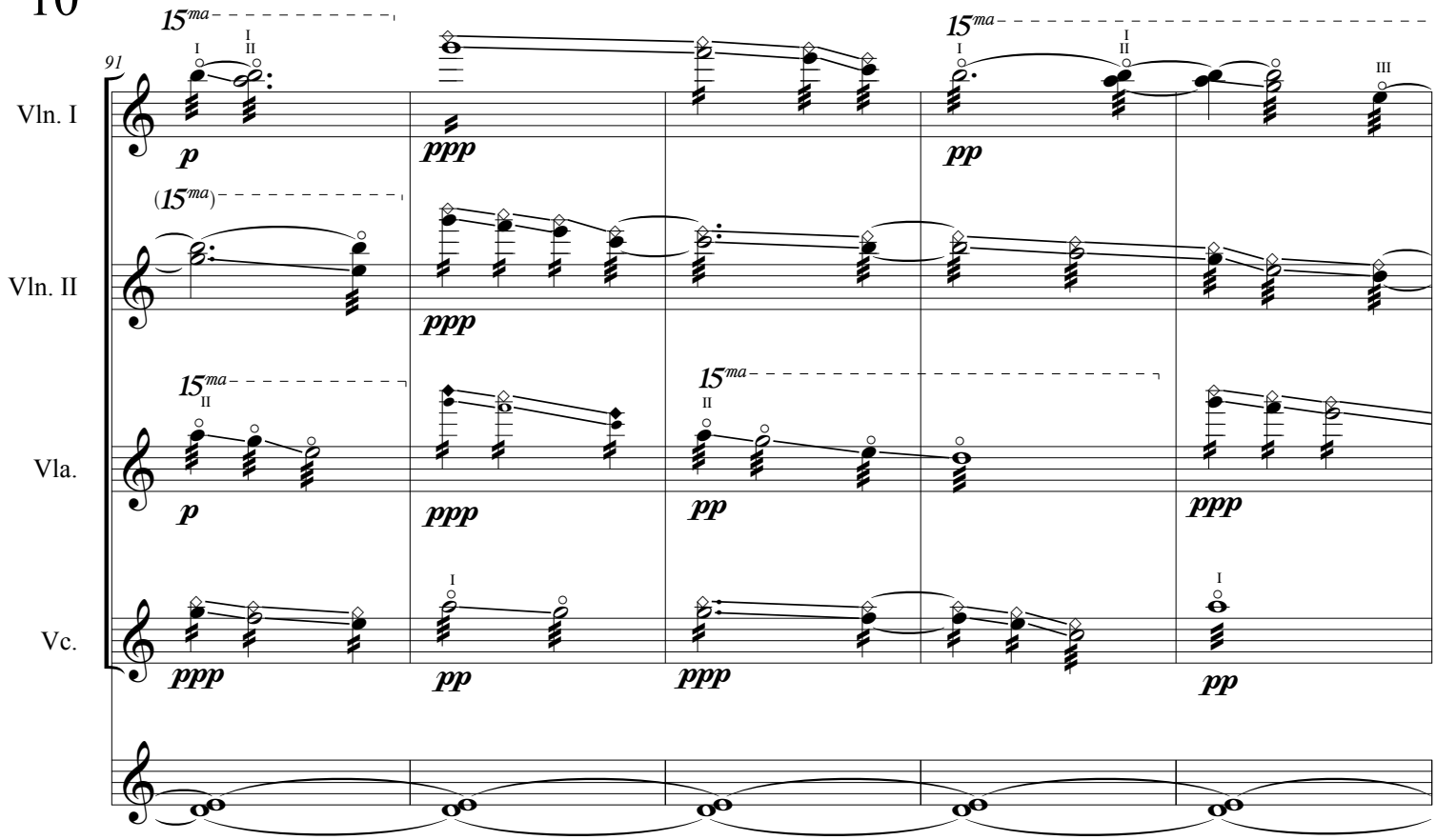

Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
II
III
I
ppp
p

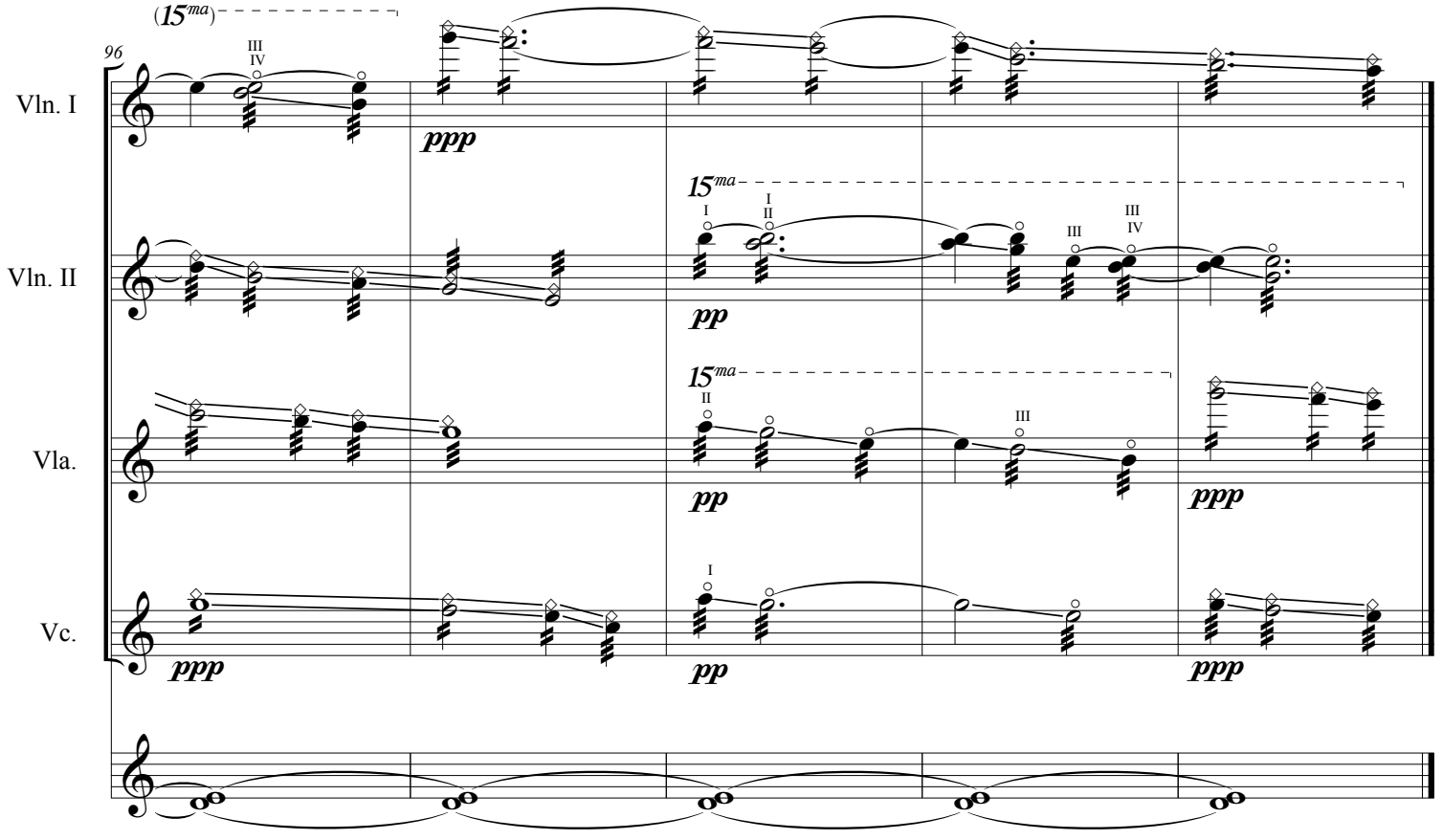

Vln. I
Vln. II
Vla.
Vc.
15ma
II
p
ppp
15ma
I
I
II


76
Vln. I
Vln. II
Vla.
Vc.
15ma
II
p
ppp
(15ma)
15ma
I


Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
p
ppp

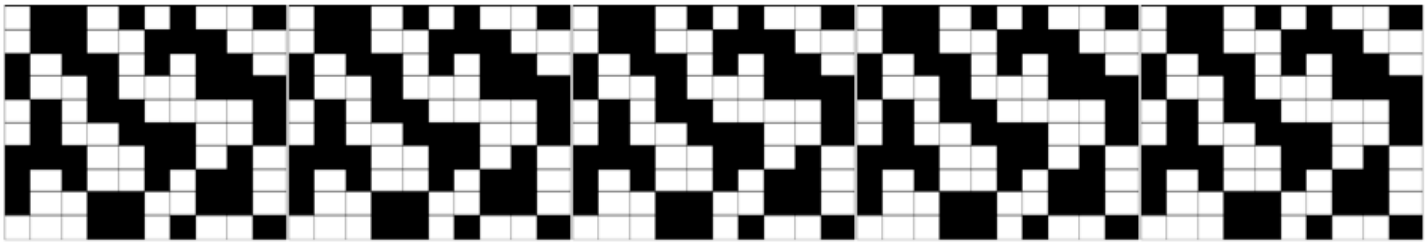

86
Vln. I
Vln. II
Vla.
Vc.
(15ma)
15ma
p
pp
ppp


91
Vln. I
Vln. II
Vla.
Vc.
15ma
(15ma)
p
ppp
pp


96
Vln. I
Vln. II
Vla.
Vc.
(15ma)
15ma
ppp
pp

Egidija Medekšaitė

MOORCHANA



for Oboe, Bass Clarinet in B-flat, Violin, Viola, Violoncello and Percussion

Programme note:

The composition explores the meaning of Mūrch'hanā through mapping its non-repetitive structure and its elements into "mutating" musical parameters, which gradually transform from one sonic texture to another. In addition, distinct variations of timbre and diatonic harmony, which rely on non-repetitive rhythmic patterning, highlight the unstable motion.

Scoring:

Oboe
Bass Clarinet in B-flat
Percussion (1 player)
Violin
Viola
Violoncello

Explanatory notes:

 - 1/4 tone sharp

 - 1/4 tone flat

 - Air sound

 - Slap tongue

 - Key clicks

 - Damp left hand all strings

 - Highest note of the string

 - Timbre trill

 - Timbre fingering

 - Brushes

s.t. - sul tasto

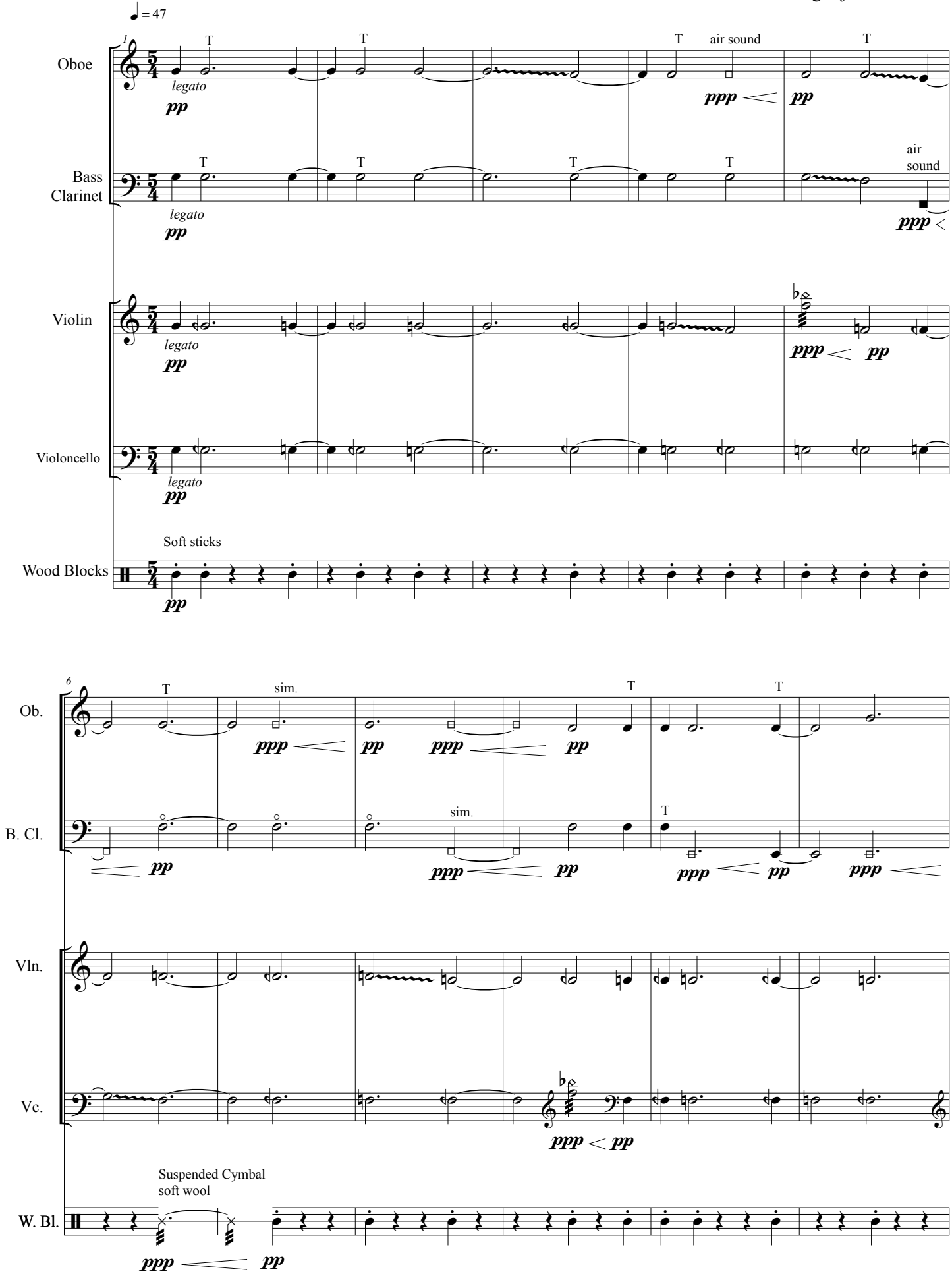
s.p. - sul ponticello

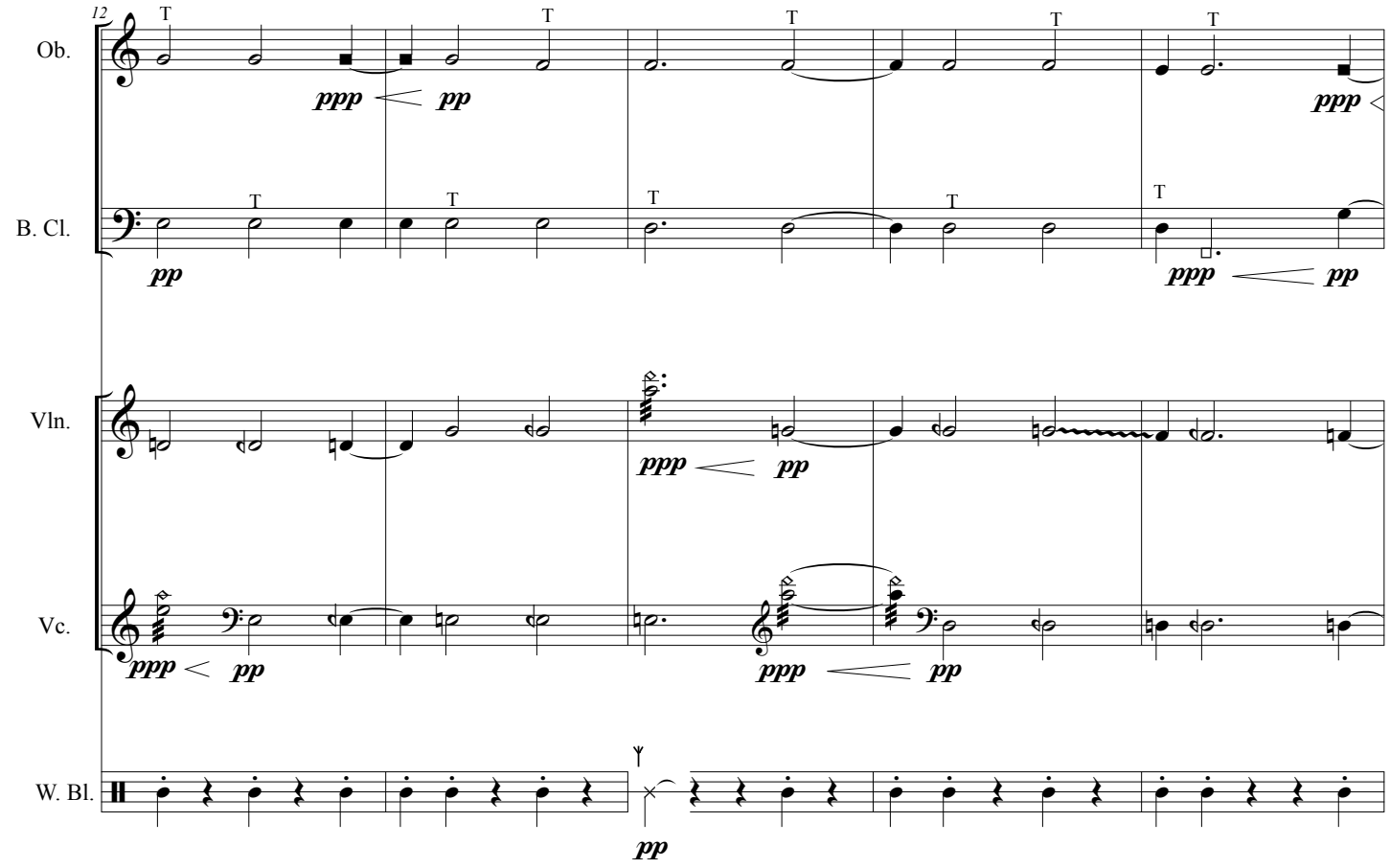
Duration: ± 13 minutes

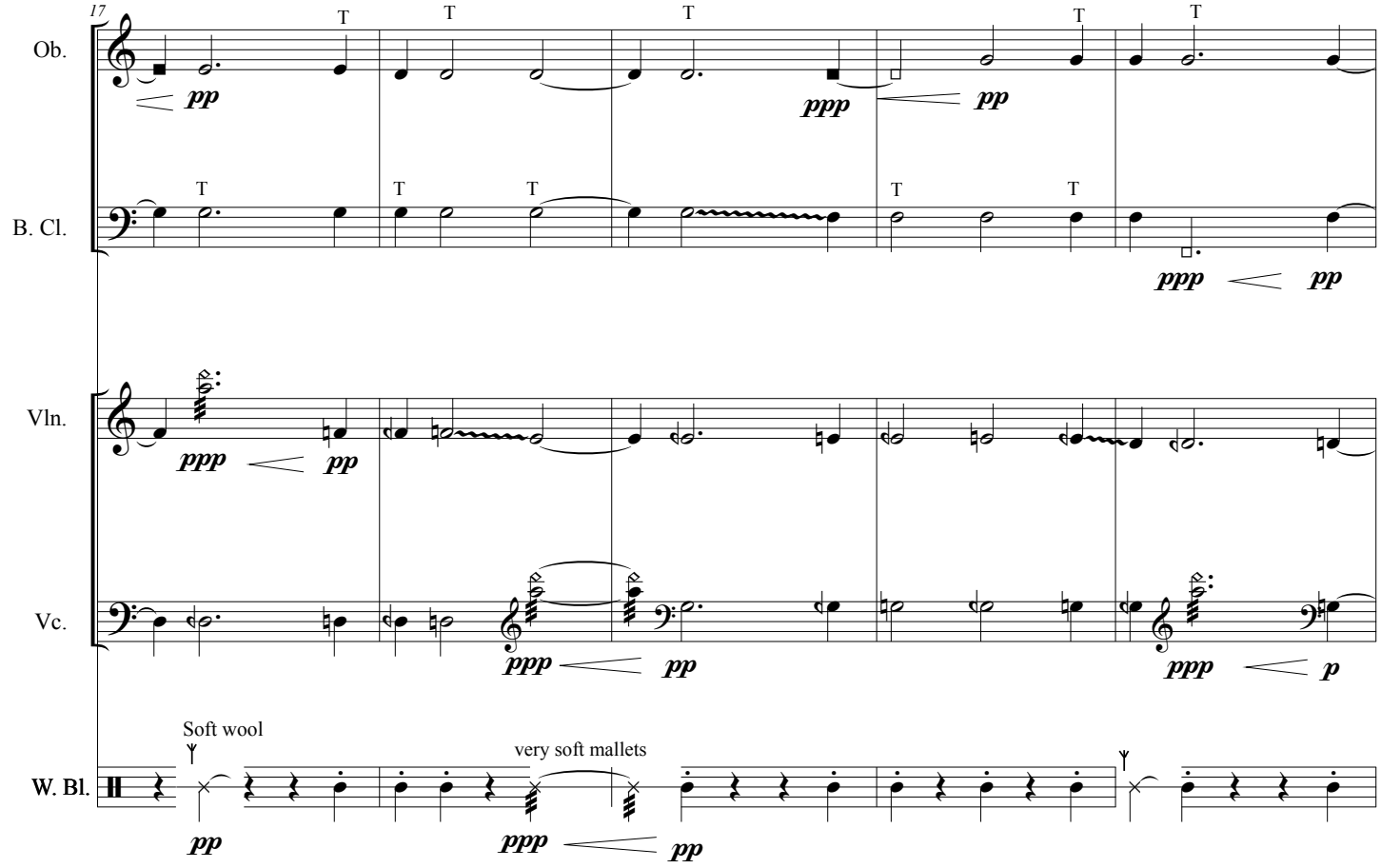
Score

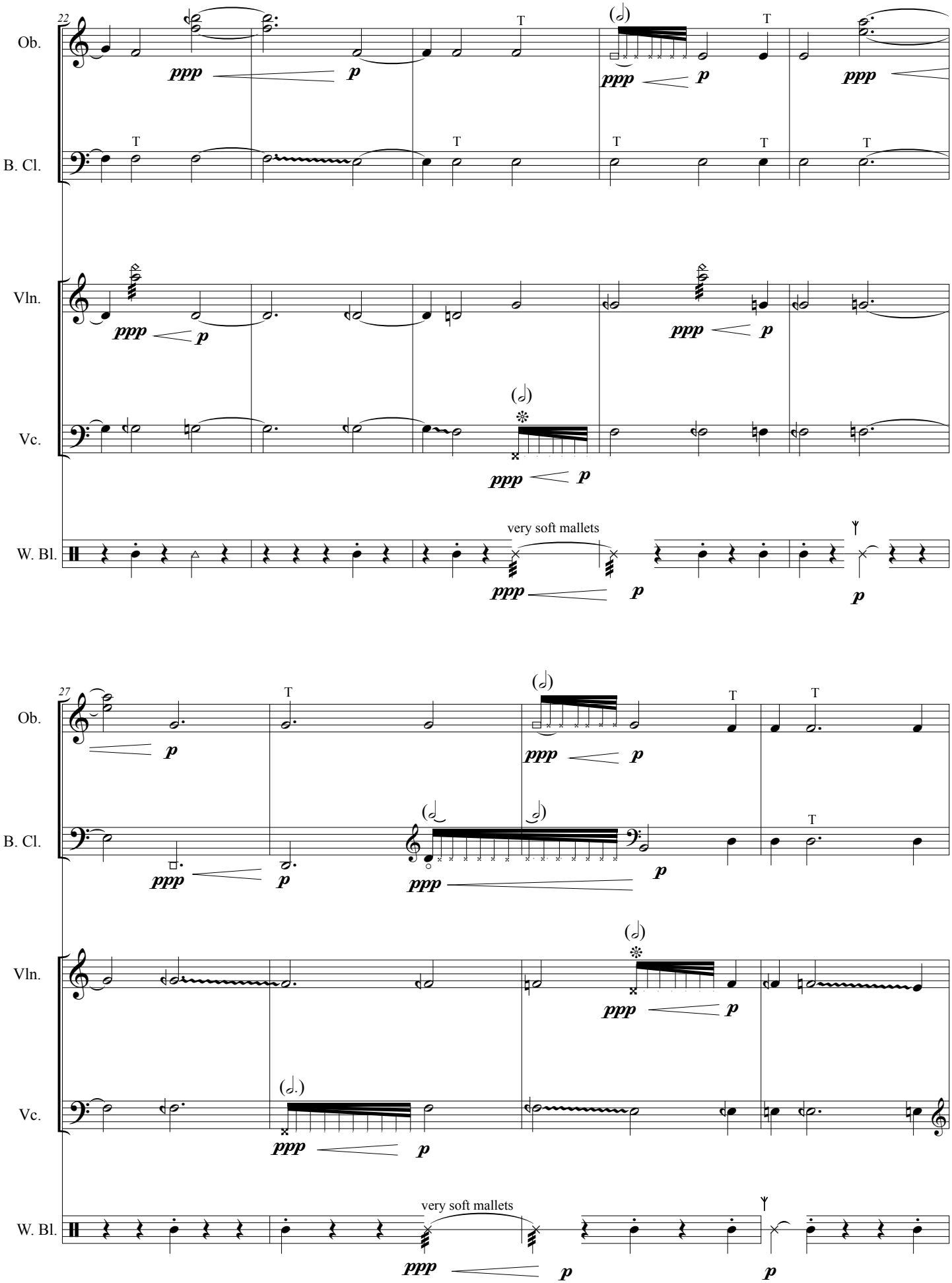
MOORCHANA

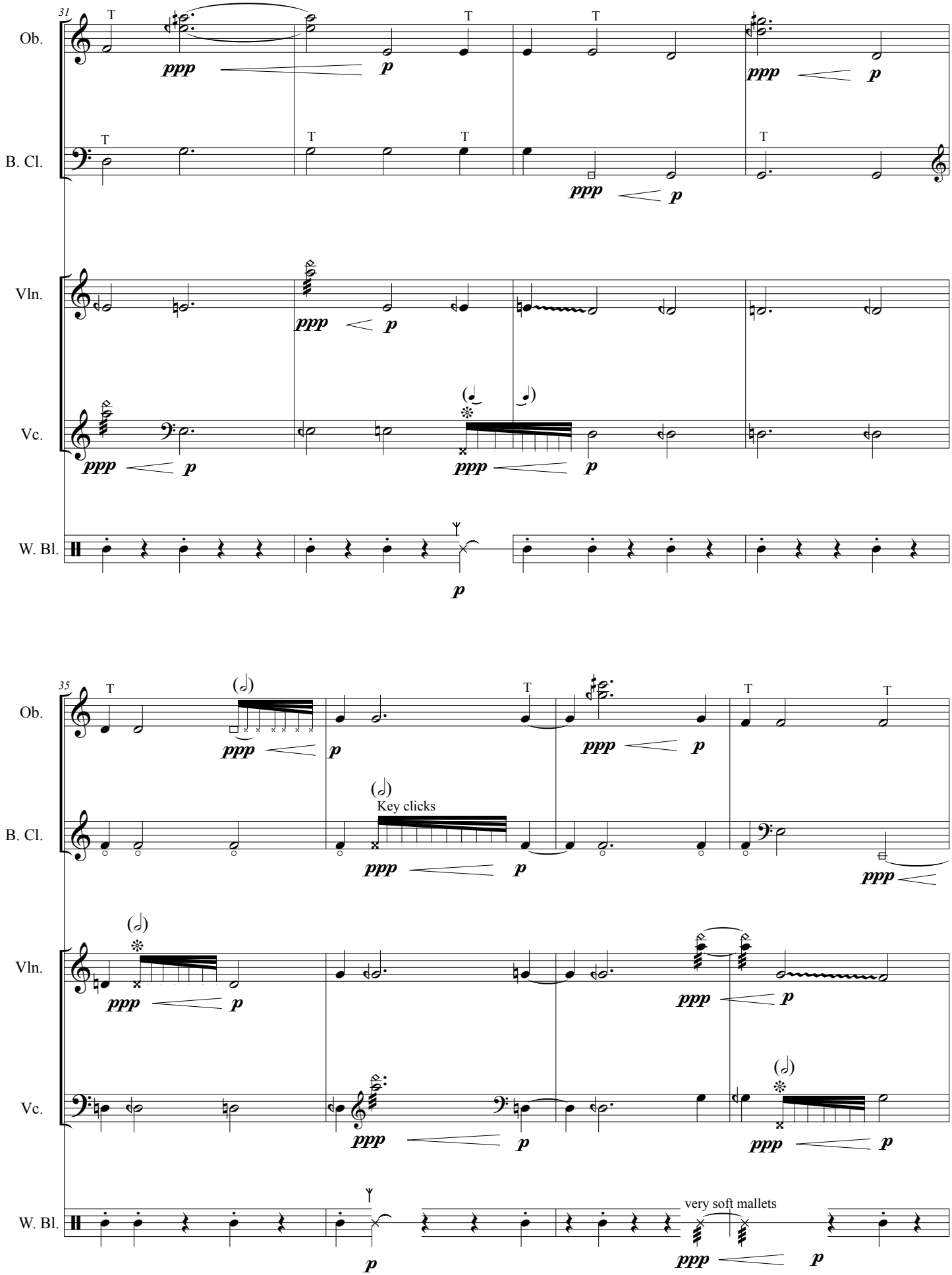
Egidija Medeksaite

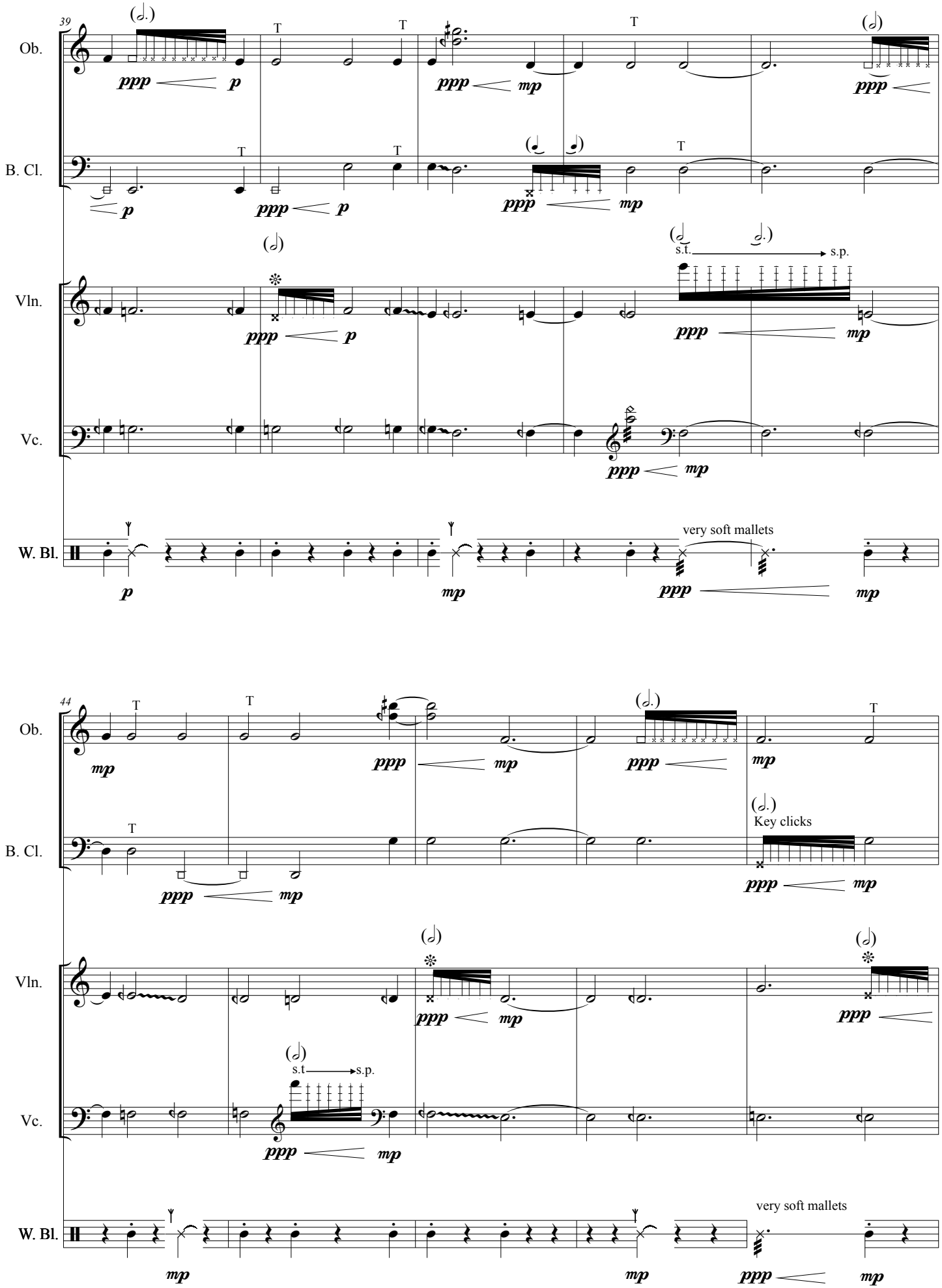


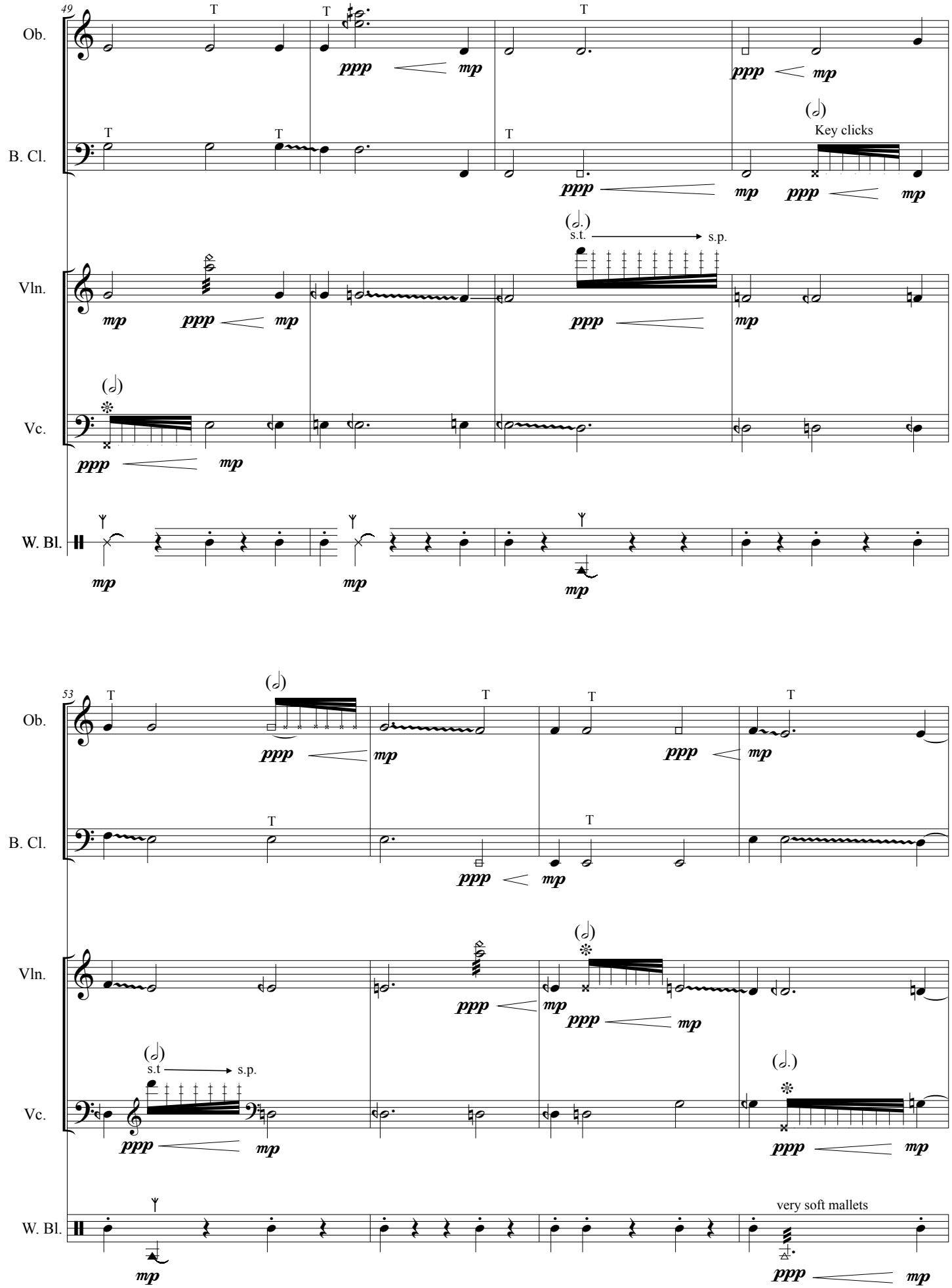

12
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
ppp
pp

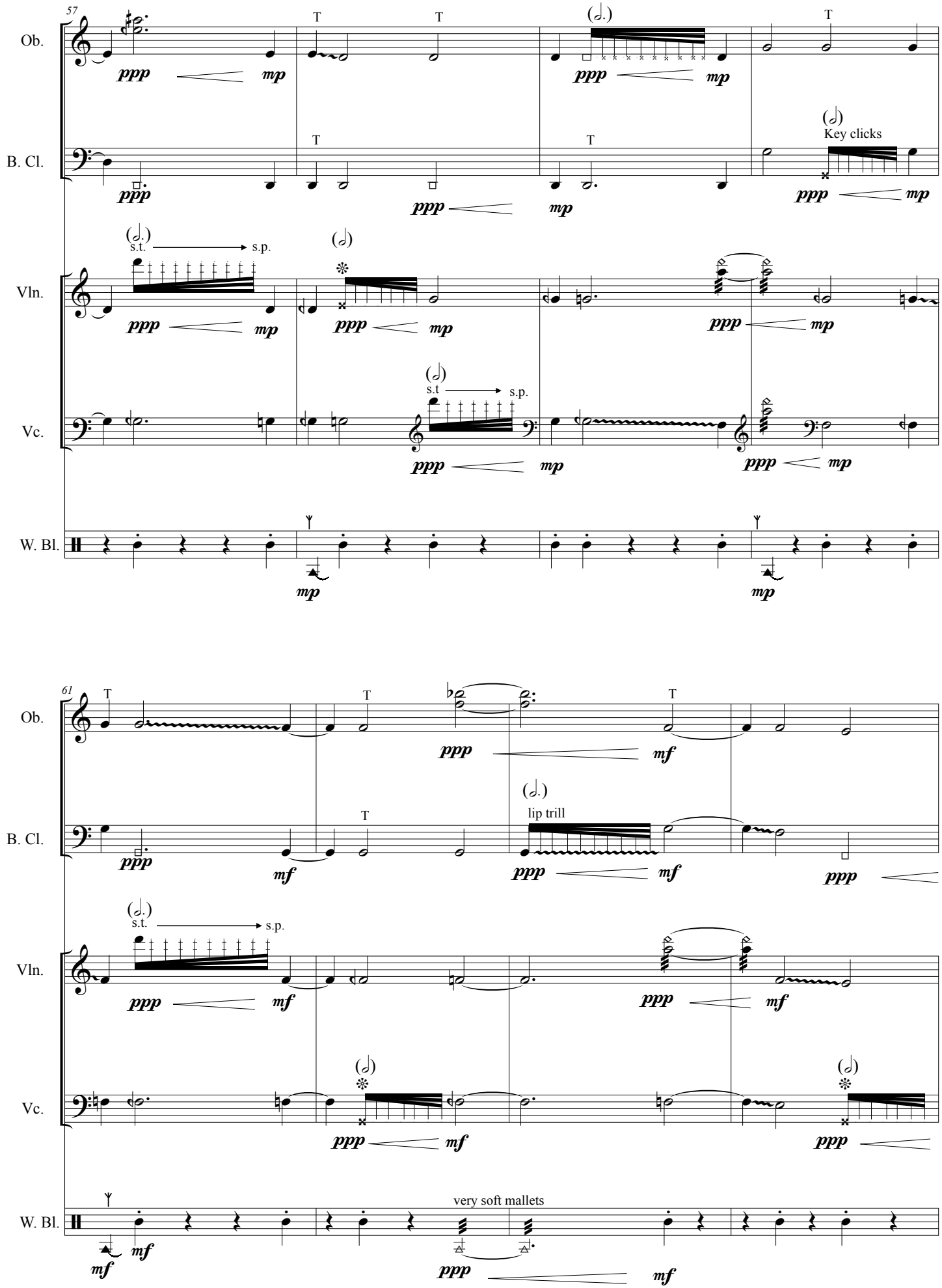

17
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
ppp
pp
p
Soft wool
very soft mallets

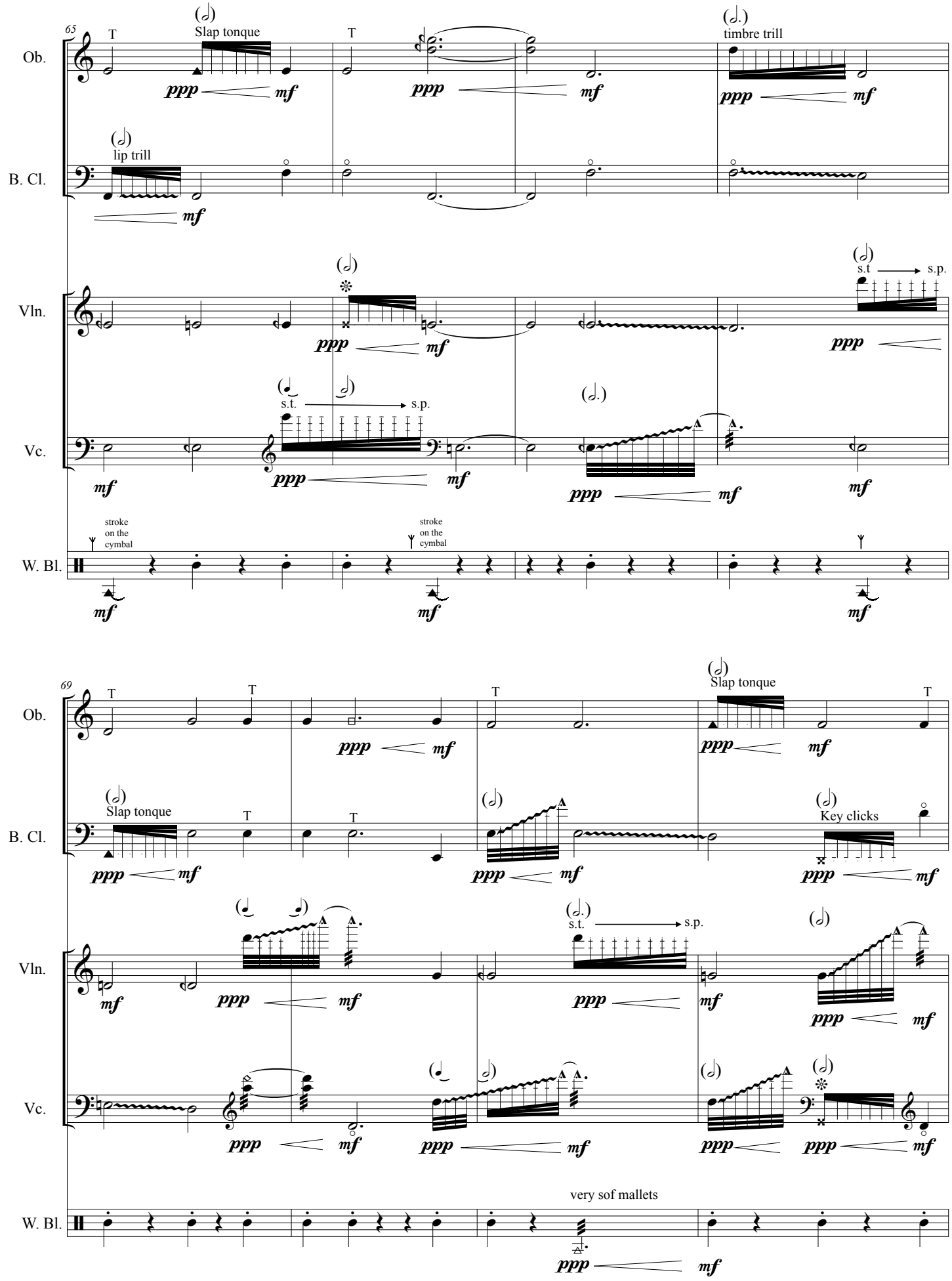

22
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
very soft mallets
27
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
very soft mallets

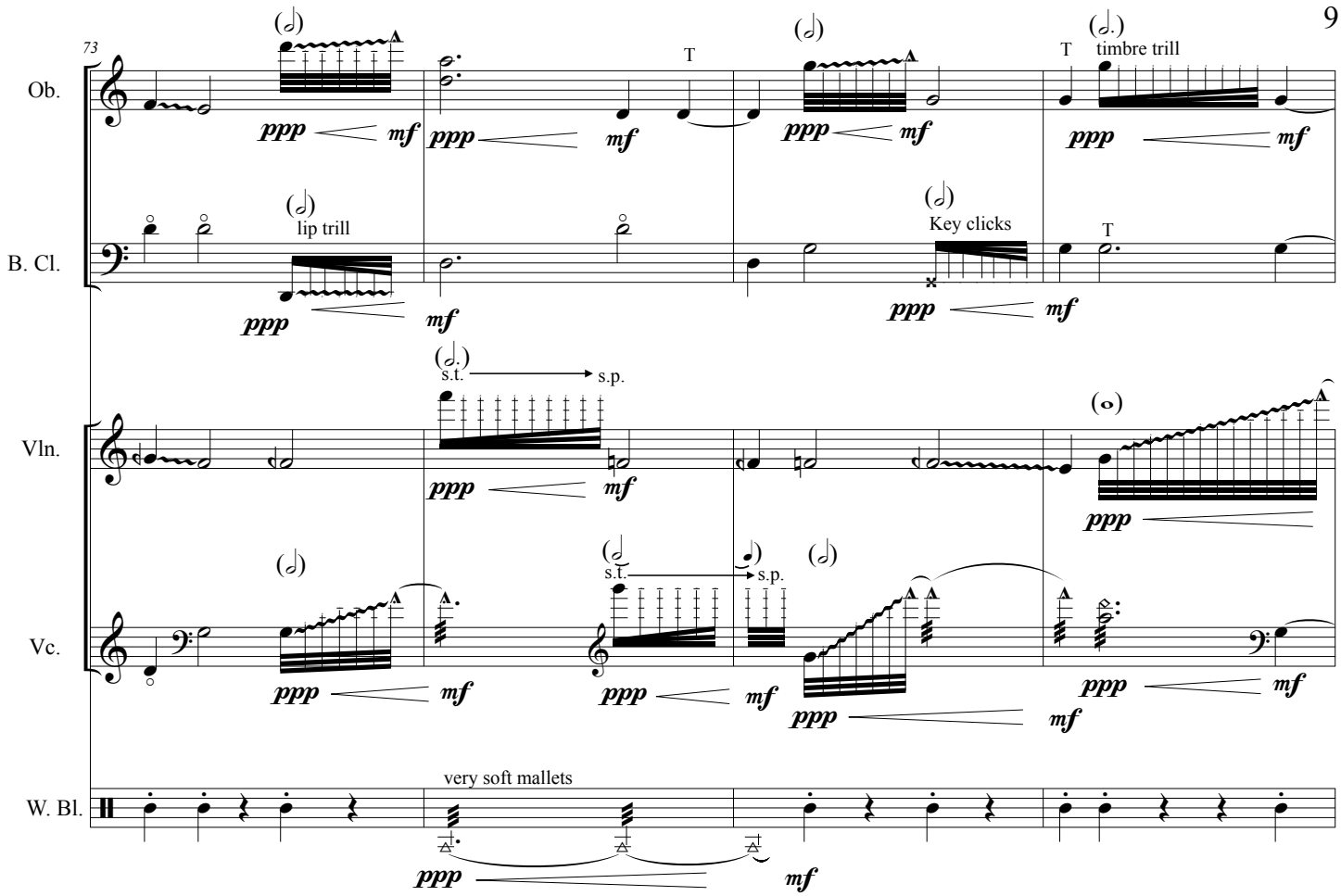

31
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
ppp
p
35
Key clicks
very soft mallets

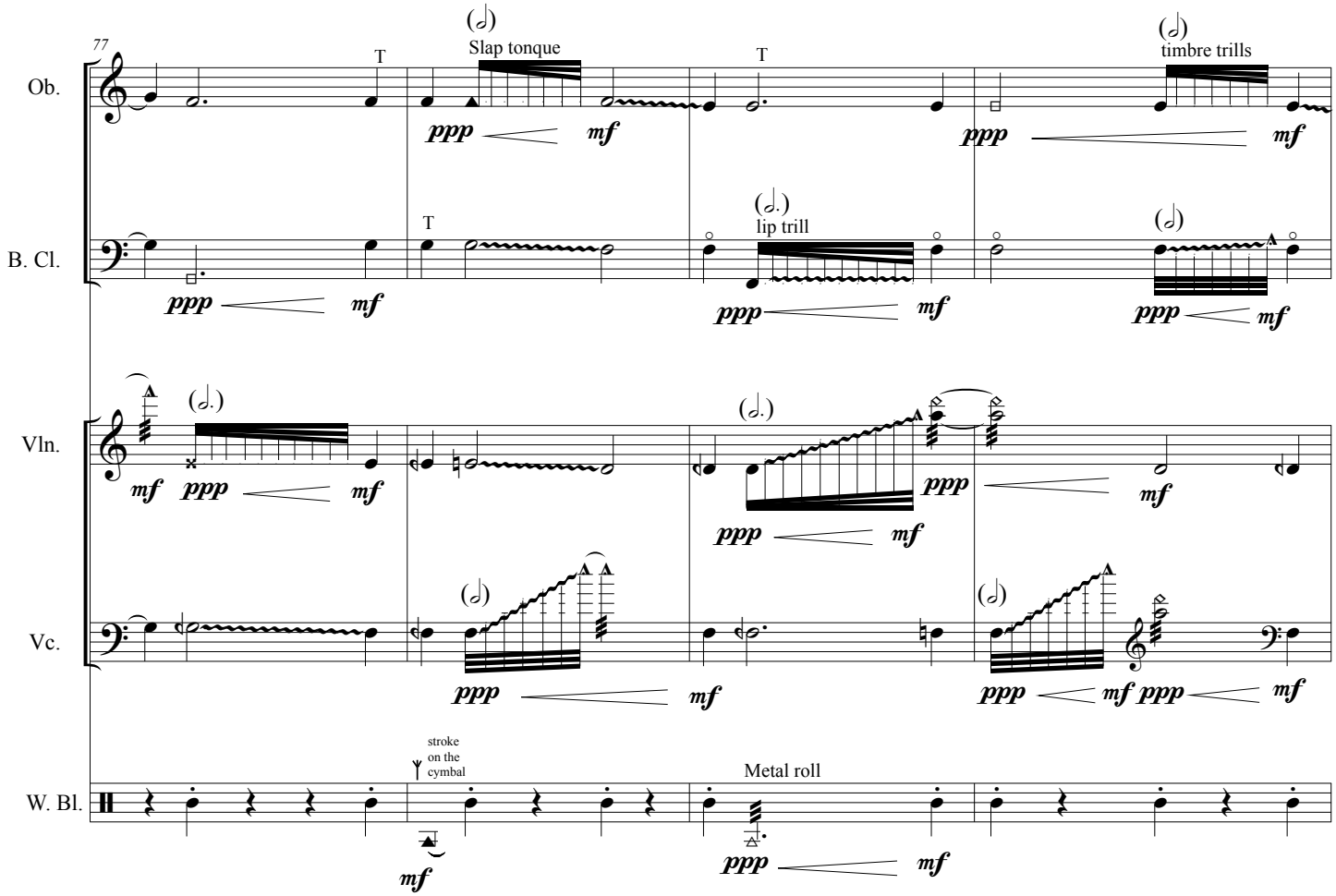

39
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
s.t.
s.p.
very soft mallets
44
Key clicks

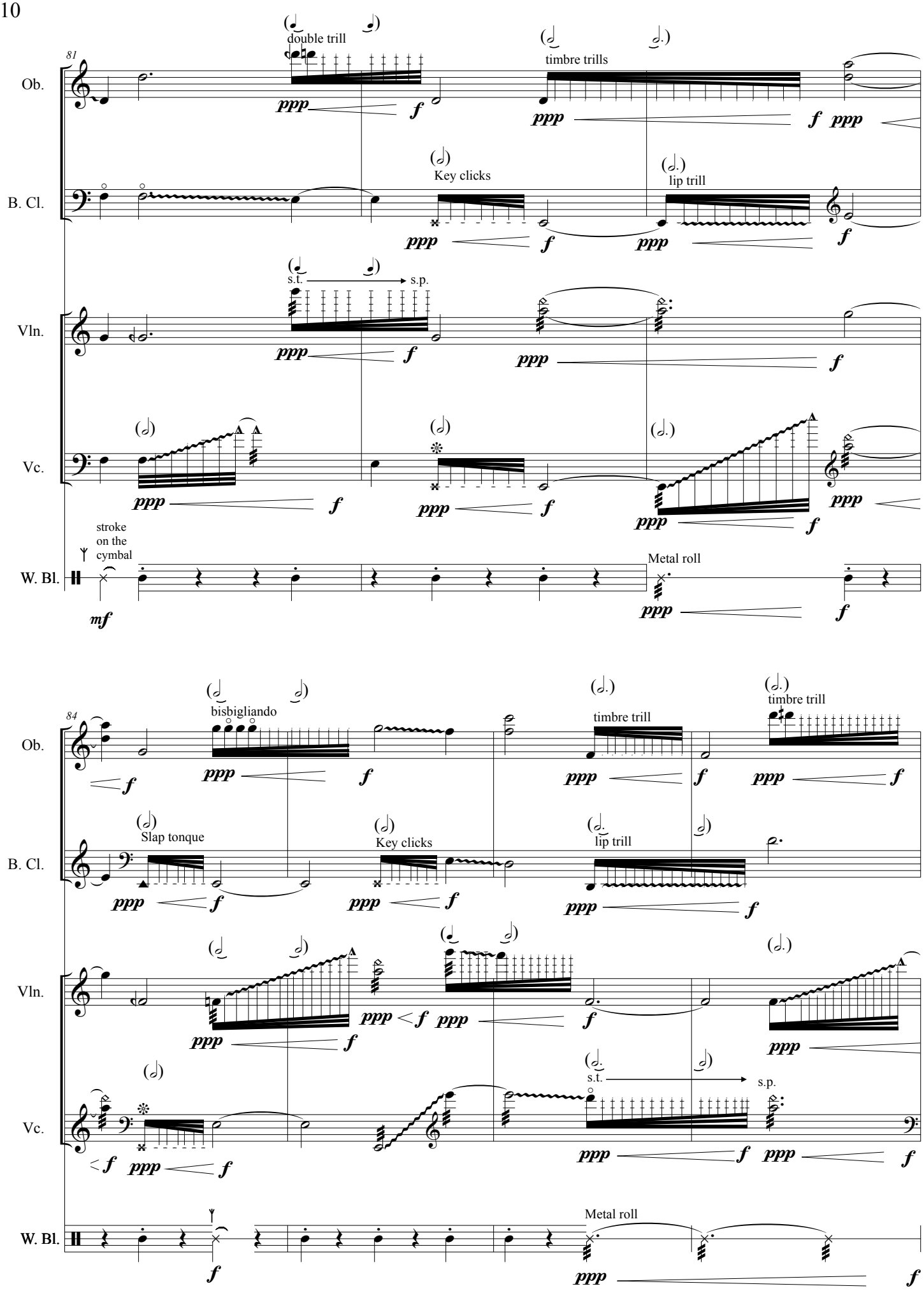

49
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
ppp
mp
(𝅗𝅥)
Key clicks
(𝅗𝅥.)
s.t.
s.p.
53
s.t
very soft mallets

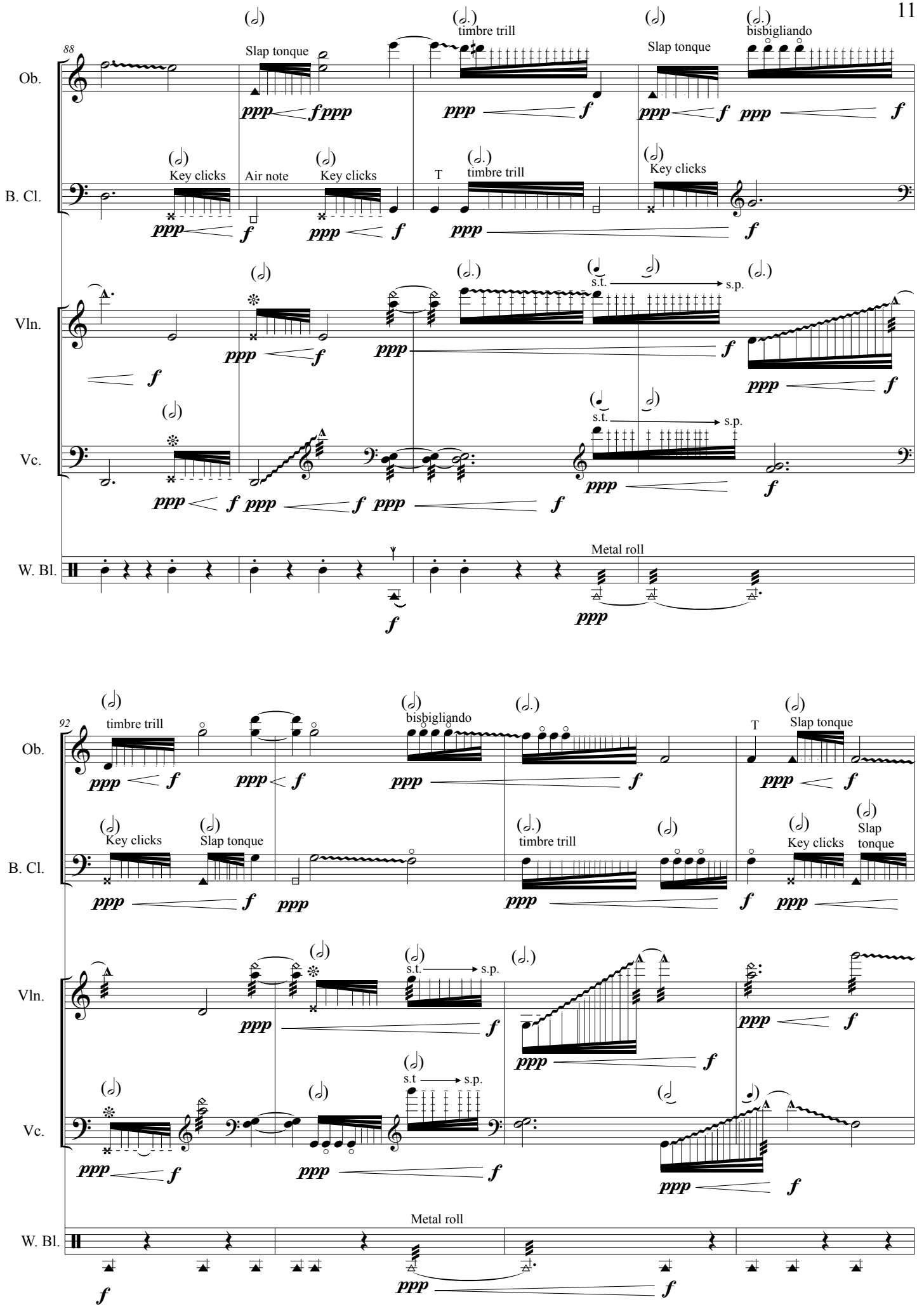

57
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
ppp
mp
(𝅗𝅥.)
(𝅗𝅥)
Key clicks
s.t.
s.p.
s.t
61
mf
lip trill
very soft mallets

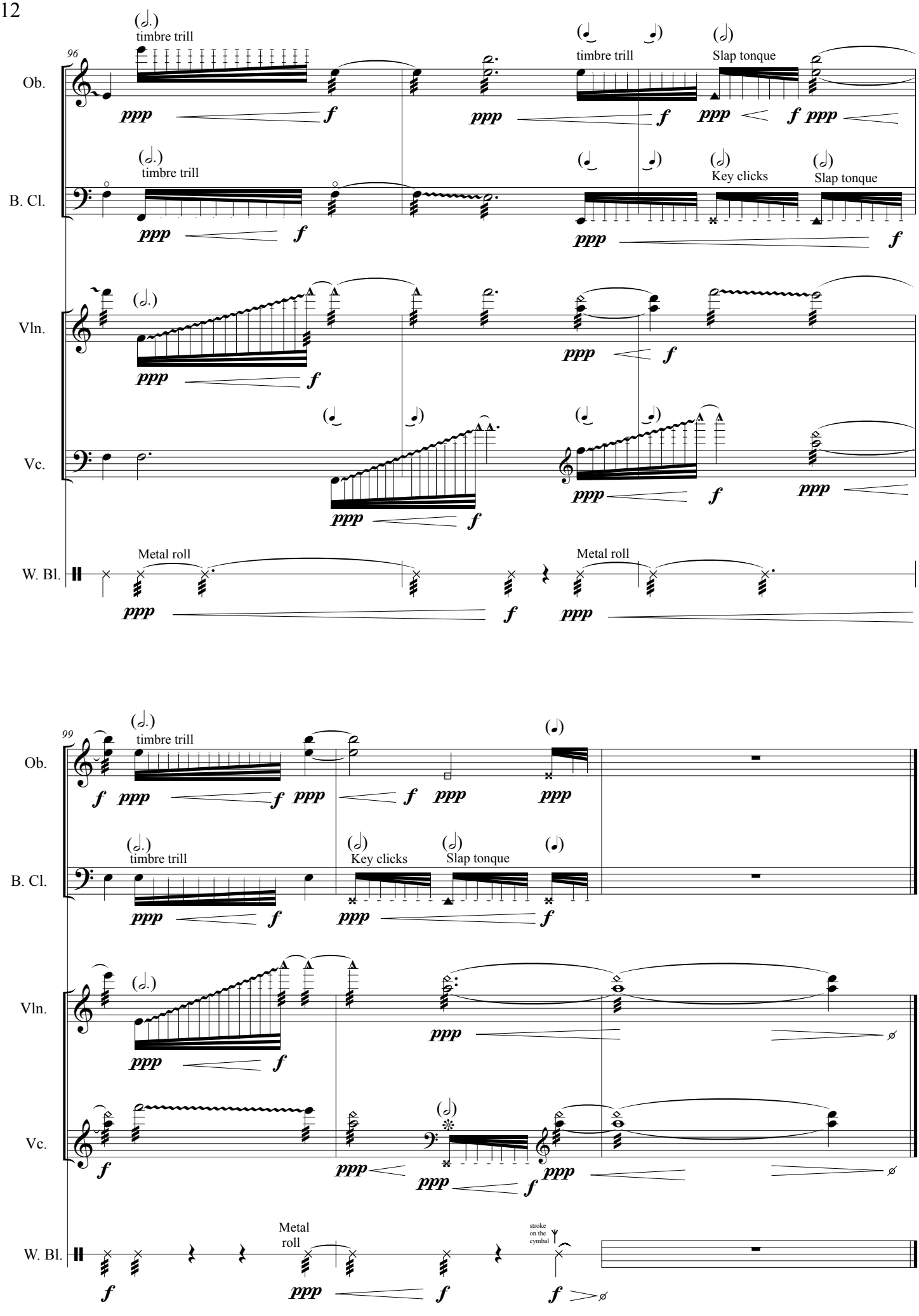

65
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
Slap tonque
timbre trill
lip trill
s.t.
s.p.
stroke on the cymbal
69
Key clicks
very sof mallets
ppp
mf


73
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
timbre trill
lip trill
Key clicks
s.t.
s.p.
very soft mallets
ppp
mf


77
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
T
Slap tonque
timbre trills
lip trill
stroke on the cymbal
Metal roll
ppp
mf

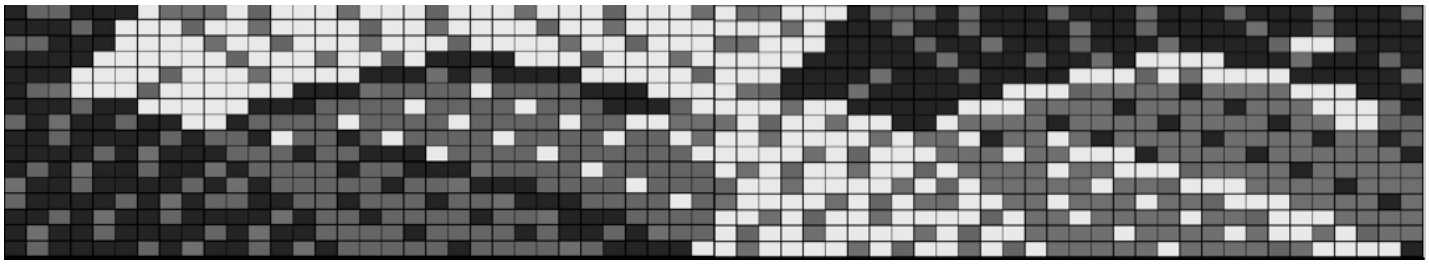

81
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
double trill
timbre trills
Key clicks
lip trill
s.t.
s.p.
stroke on the cymbal
Metal roll
84
bisbigliando
timbre trill
Slap tonque
Key clicks
lip trill
s.t.
s.p.
Metal roll


88
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
Slap tonque
timbre trill
Slap tonque
bisbigliando
Key clicks
Air note
Key clicks
T
timbre trill
Key clicks
s.t.
s.p.
s.t.
s.p.
Metal roll
92
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
timbre trill
bisbigliando
T
Slap tonque
Key clicks
Slap tonque
timbre trill
Key clicks
Slap tonque
s.t.
s.p.
s.t
s.p.
Metal roll


96
Ob.
B. Cl.
Vln.
Vc.
W. Bl.
timbre trill
Slap tonque
Key clicks
Metal roll
99
Metal
roll
stroke
on the
cymbal

Egidija Medekšaitė

TEXTILE_4



version for solo piano with electronics

Programme note:

Textile_4 is based on a compound weave of two or more sets of warps or wefts, producing a double cloth. The weight, luxury, and versatility of double cloth distinguish it from single weaves. Moreover, double weaves offer unique design possibilities, resulting in functional, sculptural or purely decorative works of art. The fabric pattern is reversible, consisting of distinct weaves or colours, and the pattern on each surface complements the opposite side.

Textile_4 exists in two versions: electroacoustic and acoustic. It can be played by solo prepared piano with live electronics, or by four prepared pianos.

Explanatory notes:

The electroacoustic materials were composed using sounds generated by two patches of MAX/MSP program. The patches contain various controllers for the tempo, for individual pitches (green, yellow, red, and blue colours), and randomly perform the sixteen melodic lines of both sides of the double cloth independently, creating a dialogue between natural organic (piano) and unnatural mechanic sounds (MAX/MSP program). Due to the random selection of the sixteen melodic lines from both sides of the double cloth, the final result produces organic sounds in non-repetitive modes.

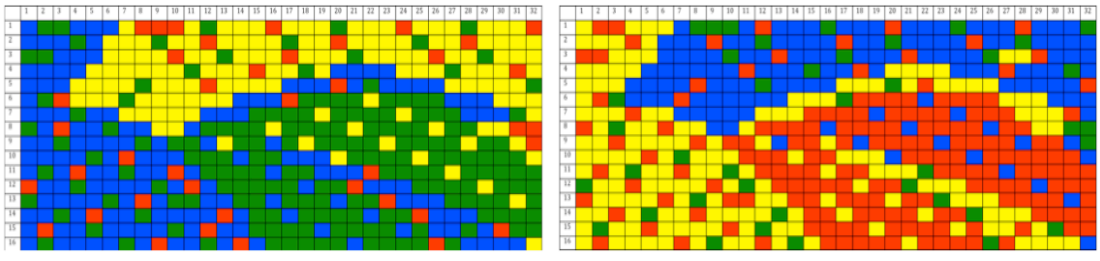
In order to achieve the coordination of rhythm and predefined tempo, a click track is required for the solo performer.

The piano preparation is created using various objects made from different materials. Each colour of the textile pattern is matched to a distinct material:

Colour				
Preparation material	Wood	Plastic	Rubber	Metal

In *Textile_4*, performer can choose any line of double cloth in order to generate a system of objects for the preparation, following the colour scheme (see Figure 1).

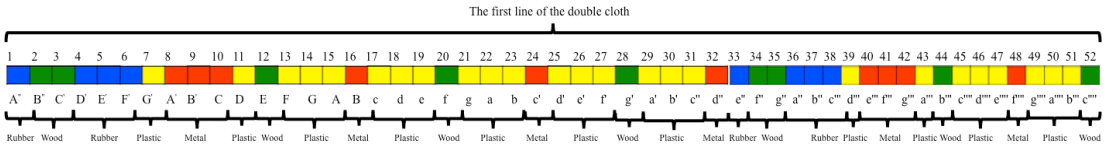
Figure 1: The overall textile pattern



(a) (b)

Figure 2 illustrates an example of the preparation of fifty-two white keys, which are mapped to the colour scheme, from the lowest to the highest note.

Figure 2: First line of textile pattern as a colour scheme for the identification of distinct materials for prepared piano.



The performer has a certain amount of freedom with regard to preparing the piano, following his/her own imagination and creativity, so that individual choices will lead to different atmospheres.

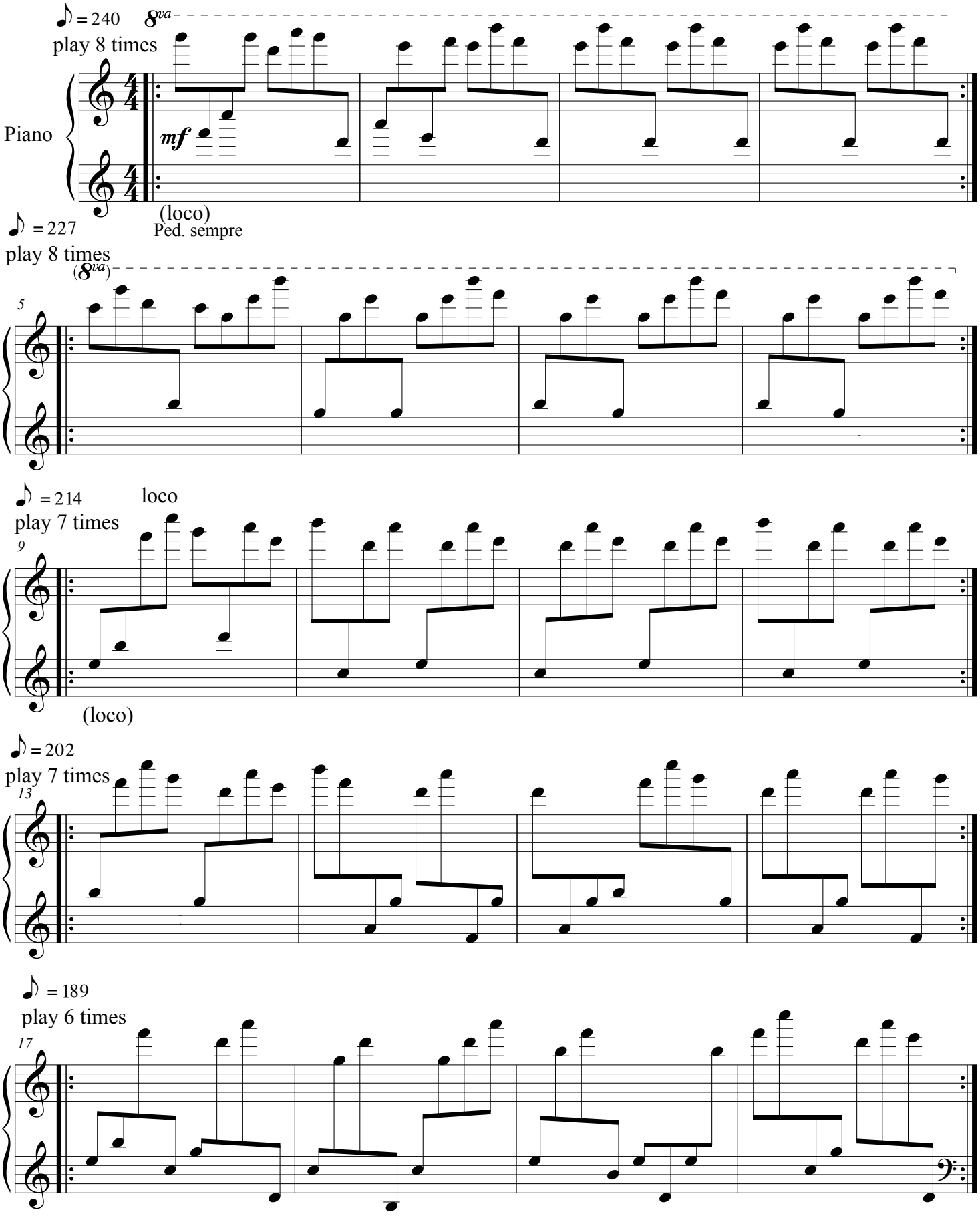
The work can be realized without preparation if the means to do so aren't available.

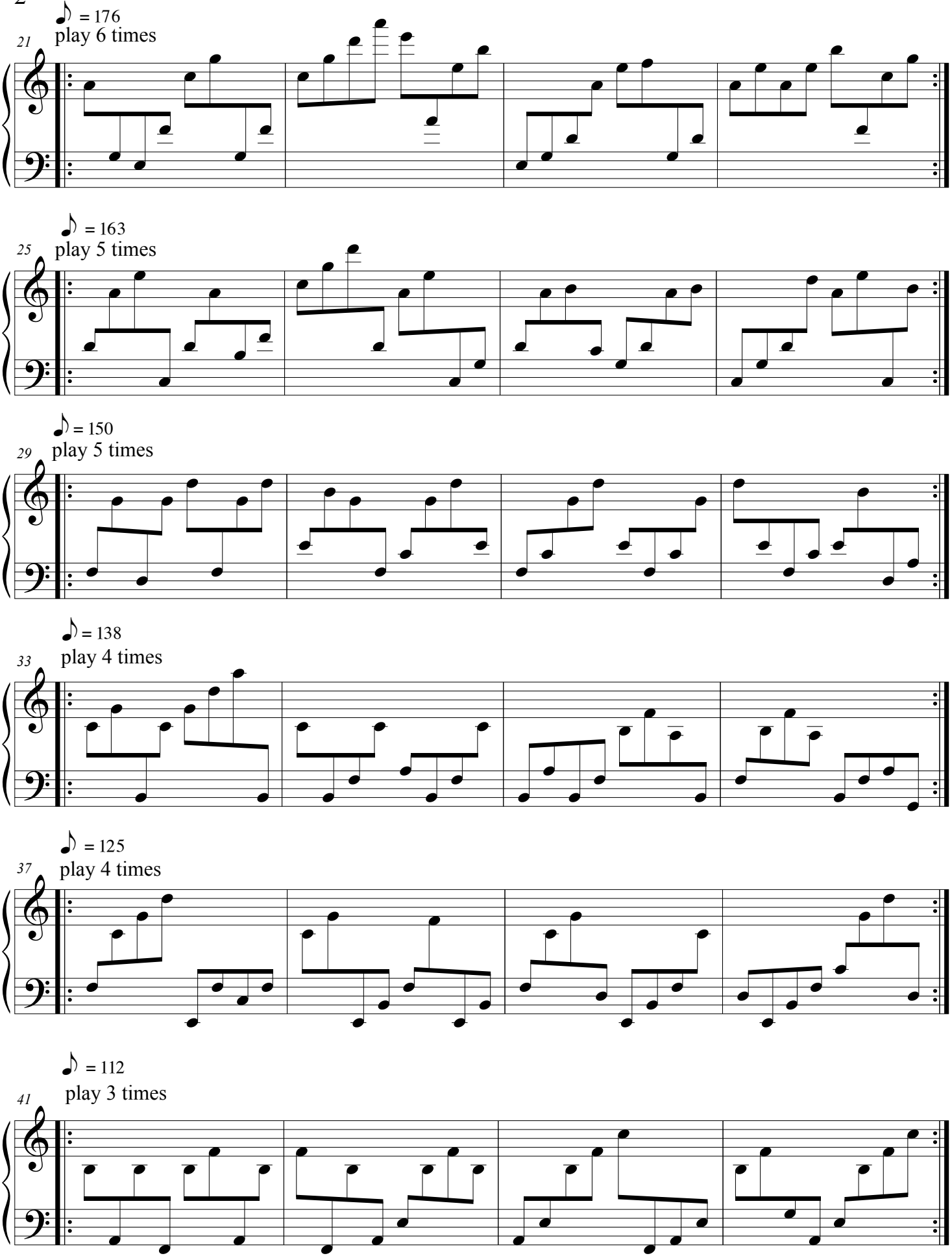
Duration: ± 16 minutes

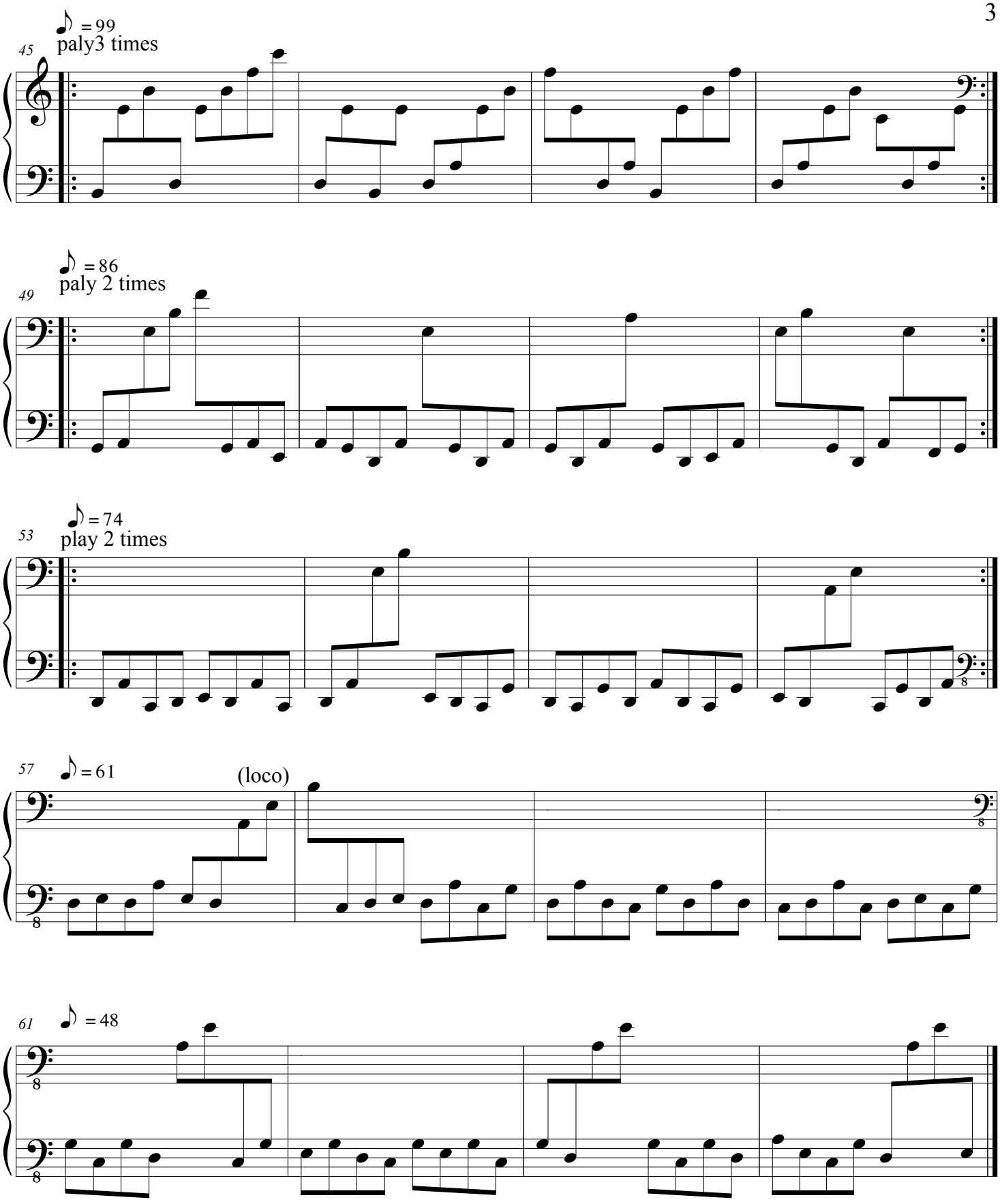
Score

Textile_4

Egidija Medeksaite (2013)

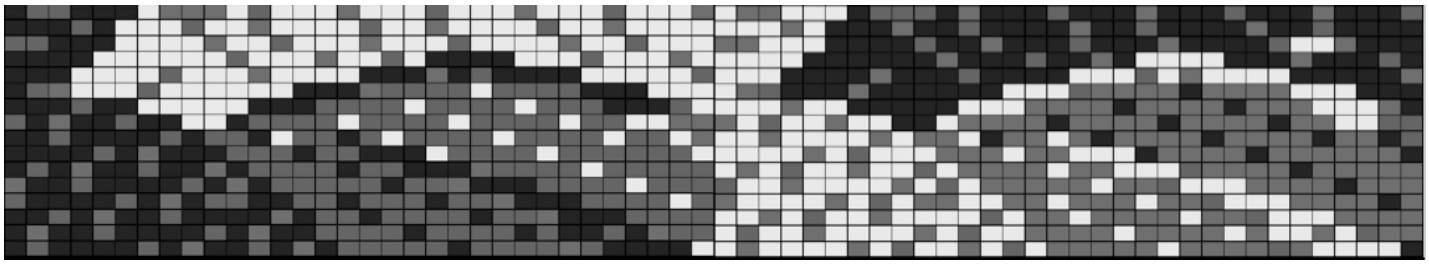



♪ = 176
play 6 times
21
♪ = 163
play 5 times
25
♪ = 150
play 5 times
29
♪ = 138
play 4 times
33
♪ = 125
play 4 times
37
♪ = 112
play 3 times
41


♪ = 99
paly3 times
45
♪ = 86
paly 2 times
49
♪ = 74
play 2 times
53
57
♪ = 61
(loco)
61
♪ = 48

Egidija Medekšaitė

TEXTILE_4



version for four prepared pianos

Programme note:

Textile_4 is based on a compound weave of two or more sets of warps or wefts, producing a double cloth. The weight, luxury, and versatility of double cloth distinguish it from single weaves. Moreover, double weaves offer unique design possibilities, resulting in functional, sculptural or purely decorative works of art. The fabric pattern is reversible, consisting of distinct weaves or colours, and the pattern on each surface complements the opposite side.

Textile_4 exists in two versions: electroacoustic and acoustic. It can be played by solo prepared piano with live electronics, or by four prepared pianos.

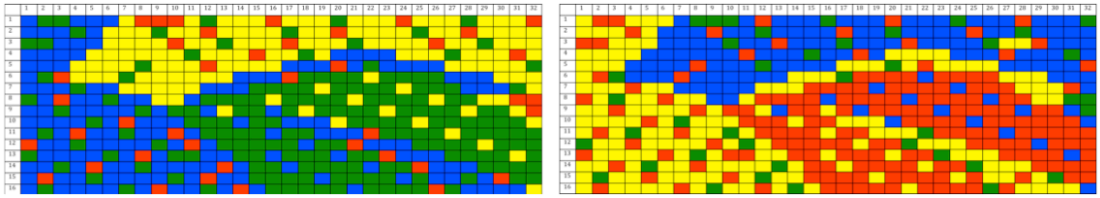
Explanatory notes:

The preparation for the four pianos is created using various objects made from different materials. Each colour of the textile pattern is matched to a distinct material:

Colour				
Preparation material	Wood	Plastic	Rubber	Metal

In *Textile_4*, each performer can choose any line of double cloth in order to generate a system of objects for the preparation, following the colour scheme (see Figure 1).

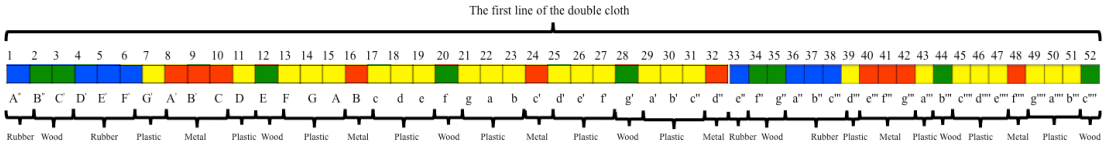
Figure 1: The overall textile pattern



(a) (b)

Figure 2 illustrates an example of the preparation of fifty-two white keys, which are mapped to the colour scheme, from the lowest to the highest note.

Figure 2: First line of textile pattern as a colour scheme for the identification of distinct materials for prepared piano.



Each performer has a certain amount of freedom with regard to preparing the piano, following his/her own imagination and creativity, so that their individual choices will lead to different atmospheres.

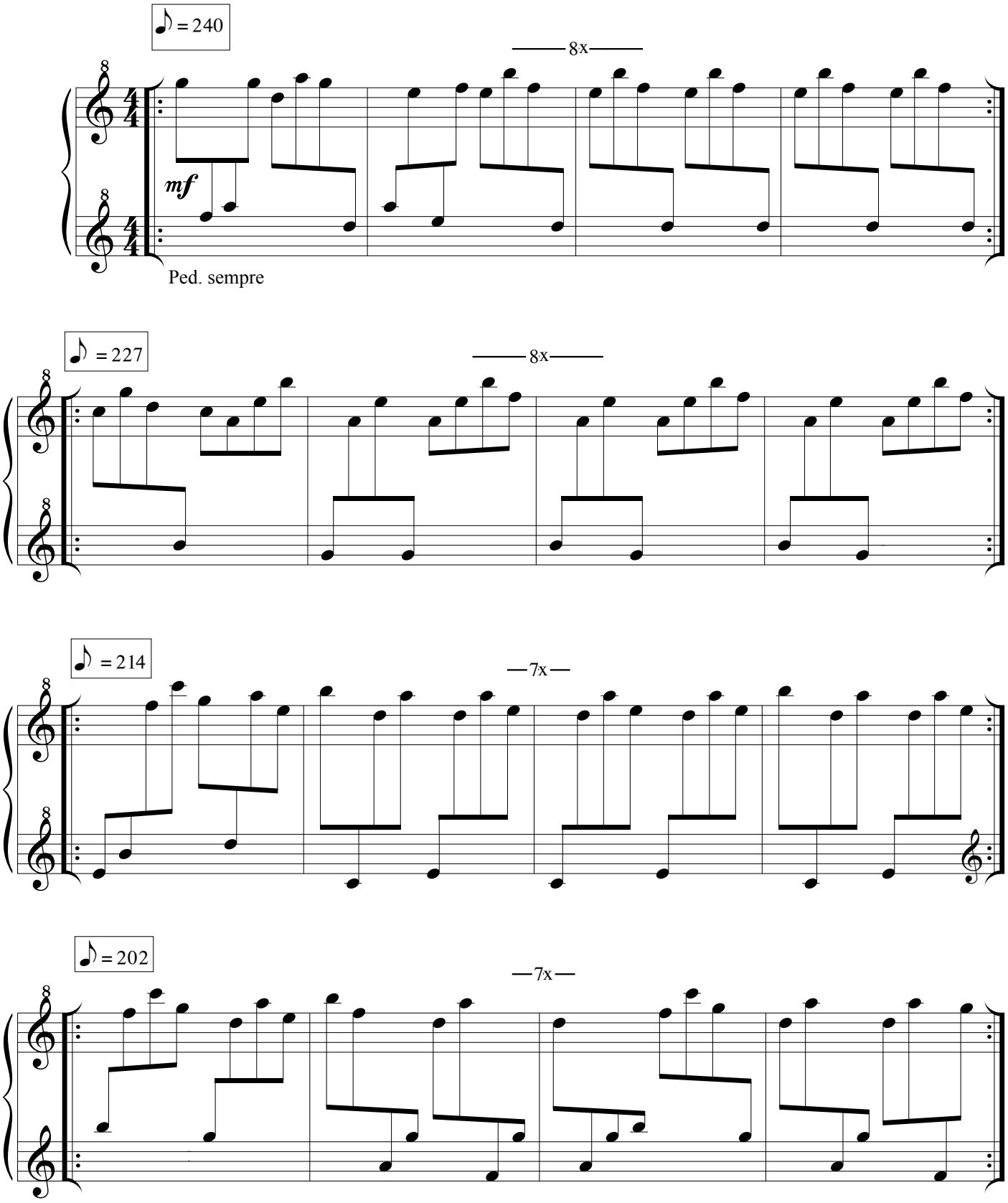
In order to achieve the coordination of rhythm and predefined tempo, separate click tracks are required for the performers; these coordinates all four parts, each with its own shifting tempi, indicating the begining and the ending of the piece by using different sounds.

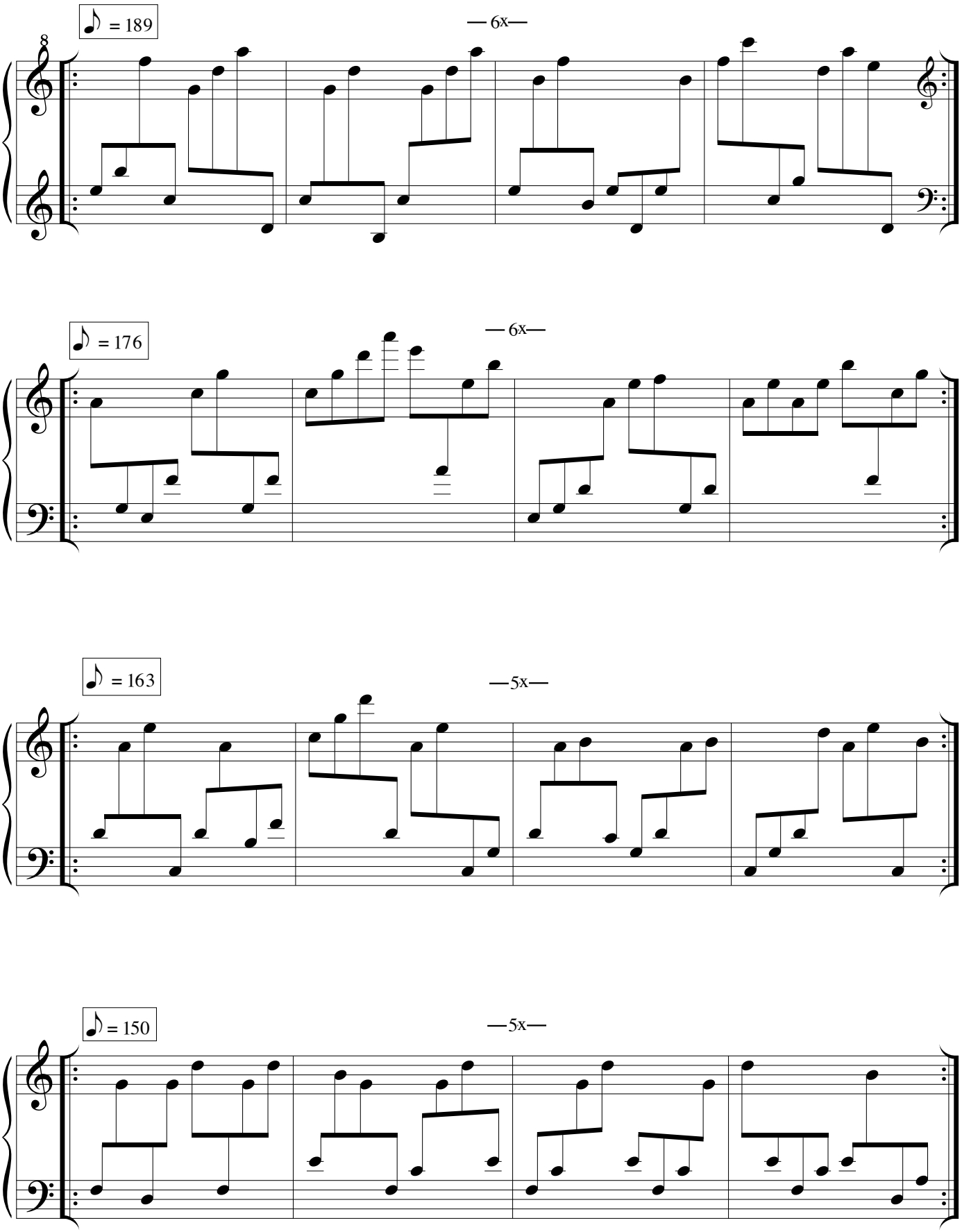
Duration: ± 16 minutes

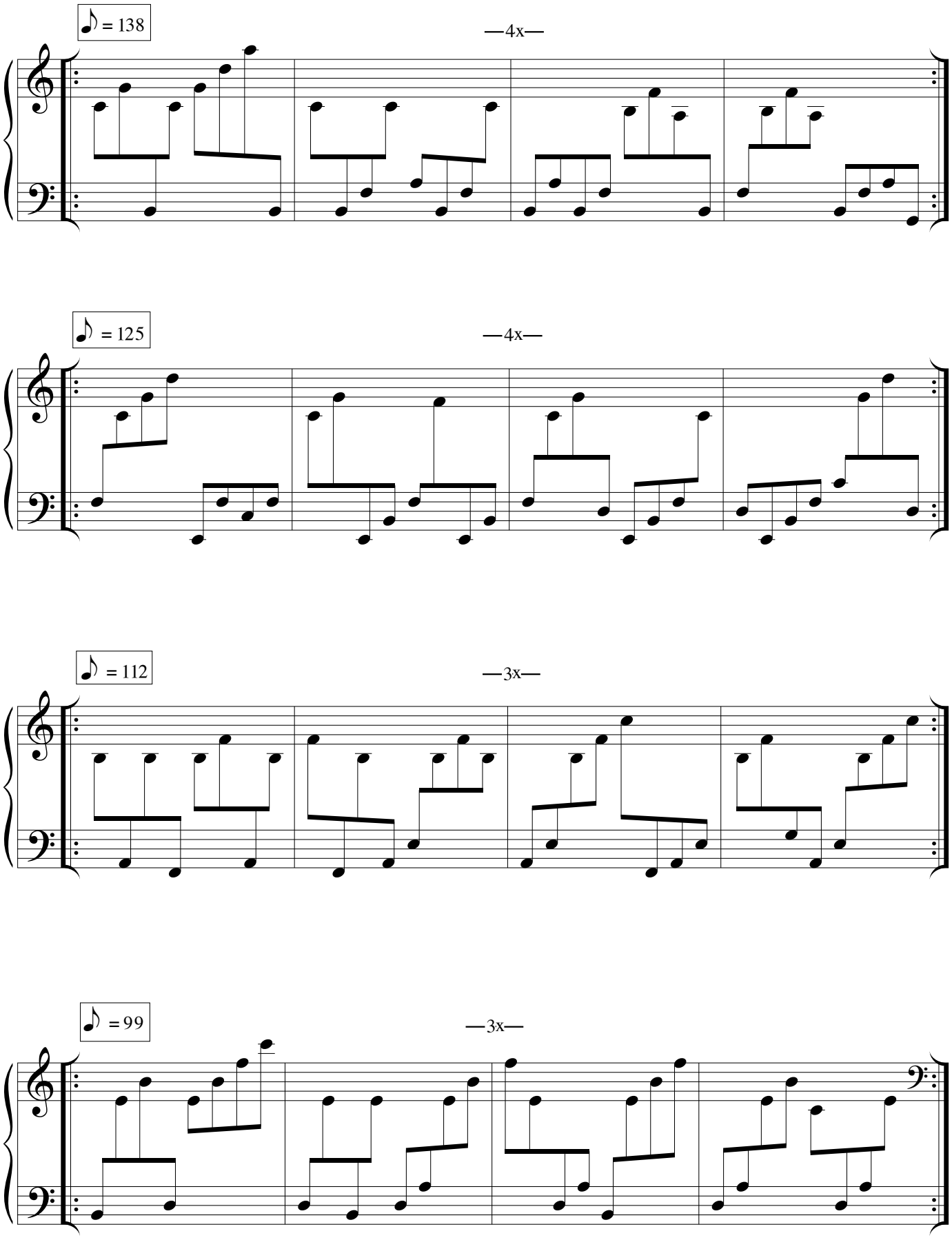
TEXTILE_4

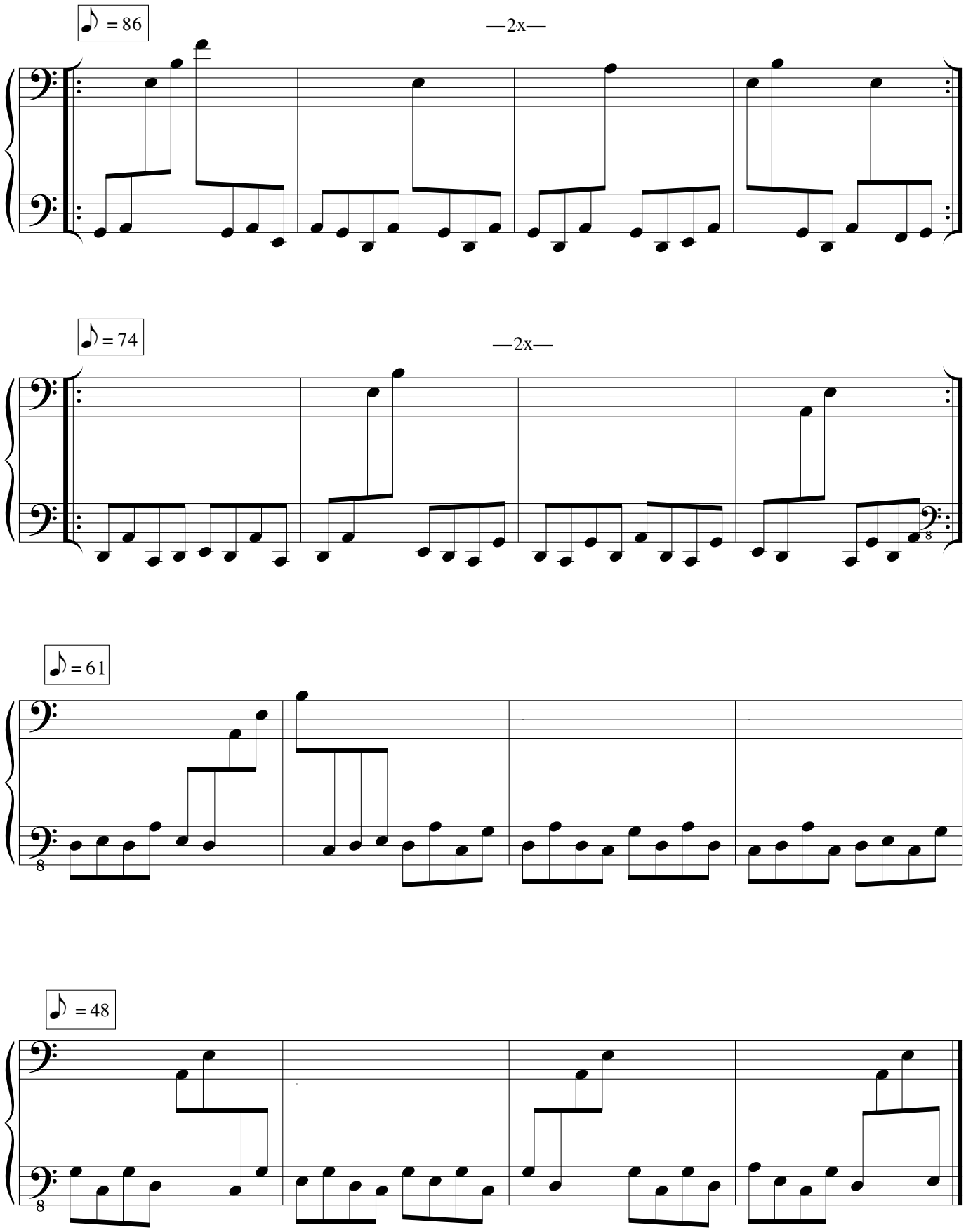
Piano 1

Egidija Medeksaite (2013)




♪ = 189
— 6x—
♪ = 176
— 6x—
♪ = 163
—5x—
♪ = 150
—5x—

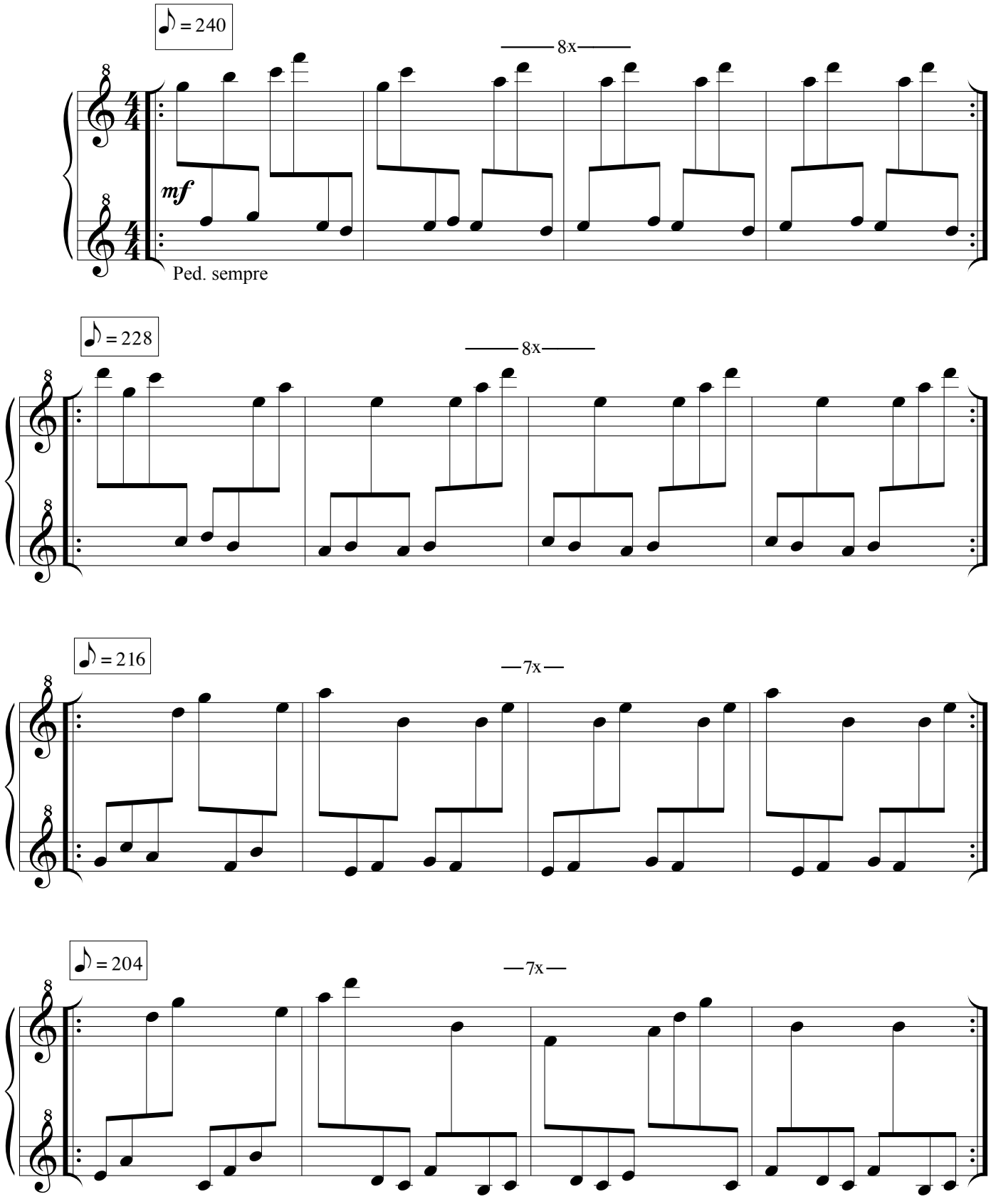

♪ = 138
—4x—
♪ = 125
—4x—
♪ = 112
—3x—
♪ = 99
—3x—

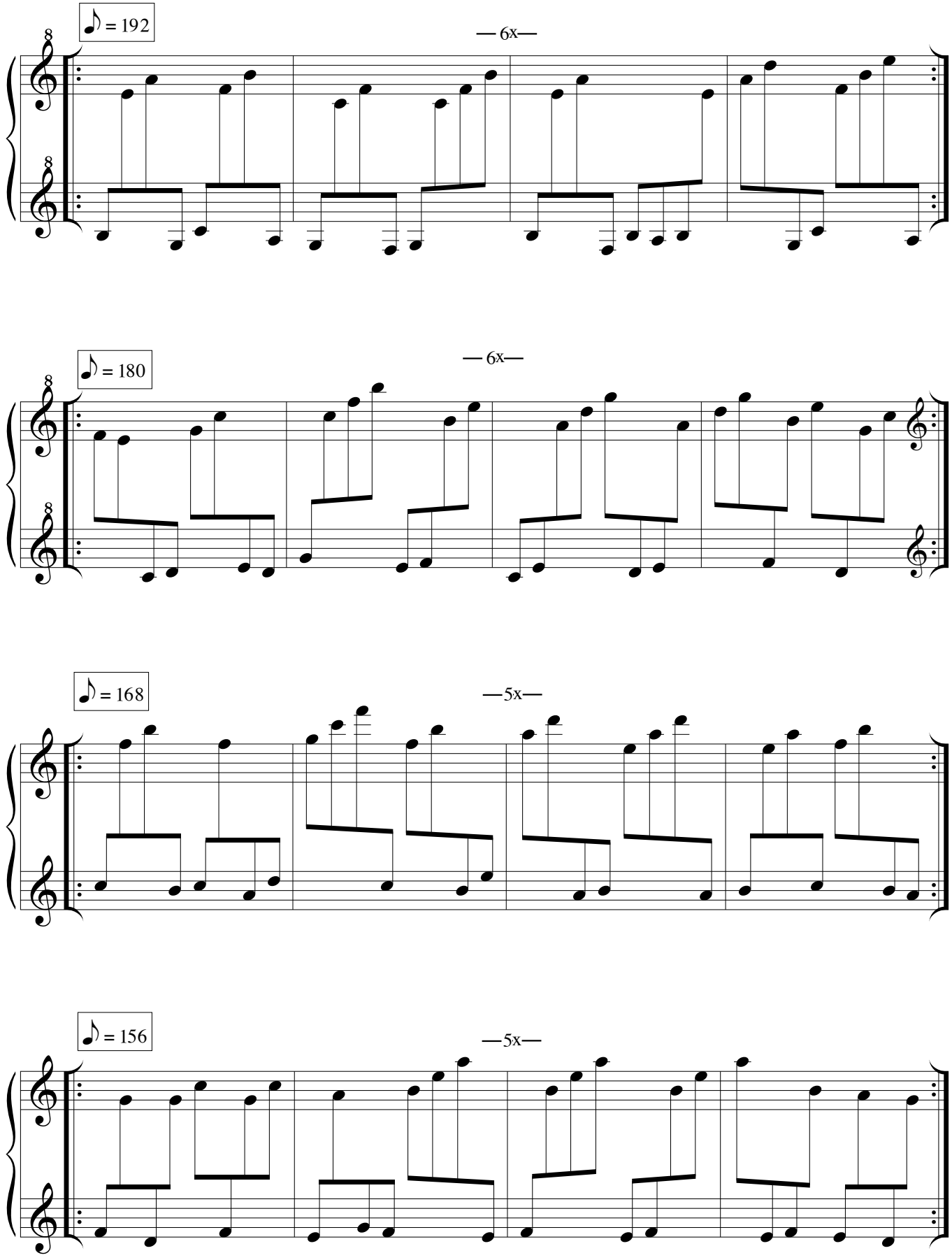

♪ = 86
—2x—
♪ = 74
—2x—
♪ = 61
8
8
♪ = 48
8

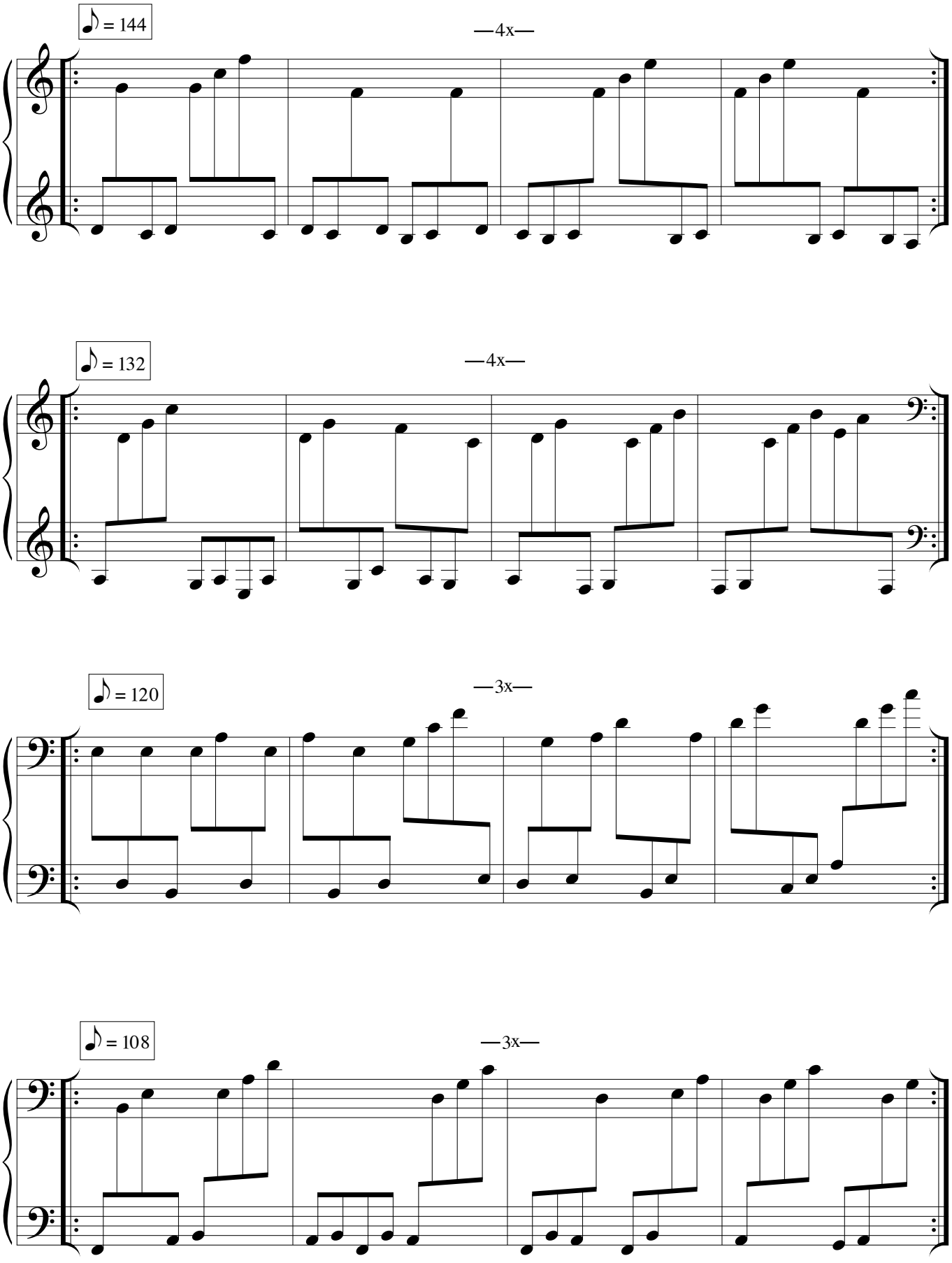
Piano 2

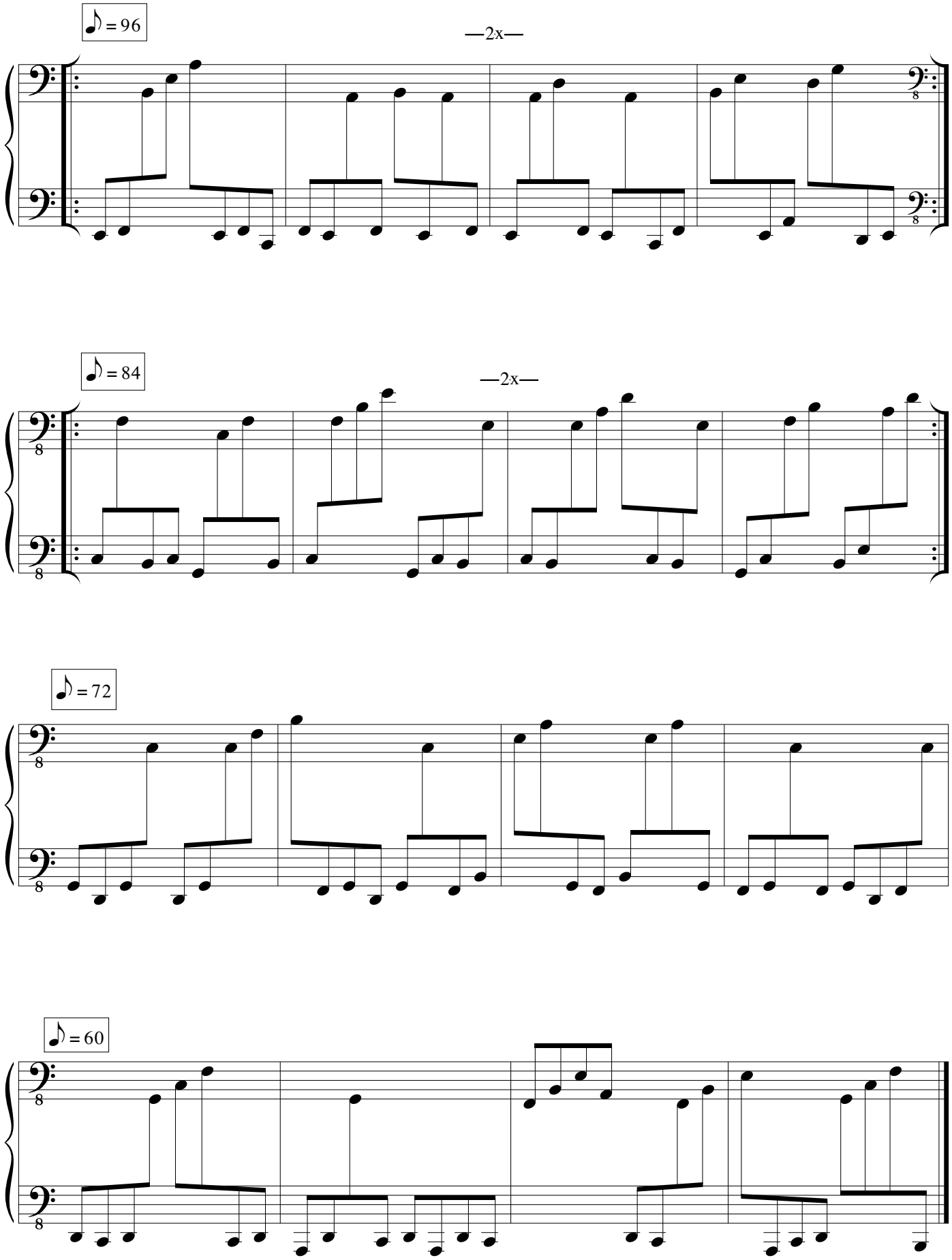
TEXTILE_4

Egidija Medeksaite (2013)




♪ = 192
— 6x—
♪ = 180
— 6x—
♪ = 168
—5x—
♪ = 156
—5x—

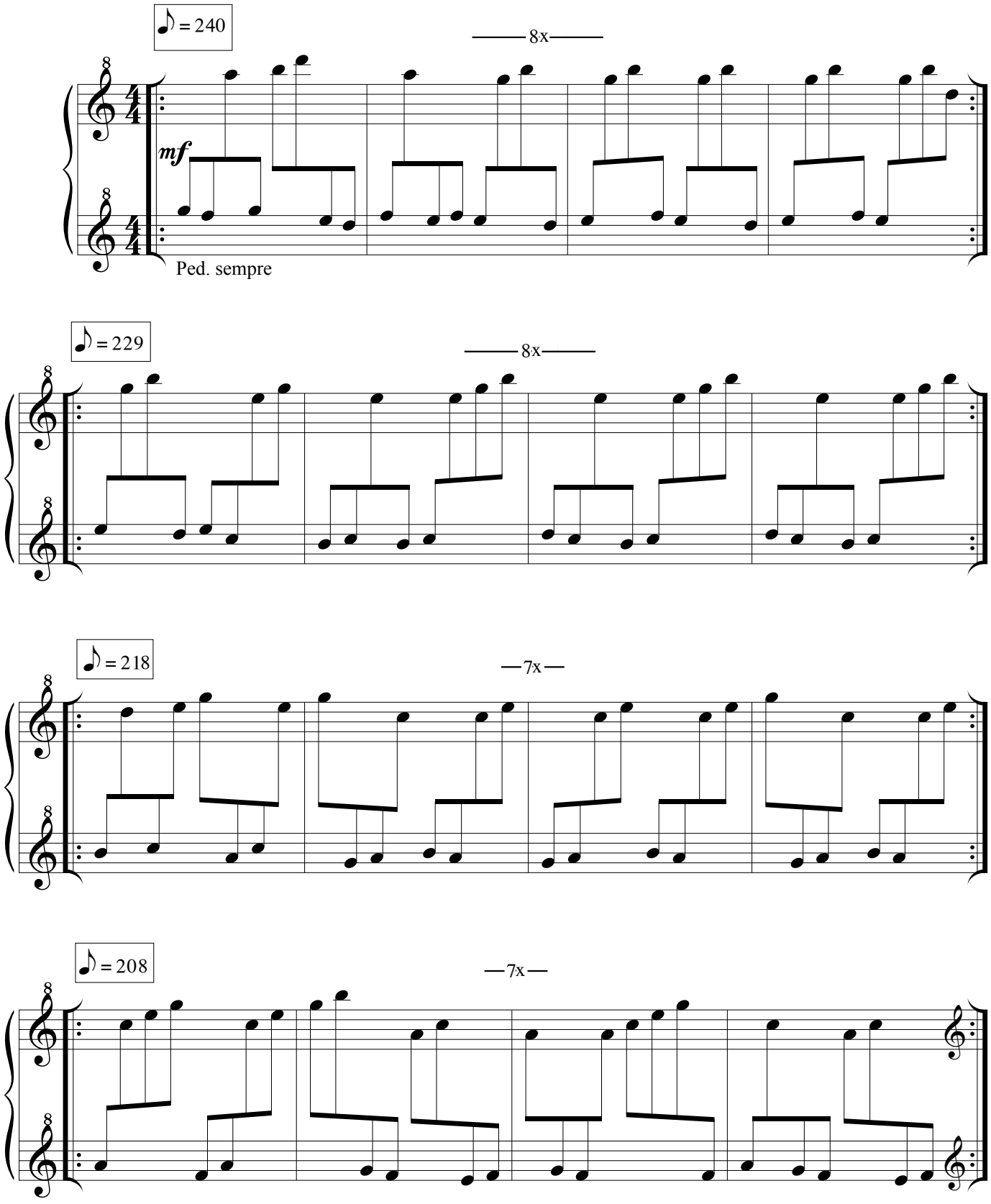

♪ = 144
—4x—
♪ = 132
—4x—
♪ = 120
—3x—
♪ = 108
—3x—

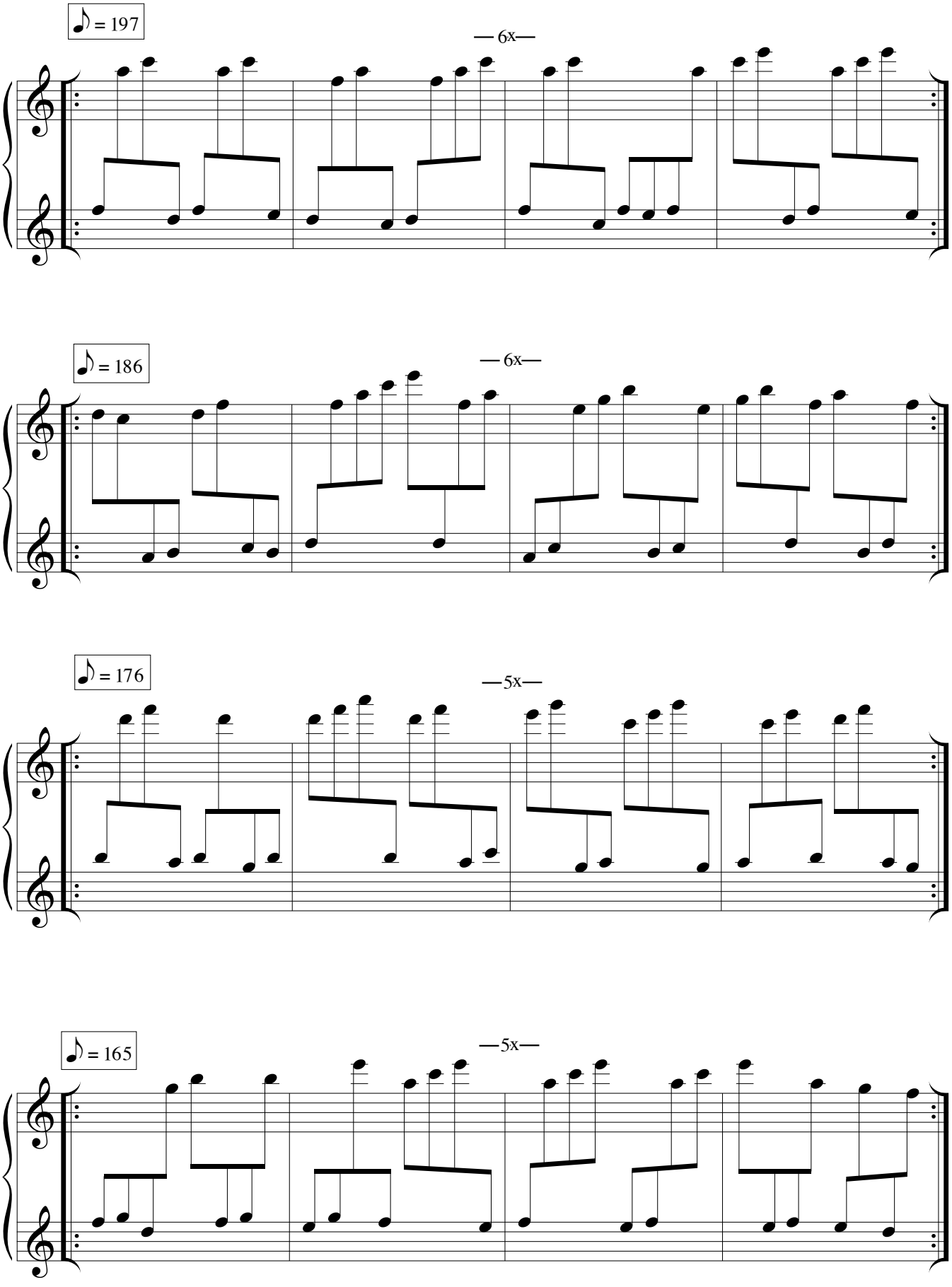

♪ = 96
—2x—
♪ = 84
—2x—
♪ = 72
♪ = 60

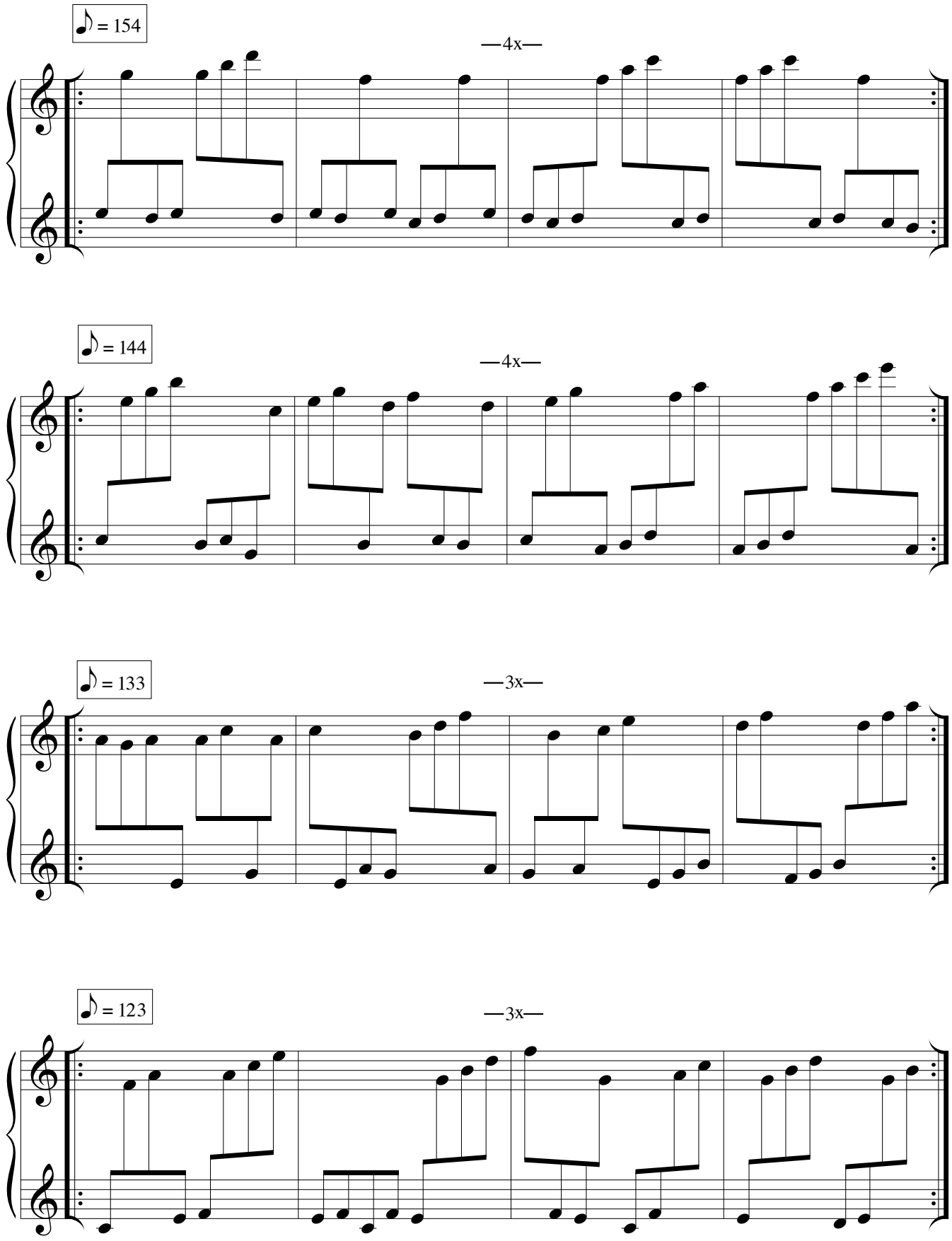
Piano 3

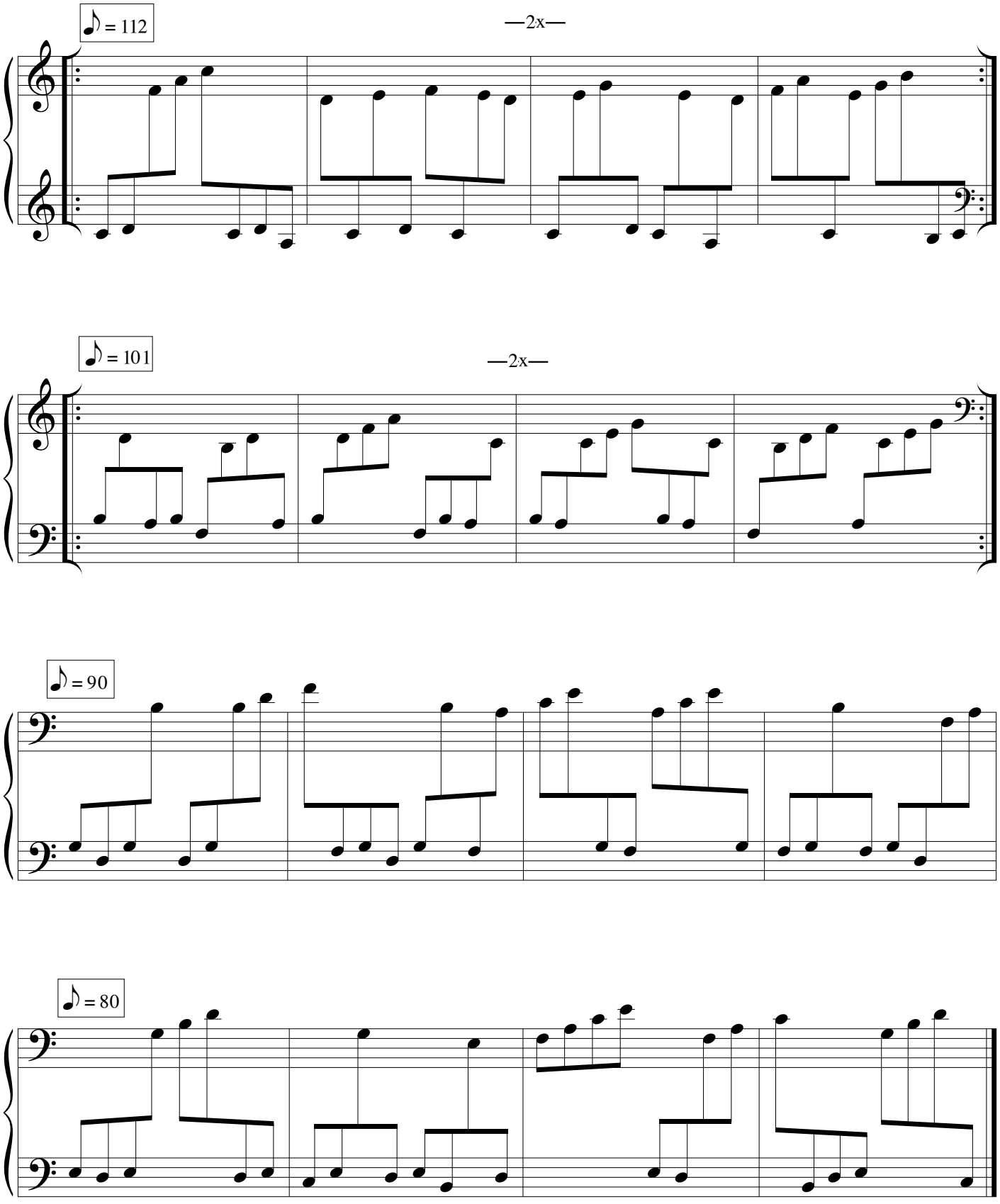
TEXTILE_4

Egidija Medeksaite (2013)




♪ = 197
— 6x —
♪ = 186
— 6x —
♪ = 176
— 5x —
♪ = 165
— 5x —

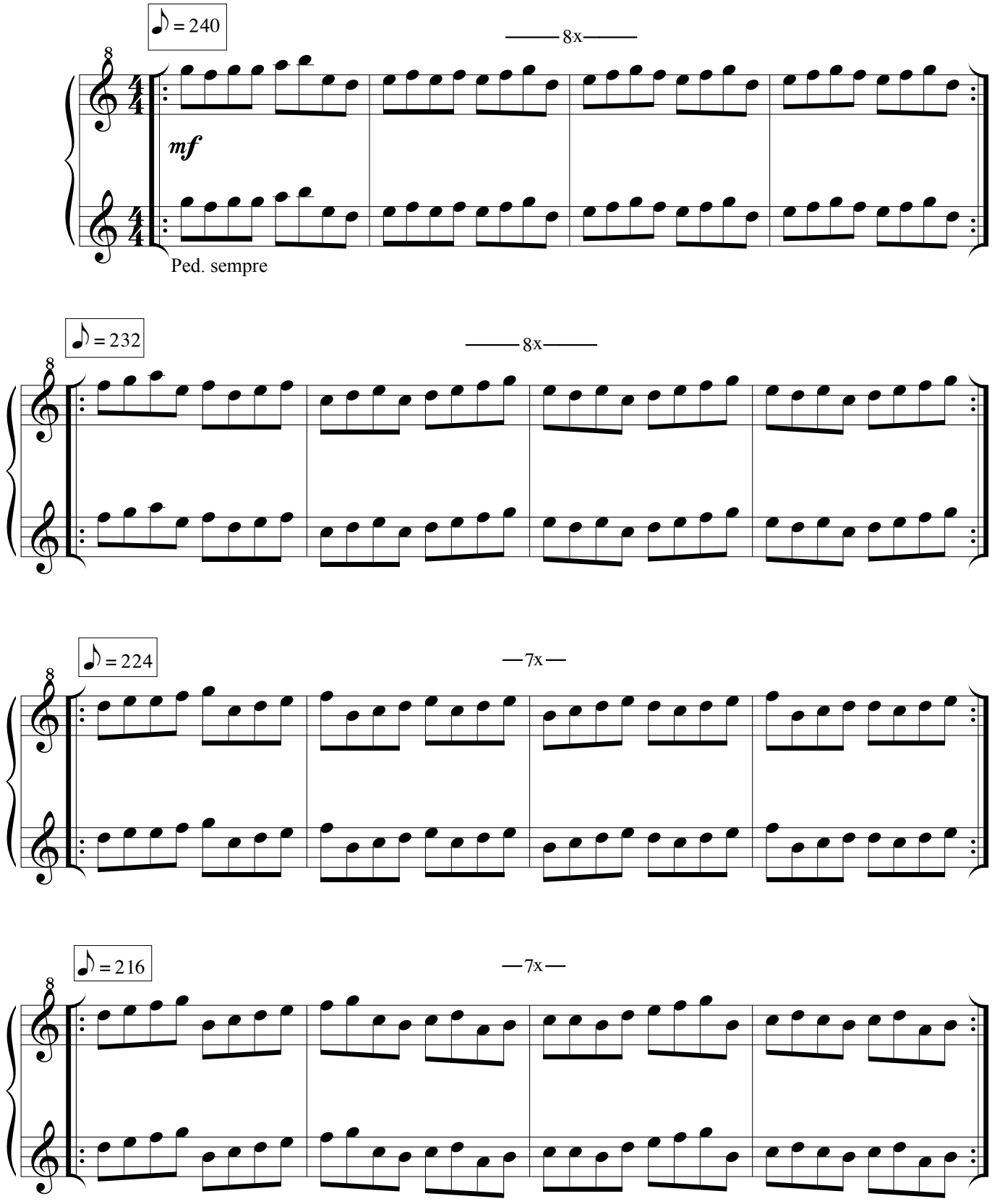

♪ = 154
—4x—
♪ = 144
—4x—
♪ = 133
—3x—
♪ = 123
—3x—

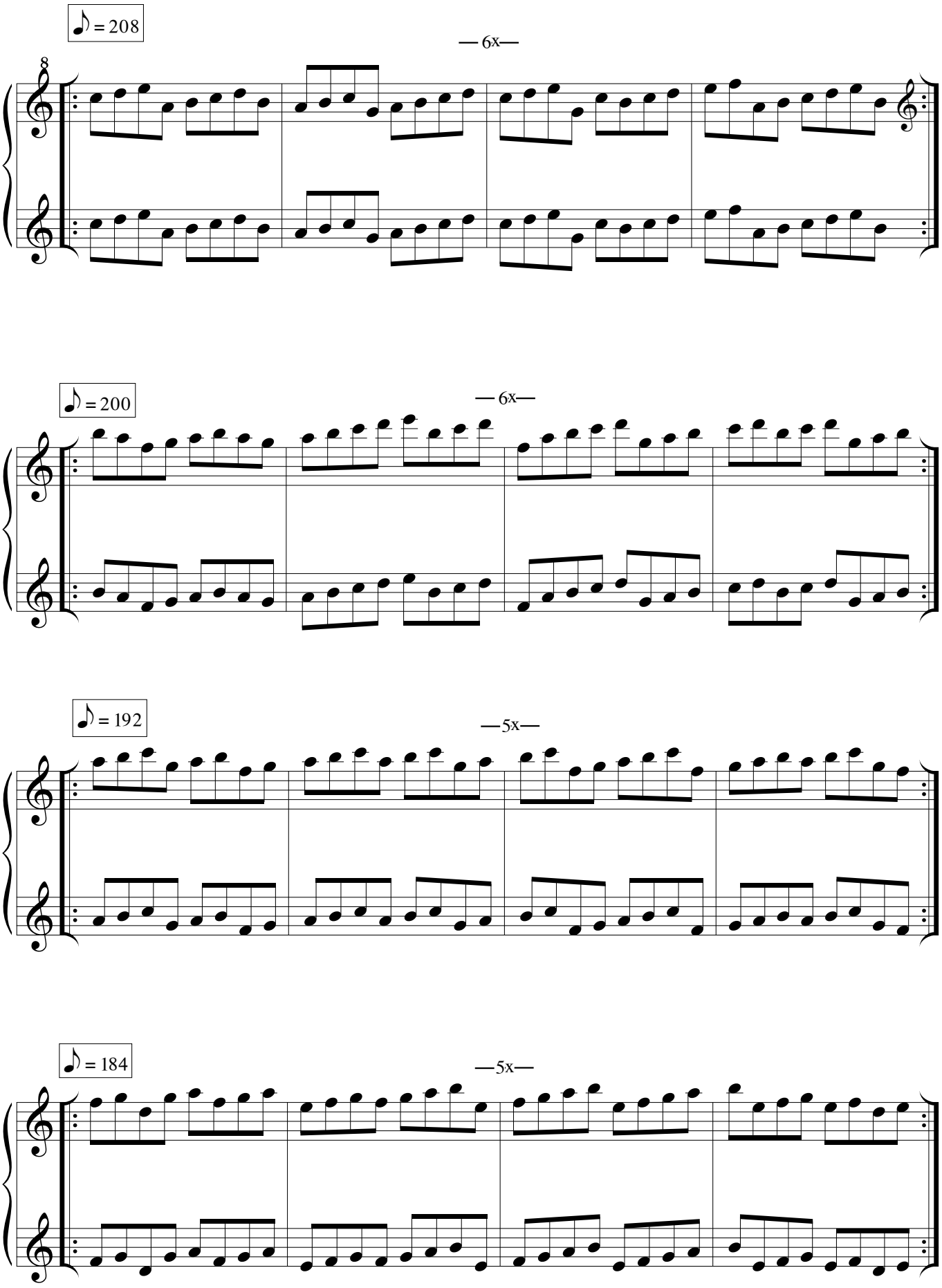

♪ = 112
—2x—
♪ = 101
—2x—
♪ = 90
♪ = 80

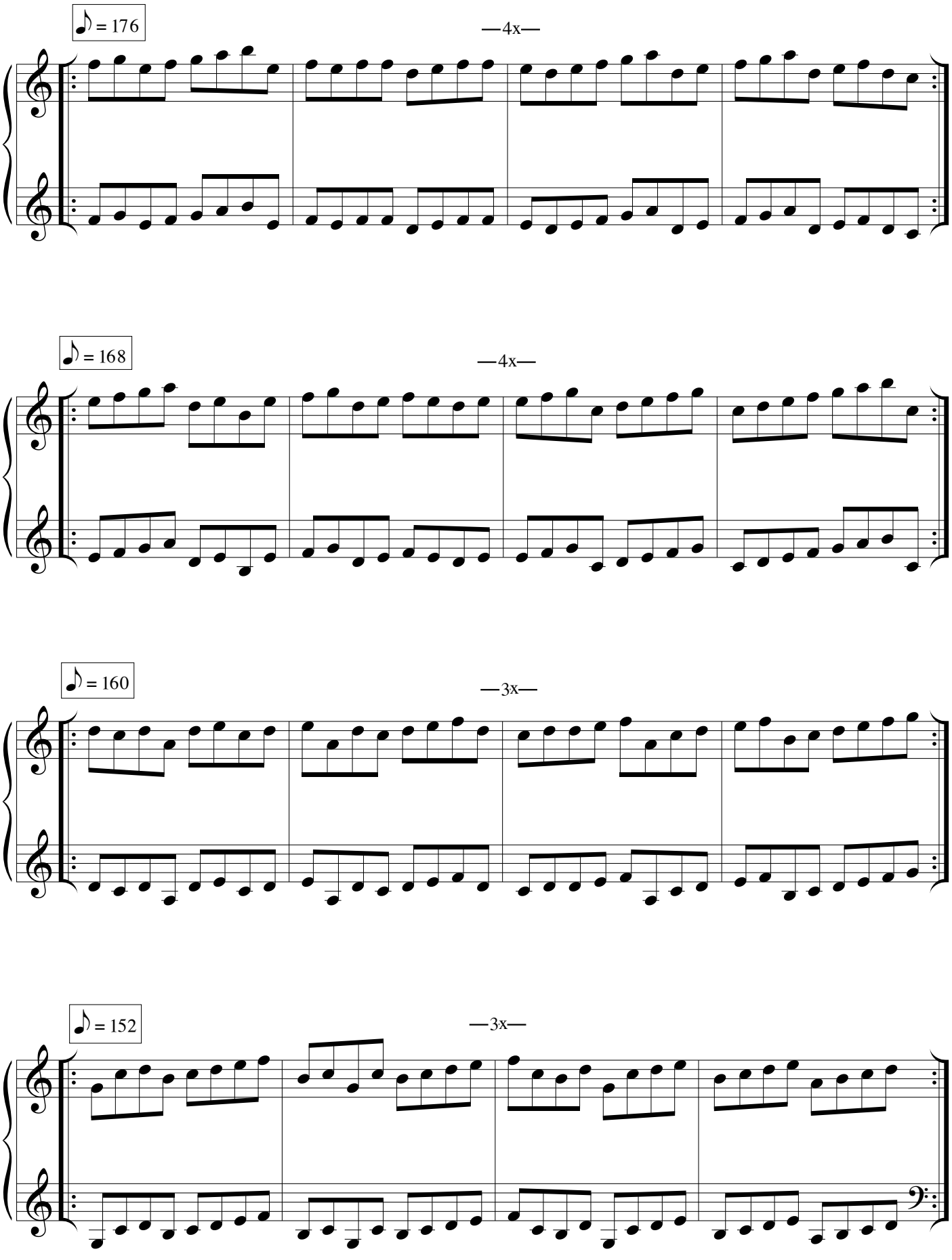
Piano 4

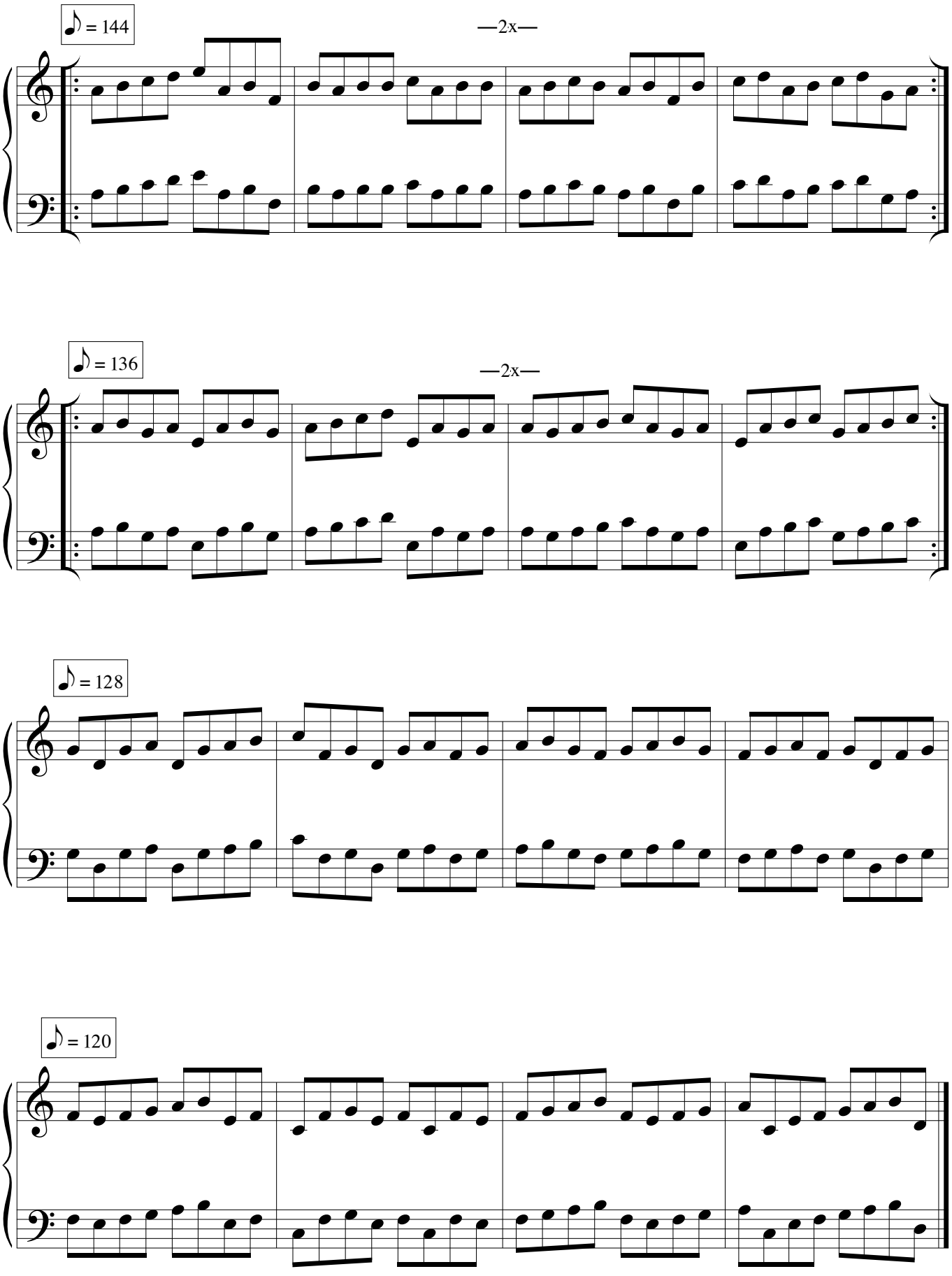
TEXTILE_4

Egidija Medeksaite (2013)



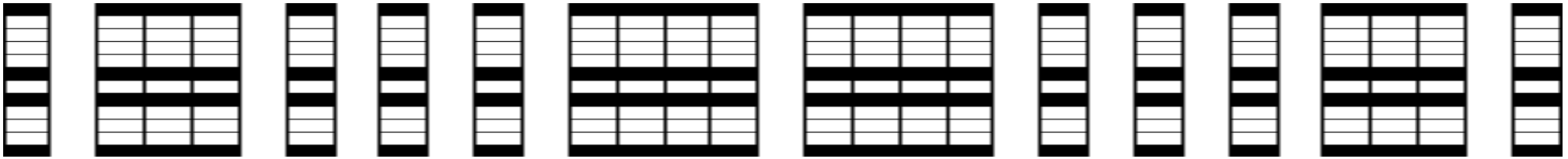

♪ = 208
— 6x—
♪ = 200
— 6x—
♪ = 192
—5x—
♪ = 184
—5x—


♪ = 176
—4x—
♪ = 168
—4x—
♪ = 160
—3x—
♪ = 152
—3x—


♪ = 144
—2x—
♪ = 136
—2x—
♪ = 128
♪ = 120

Egidija Medekšaitė

NIGAMAGAMINI



for amplified solo bass flute and pre-recorded tape

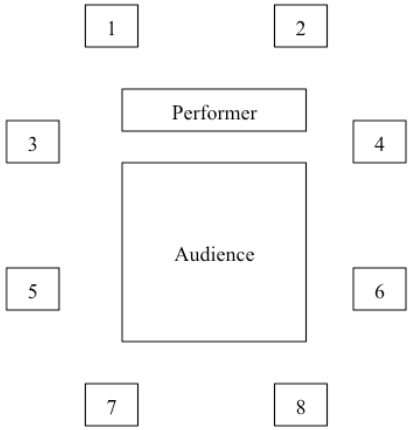
Programme note:

The pre-recorded tape is based on the same material as the solo bass flute part. Four musicians were asked to record their own interpretations of this piece. Sound synthesis, modulation, transposition and other effects were then used in order to create various drones and different timbres. Over the course of the piece, these combined drones form growing textures of sound and timbre, which gradually interweave into one massive textural pattern. Nigaragamini is a Carnatic raga, which is associated which belongs to Veda Chakram - BHU. It is the 4th rāga in the 4th *chakra Veda*. The mnemonic name is *Veda-Bhu*.Kharaharapriya.

Explanation notes:

The flautist can freely determine the durations of the pauses between the notes, and can take as much time as needed. Moreover, the performer has the freedom to choose sonic events from the list of options below, using their musical judgement in response to the pre-recorded material. Going from one note to the next the sonic event must be changed.

During the performance the pre-recorded material is realized by an 8.1 surround system, in which all four versions are spatialized and played from different loudspeakers: for example, the speakers 1 & 8 are assigned to the solo performer, speakers 2 & 7 are assigned to the first interpretation, speakers 3 & 6 are assigned to the second interpretation, and speakers 4 & 5 are assigned to the third and fourth interpretations. Special care has to be taken with regard to balancing the live amplified bass flute and the pre-recorded material. The speaker configuration is shown below:



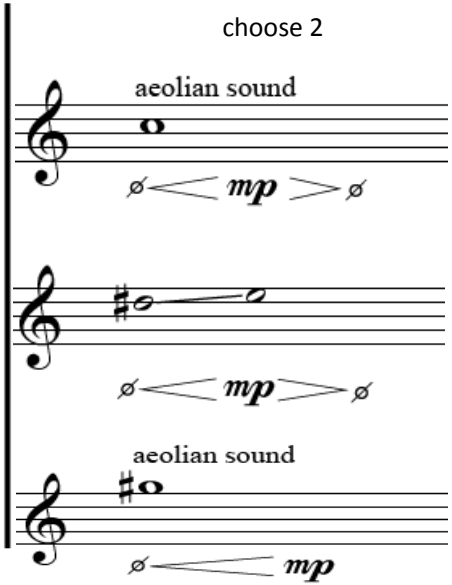
If there is no possibility for an 8.1 surround system, then the pre-recorded material and amplified solo flute can be realized with a Stereo system.

Duration: ± 10 minutes

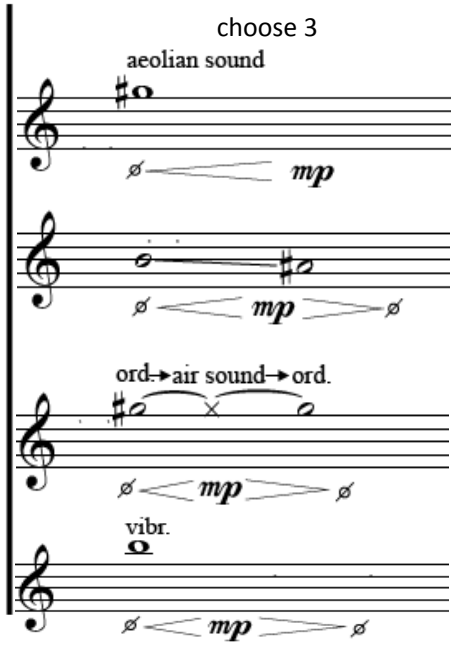
NIGAMAGAMINI

Egidija Medekšaitė (2014)

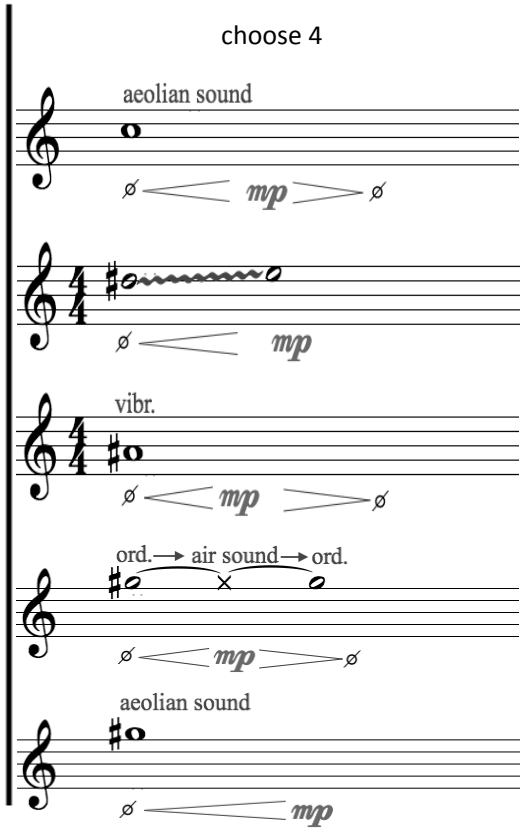
0'00"



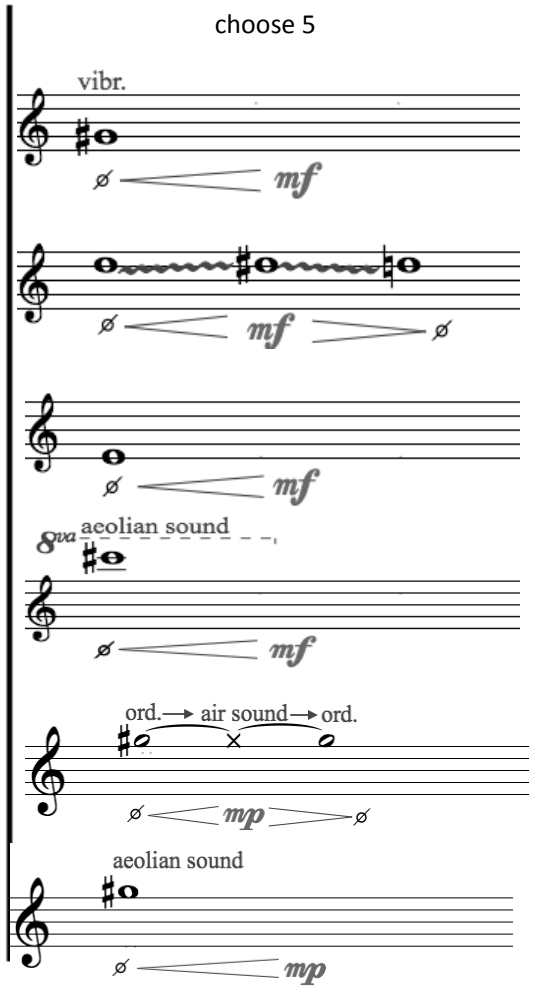
1'17"



2'34"

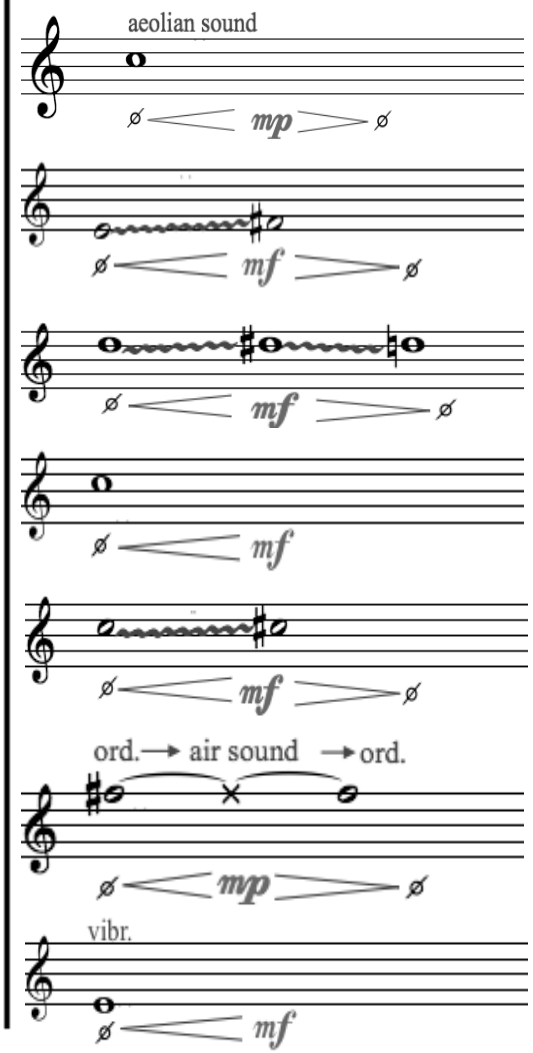


3'51"



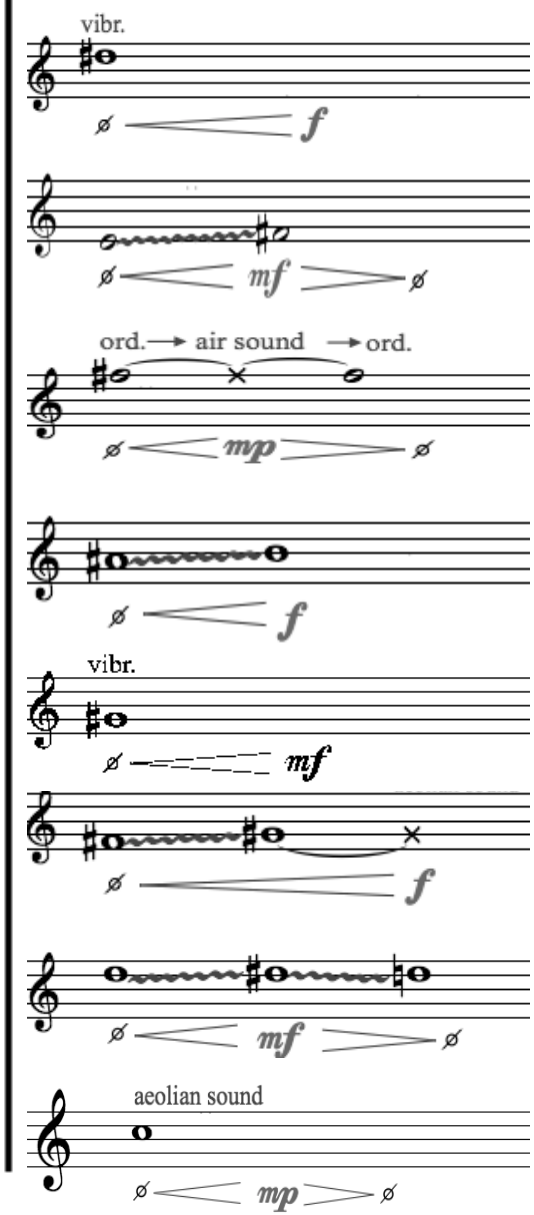
5'08"

choose 6



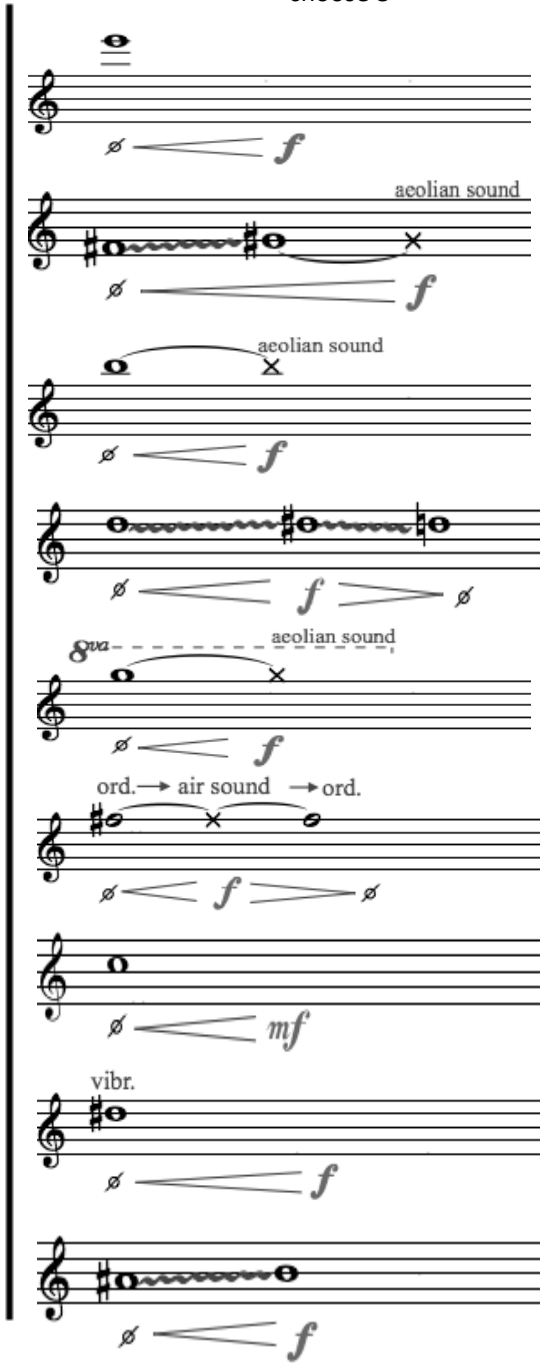
6'25"

choose 7



7'42"

choose 8



9'02"

Egidija Medekšaitė

SANDHI PRAKASH

for String Chamber Orchestra

Programme note:

The title of the composition is derived from the Indian raga's title ***Sandhi Prakash,*** perceived as the junction of day and night. ***"Sandhi"*** means *junction*, and ***"Prakash"*** means *light*. This period happens twice within 24 hours: once at Sunrise and again at Sunset, each lasting three hours, from 4 to 7 o'clock. This composition represents the idea of transformation from lightness to darkness.

Scoring:

Violin I (4)
Violin II (4)
Viola (3)
Violoncello (3)
Double Bass (2)

Explanation notes:

s.t. - sul tasto

s.p. - sul ponticello

○ - natural harmonics

 - glissando

 - tremolo

 - the highest notes of the string

 - bowing on the tailpiece

x - playing on the bridge

Duration: ± 10 minutes

Dedicated to

Kelly Lovelady and Ruthless Jabiru ensemble

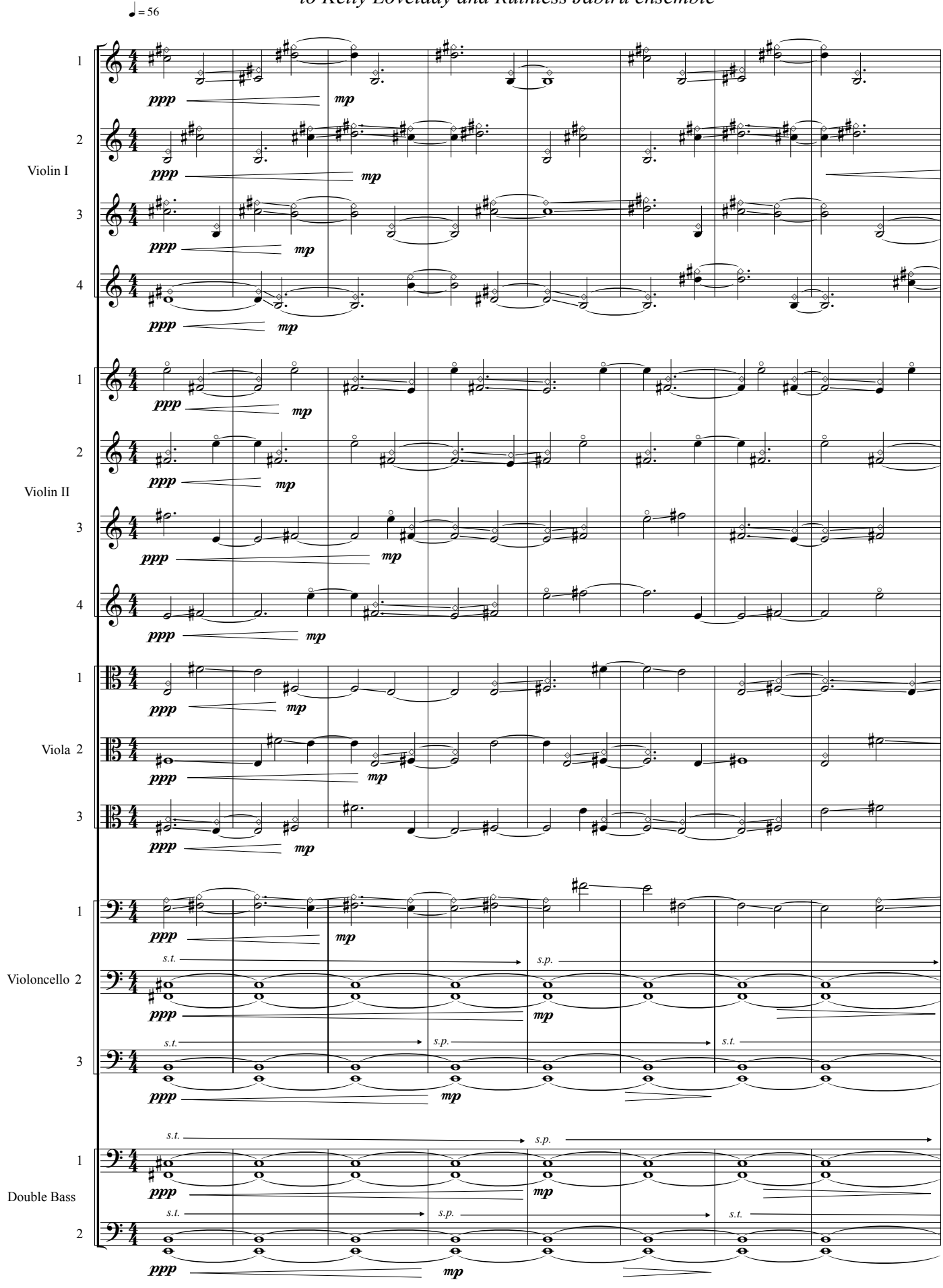
Score

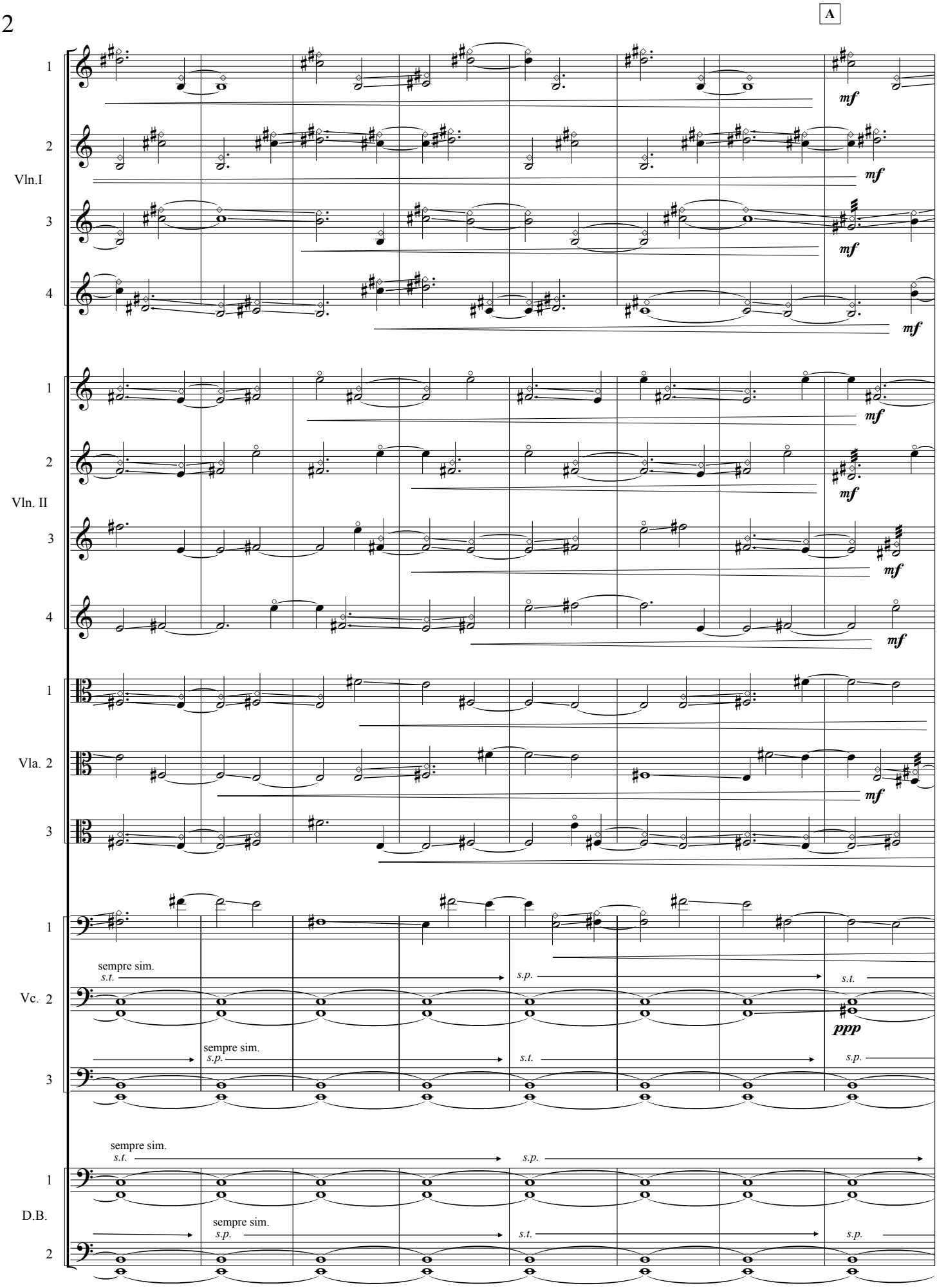
Sandhi Prakash

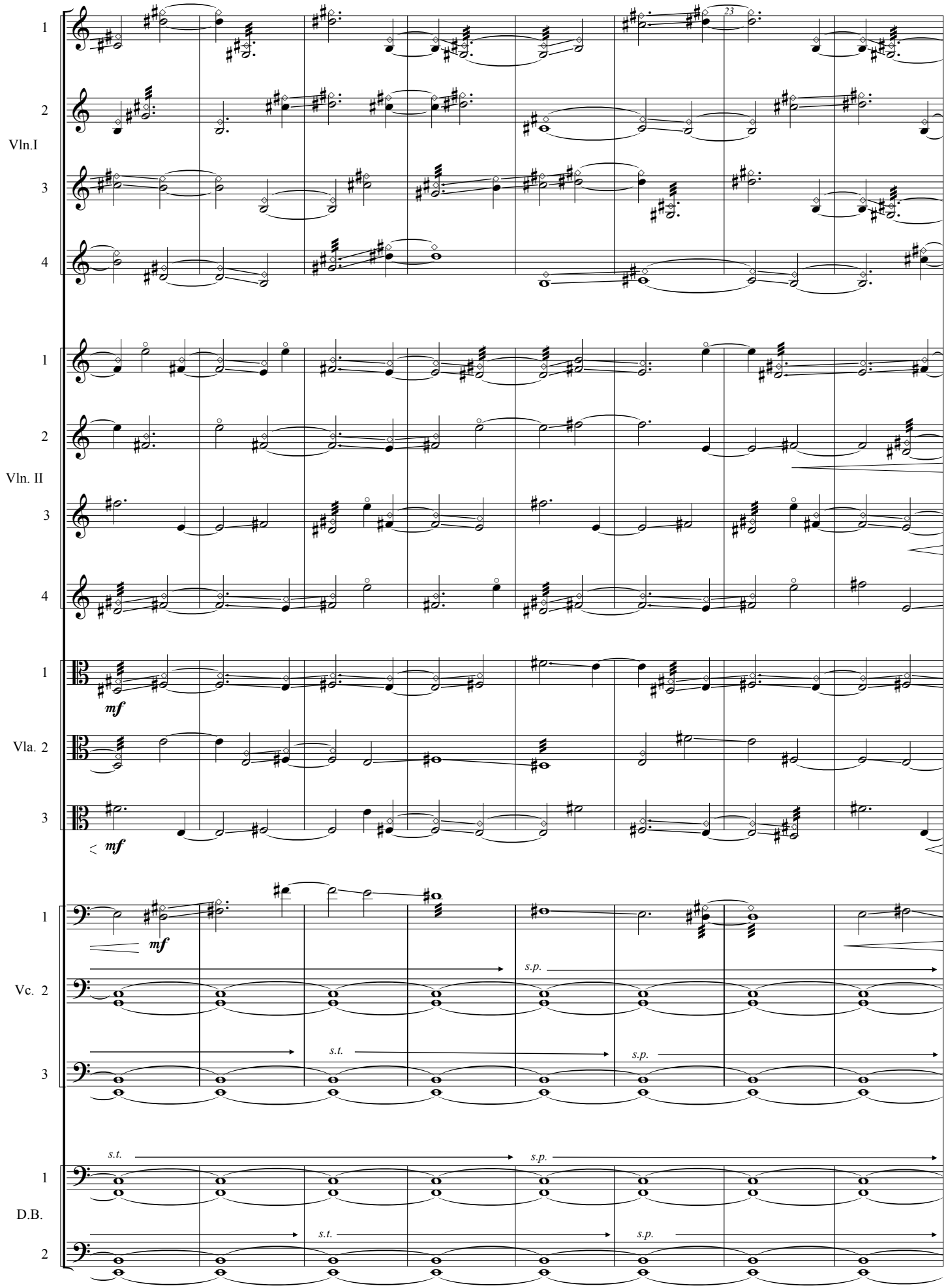
JUNCTION OF DAY AND NIGHT

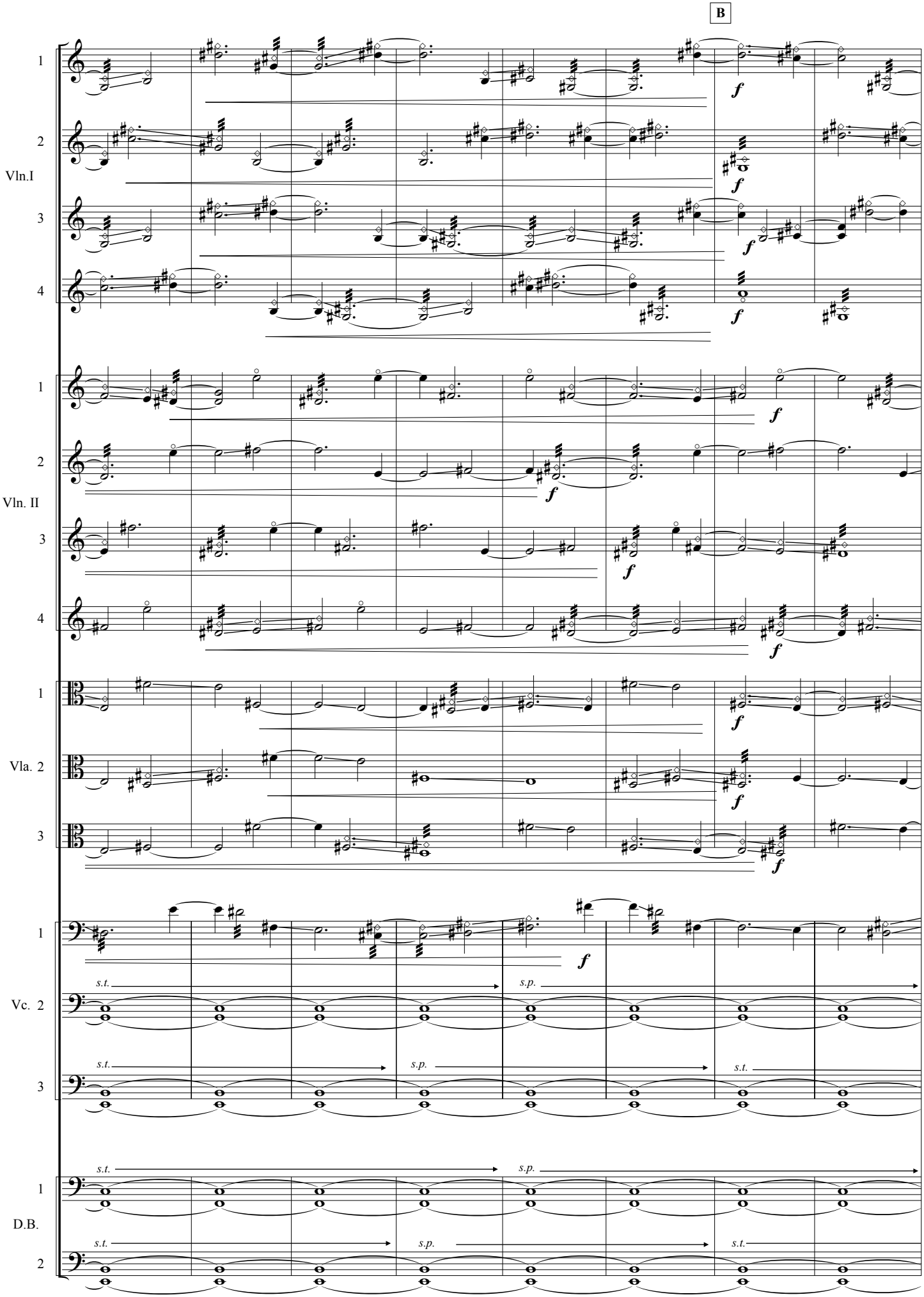
E. Medeksaite (2013)

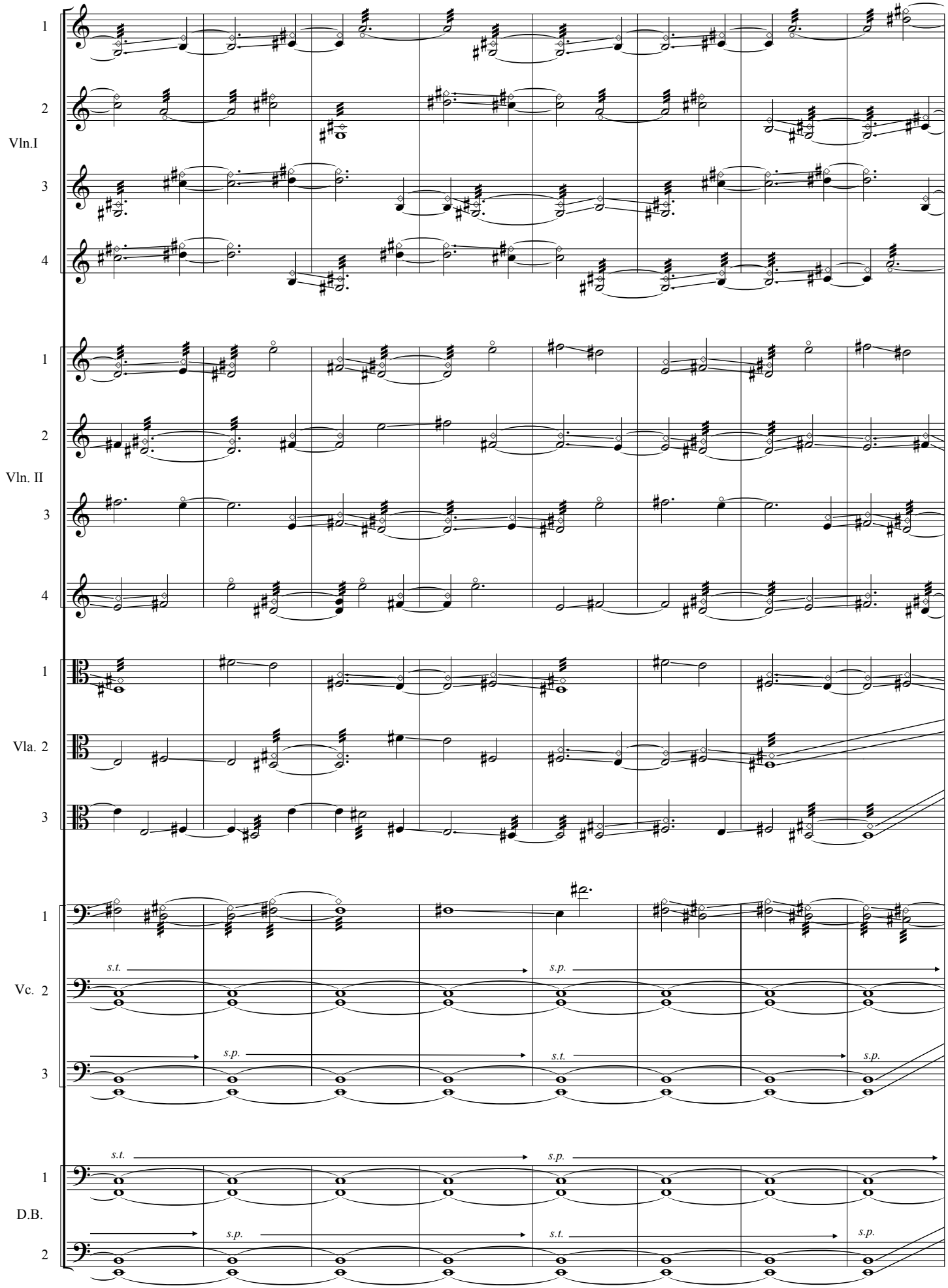
to Kelly Lovelady and Ruthless Jabiru ensemble

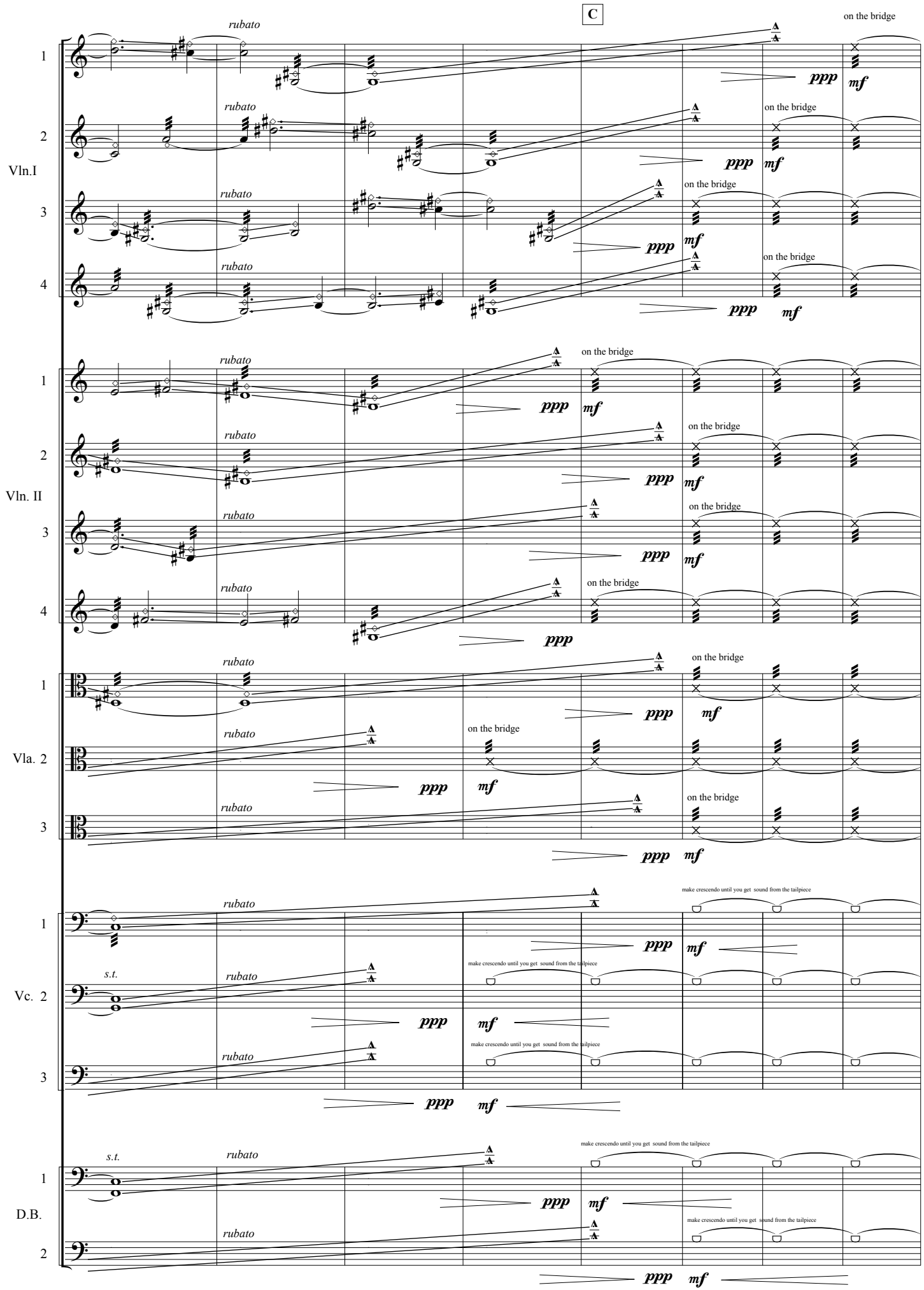


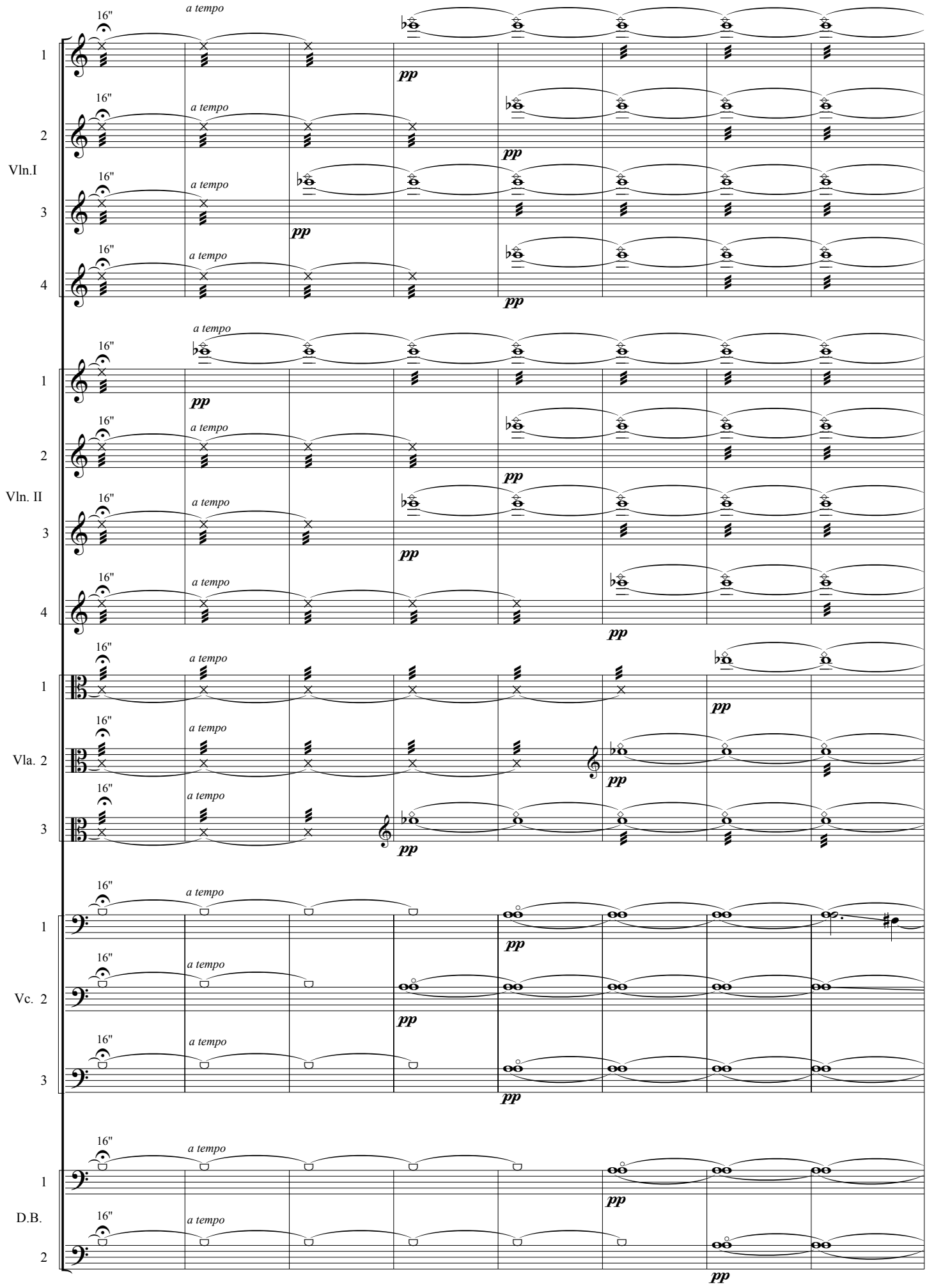

A
1
2
Vln.I
3
4
mf
1
2
Vln. II
3
4
mf
1
Vla. 2
3
mf
1
sempre sim.
s.t.
s.p.
s.t.
Vc. 2
ppp
3
sempre sim.
s.p.
s.t.
s.p.
sempre sim.
s.t.
s.p.
1
D.B.
sempre sim.
s.p.
s.t.
s.p.
2

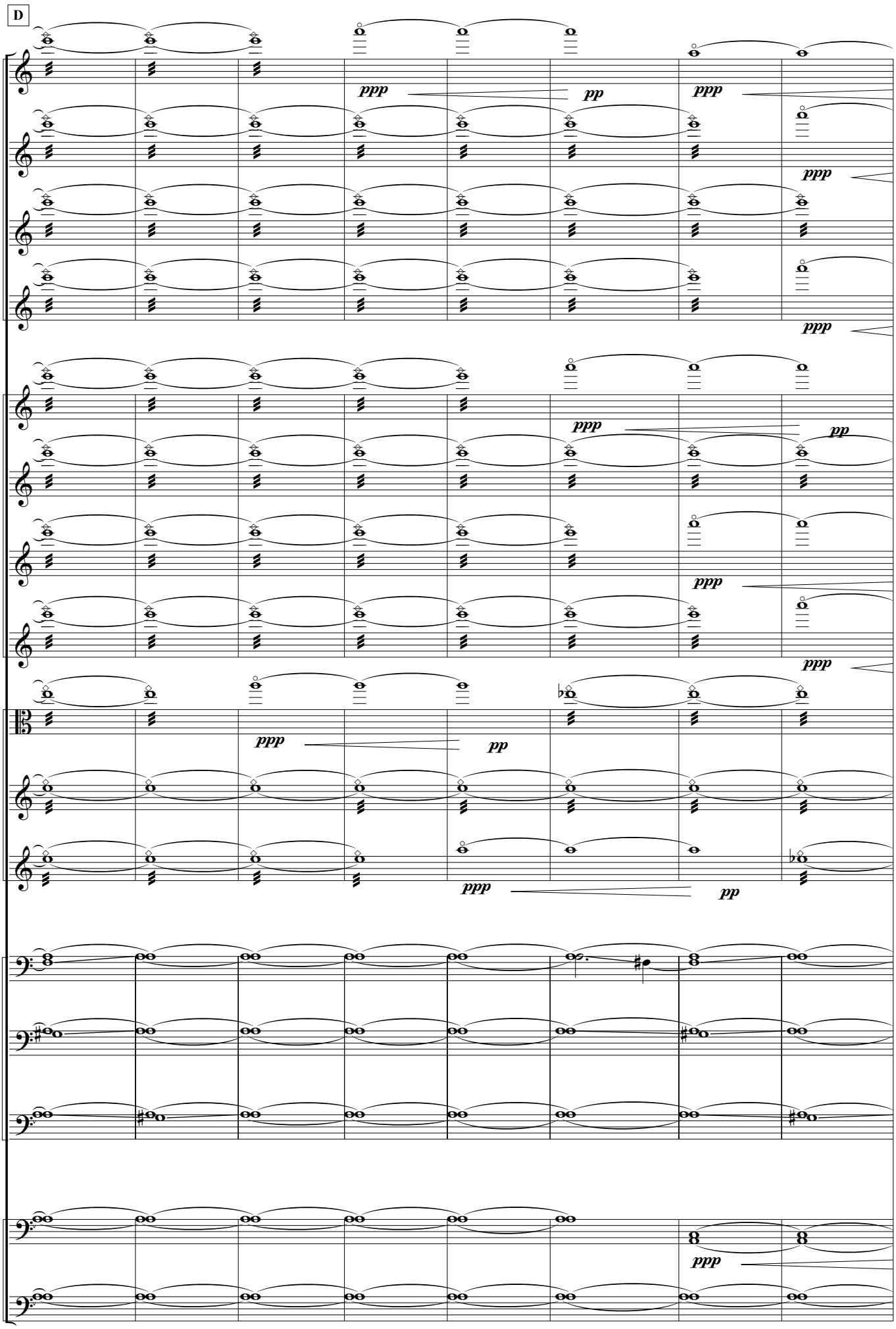

1
2
Vln.I
3
4
23
1
2
Vln. II
3
4
1
mf
Vla. 2
3
mf
1
mf
Vc. 2
s.p.
3
s.t.
s.p.
s.t.
s.p.
1
D.B.
2
s.t.
s.p.

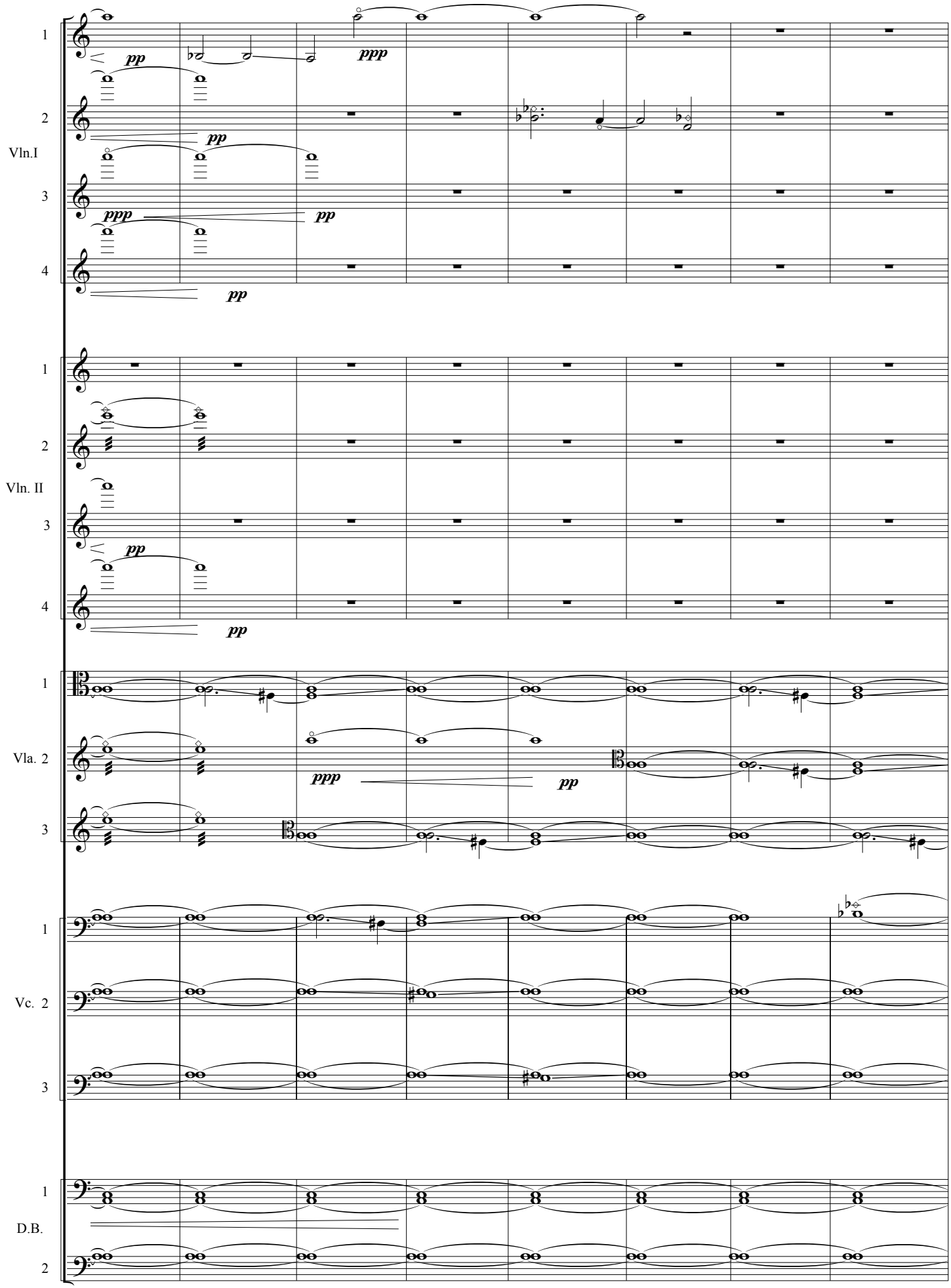

B
1
2
Vln.I
3
4
f
1
2
Vln. II
3
4
f
1
Vla. 2
3
f
1
Vc. 2
3
s.t.
s.p.
s.t.
s.p.
s.t.
1
D.B.
2
s.t.
s.p.
s.t.
s.t.
s.p.
s.t.

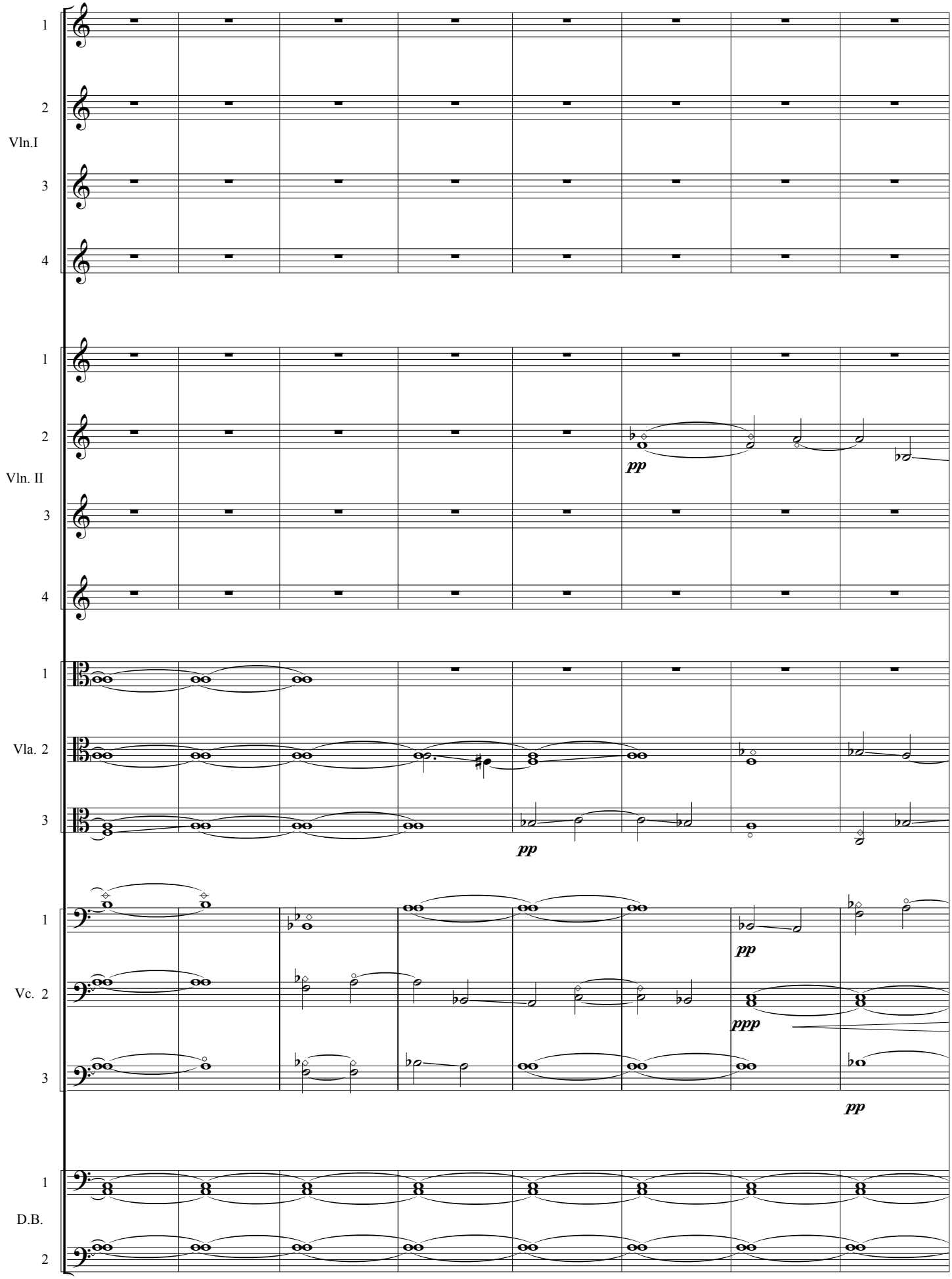

1
2
Vln.I
3
4
1
2
Vln. II
3
4
1
Vla. 2
3
1
Vc. 2
3
s.t.
s.p.
s.p.
s.t.
s.p.
1
D.B.
2
s.t.
s.p.
s.p.
s.t.
s.p.

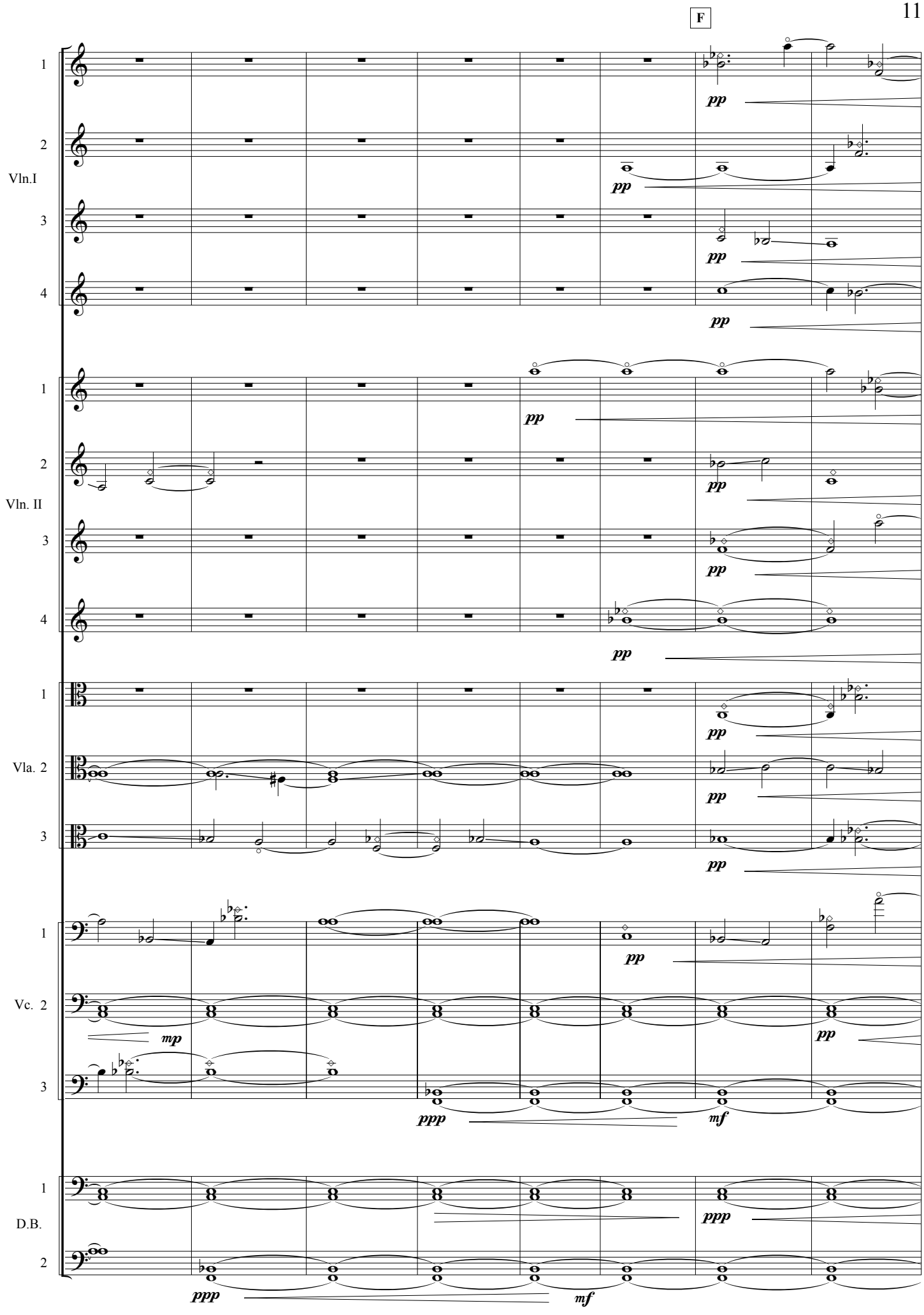

C
Vln.I
Vln. II
Vla. 2
Vc. 2
D.B.
1
2
3
4
rubato
s.t.
ppp
mf
on the bridge
make crescendo until you get sound from the tailpiece

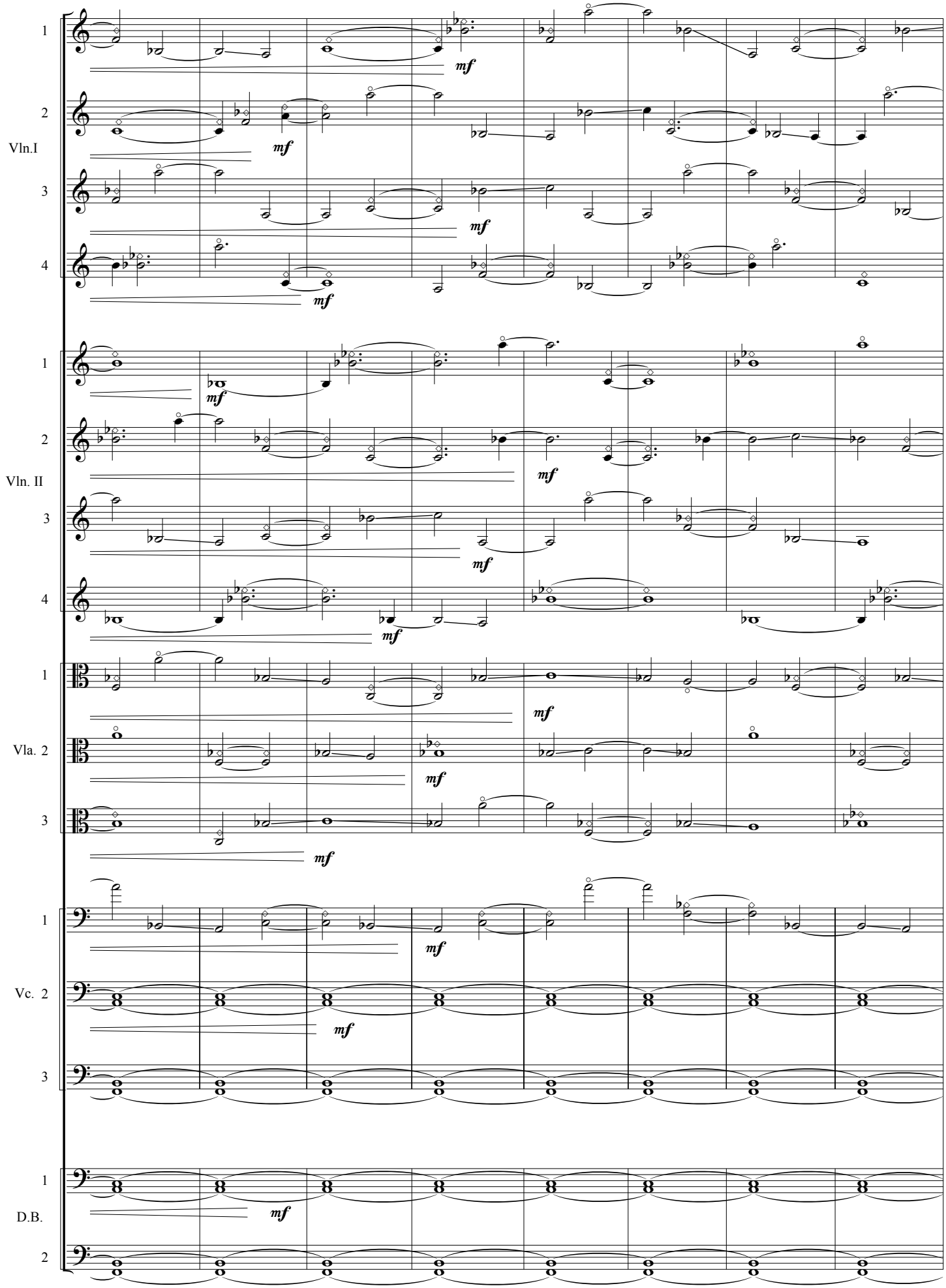

Vln.I
Vln. II
Vla. 2
Vc. 2
D.B.
1
2
3
4
16"
a tempo
pp

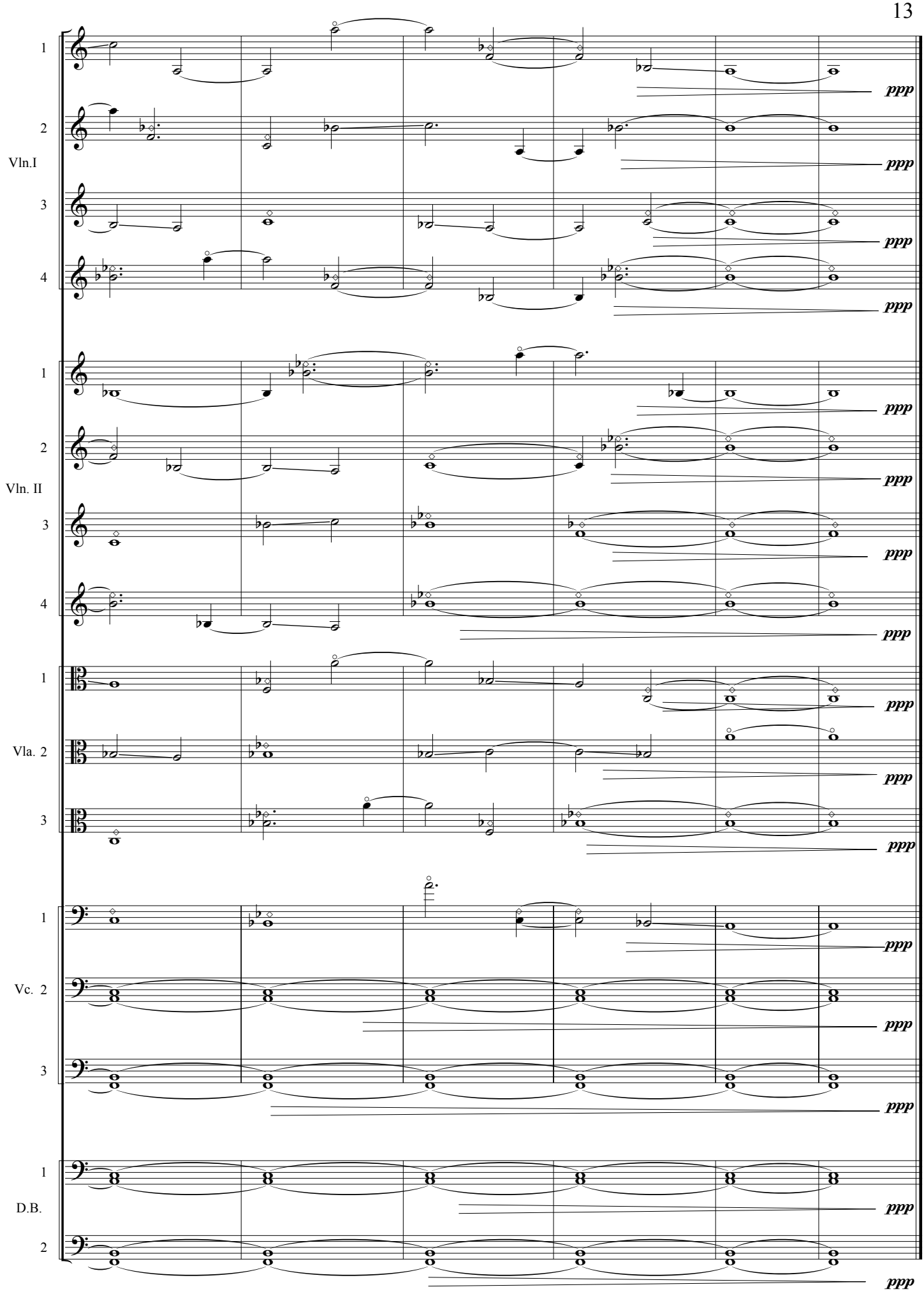

D
1
2
Vln.I
3
4
ppp
pp
ppp
ppp
1
2
Vln. II
3
4
ppp
pp
ppp
ppp
1
Vla. 2
3
ppp
pp
ppp
pp
1
Vc. 2
3
1
D.B.
2
ppp


1
2
Vln.I
3
4
pp
ppp
pp
ppp
pp
1
2
Vln. II
3
4
pp
pp
1
Vla. 2
3
ppp
pp
1
Vc. 2
3
1
D.B.
2


1
2
Vln.I
3
4
1
2
Vln. II
3
4
1
Vla. 2
3
1
Vc. 2
3
1
D.B.
2
pp
pp
pp
ppp
pp

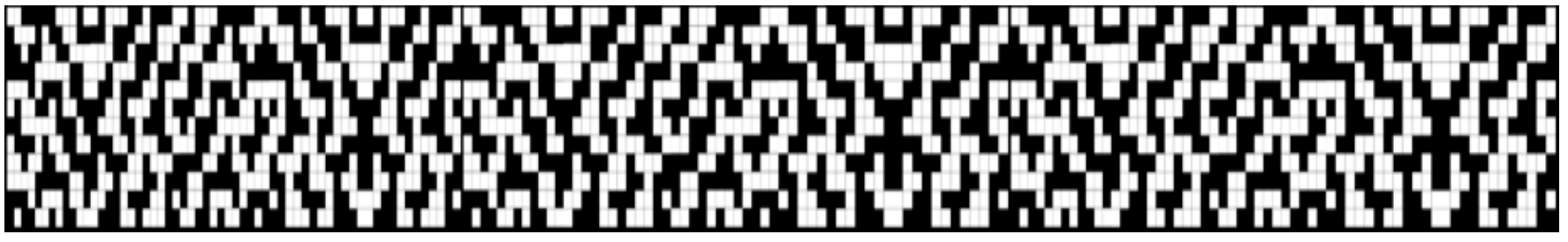

F
1
2
Vln.I
3
4
pp
1
2
Vln. II
3
4
pp
1
Vla. 2
3
pp
1
Vc. 2
3
mp
ppp
mf
pp
1
D.B.
2
ppp
mf
ppp


1
2
Vln.I
3
4
mf
1
2
Vln. II
3
4
mf
1
Vla. 2
3
mf
1
Vc. 2
3
mf
1
D.B.
2
mf


1
2
Vln.I
3
4
ppp
1
2
Vln. II
3
4
ppp
1
Vla. 2
3
ppp
1
Vc. 2
3
ppp
1
D.B.
2
ppp

Egidija Medekšaitė

TEXTILE_5



for Symphony Orchestra

Programme note:

Textile_5 is a contemplative musical landscape, emphasizing the development of musical parameters via repetitions of pitches, various textures, and rhythmical transformations. It explores the synthesis of opposite approaches within the compositional method, being the rational and the intuitive, throughout symmetrical micro-macrostructures, symmetrical division of the orchestra, and symmetrical structure of the time signature.

Textile_5 is a single-movement structure that focuses on aural phenomena, maintaining the essentially slow and transparent character, achieved by various textural multilayered repetitions and multidimensional layouts. The timbral structure is mostly organized by continuous elements and often works more as an additional coloristic effect, rather than as a melodic line. In *Textile_5* the use of the textile transformations are mapped to different timbral perspectives, constructing different aspects of the musical discourse by maintaining a timbral surface layers of constant reinvention.

Scoring:

3 Flutes
3 Oboes
3 Clarinets in B-flat
3 Bassoons

3 Horns in F
3 Trumpets in B-flat
3 Trombones
Tuba

Percussion 1 - Crotales
Percussion 2 - Vibraphone
Percussion 3 - Glockenspiel

Piano
Harp

Violin I [16]
Violin II [14]
Viola [10]
Violoncello [8]
Contrabass [4]

Score in C

Duration: ± 30 minutes

Division of sections, dynamics and tempo:

Sections	**Section A**	**Section B**	**Section C**	**Section D**	**Section E**
Division of Sections	*Page 1*	*Page 5*	*Page 11*	*Page 15*	*Page 21*
Dynamics	***ppp***	***pp***	***p***	***mf***	***f***
Tempo	♩= 58	♩= 63	♩= 69	♩= 76	♩= 81

Explanation notes:

Bisbigliando – timbral trill using alternative fingerings

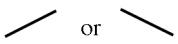
○ - natural harmonics

s.p. - sul ponticello

s.t. - sul tasto

m.s.p - molto sul ponticello

ord. - ordinario

 - glissando up or down

flz. - flutter-tonguing

Mutes for brass:

Horns:

\+ - hand stopping

Trumpets:

Section A - metal harmon mute, stem removed

Section B - fibre cup mute

Section C - metal cup mute

Section D - metal straight mute

Section E - without mute

Trombones:

Section 1 - metal bucket mute

Section 2 - metal cup mute

Section 3 - wooden straight mute

Section 4 - metal straight mute

Section 5 - without mute

Score in C

TEXTILE_5

Egidija Medeksaite (2014)

♩ = 58 ***ppp*** A1

Flute 1 2 3

Oboe 1 2 3

Clarinet in B♭ 1 2 3

Bassoon 1 2 3

Horn in F 1 2 3

Trumpet in B♭ 1 2 3

Trombone 1 2 3

Tuba

Crotales

Glockenspiel

Vibraphone

Harp

Piano

Violin I

Violin II

Viola

Violoncello

Contrabass

A2

A3

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

vibrato

simile

molto vibrato

bisbigliando

A4

A5

Fl. 1 2 3

Ob. 1 2 3

B♭ Cl. 1 2 3

Bsn. 1 2 3

Hn. 1 2 3

B♭ Tpt. 1 2 3

Tbn. 1 2 3

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

A6

1
Fl. 2
3
1
Ob. 2
3
1
B♭ Cl. 2
3
1
Bsn. 2
3
1
Hn. 2
3
1
B♭ Tpt. 2
3
1
Tbn. 2
3
Tuba
Cr.
Glock.
Vibr.
Hp.
Pno.
Vln. I
Vln. II
Vla.
Vc.
Cb.

vibrato
simile
ord.
s.p.

B1 ♩ = 63 *pp*

B2

1 Fl. 2 3

1 Ob. 2 3

1 B♭ Cl. 2 3

1 Bsn. 2 3

1 Hn. 2 3

1 B♭ Tpt. 2 3

fibre cup mute *simile*

1 Tbn. 2 3

metal cup mute *slide vibrato* *simile*

Tuba

Cr. Glock. Vibr.

Hp.

Pno.

Vln. I Vln. II

s.p. *s.t.*

Vla.

Vc.

ord.

Cb.

B3

B4

1
Fl. 2
3

1
Ob. 2
3

1
B♭ Cl. 2
3

1
Bsn. 2
3

1
Hn. 2
3

1
B♭ Tpt. 2
3

1
Tbn. 2
3

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

B5

B6

Fl. 1 2 3

Ob. 1 2 3

B♭ Cl. 1 2 3

Bsn. 1 2 3

Hn. 1 2 3

B♭ Tpt. 1 2 3

Tbn. 1 2 3

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

B7

1
Fl. 2
3

1
Ob. 2
3

1
B♭ Cl. 2
3

1
Bsn. 2
3

vibrato
simile

1
Hn. 2
3

vibrato
simile

1
B♭ Tpt. 2
3

flz.
simile

1
Tbn. 2
3
Tuba

flz.
simile

Cr.
Glock.
Vibr.
Hp.
Pno.

Vln. I
Vln. II
Vla.
Vc.
Cb.

m.s.p.
ord.

B8

B9

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

change to picc.

flz.

vibrato

simile

ord.

m.s.p.

Fl. 1 2 3

Ob. 1 2 3

B♭ Cl. 2 1 2 3

Bsn. 1 2 3

Hn. 1 2 3

B♭ Tpt. 2 1 2 3

Tbn. 1 2 3

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

flz.

vibrato

simile

bisbigliando

m.s.p.

ord.

C1 ♩= 69 *p*

C2

1 Fl. 2 3 — *change to fl.*

1 Ob. 2 3

1 B♭ Cl. 2 3

1 Bsn. 2 3

1 Hn. 2 3 — *vibrato* / *simile*

1 B♭ Tpt. 2 3 — *metal cup mute* / *vibrato* / *simile*

1 Tbn. 2 3 — *wooden straight mute* / *flz.* / *simile*

Tuba — *flz.* / *simile*

Cr.

Glock.

Vibr.

Hp. — *bisbigliando* / *simile*

Pno.

Vln. I — *m.s.p.* / *ord.* / *simile*

Vln. II — *m.s.p.* / *ord.* / *simile*

Vla. — *ord.* / *simile*

Vc. — *m.s.p.* / *simile* / *s.p.*

Cb. — *m.s.p.* / *simile* / *s.p.*

C3

C4

1
Fl. 2
3

1
Ob. 2
3

1
B♭ Cl. 2
3

1
Bsn. 2
3

1
Hn. 2
3

1
B♭ Tpt. 2
3

1
Tbn. 2
3
Tuba

Cr.
Glock.
Vibr.
Hp.
Pno.

Vln. I
Vln. II
Vla.
Vc.
Cb.

C5

C6

1
Fl. 2
3
1
Ob. 2
3
1
B♭ Cl. 2
3
1
Bsn. 2
3
1
Hn. 2
3
1
B♭ Tpt. 2
3
1
Tbn. 2
3
Tuba
Cr.
Glock.
Vibr.
Hp.
Pno.
Vln. I
Vln. II
Vla.
Vc.
Cb.

flz.
simile
molto vibrato
vibrato
m.s.p.
ord.

C7

Fl. 2
Ob. 2
B♭ Cl. 2
Bsn. 2
Hn. 2
B♭ Tpt. 2
Tbn. 2
Tuba
Cr.
Glock.
Vibr.
Hp.
Pno.
Vln. I
Vln. II
Vla.
Vc.
Cb.

flz.
simile
molto vibrato
m.s.p.
ord.

D1 ♩= 76 *mf*

D2

5/4 7/8 3/4 7/8 5/4 3/4 5/4

1 Fl. 2 3

1 Ob. 2 3

1 B♭ Cl. 2 3

1 Bsn. 2 3

1 Hn. 2 3

1 B♭ Tpt. 2 3

1 Tbn. 2 3

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

ord. *flz.* *simile* *mf*

metal straight mute *molto vibrato*

m.s.p.

medium mallets

sempre sim.

D3

D4

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

D5

1
Fl. 2
3

1
Ob. 2
3

1
B♭ Cl. 2
3

1
Bsn. 2
3

molto vibrato
simile

1
Hn. 2
3

flz.
simile

1
B♭ Tpt. 2
3

flz.
simile

1
Tbn. 2
3
Tuba

flz.
simile

Cr.
Glock.
Vibr.
Hp.
Pno.

8va

Vln. I
Vln. II
Vla.
Vc.
Cb.

ord.
m.s.p.
simile

D6

D7

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

D8

D9

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

D10

Fl. 2
Ob. 2
B♭ Cl. 2
Bsn. 2
Hn. 2
B♭ Tpt. 2
Tbn. 2
Tuba
Cr.
Glock.
Vibr.
Hp.
Pno.
Vln. I
Vln. II
Vla.
Vc.
Cb.

flz.
simile
m.s.p.
ord.
8va

E1 ♩ = 81 *f*

E2

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

hard mallets

sempre sim.

simile

flz.

ord.

E3

1
Fl.2
3
1
Ob.2
3
1
B♭ Cl. 2
3
1
Bsn. 2
3
1
Hn. 2
3
1
B♭ Tpt. 2
3
1
Tbn. 2
3
Tuba
Cr.
Glock.
Vibr.
Hp.
Pno.
Vln. I
Vln. II
Vla.
Vc.
Cb.

flz.
simile
molto vibrato

E4

E5

1
Fl.2
3

1
Ob. 2
3

1
B♭ Cl. 2
3

1
Bsn. 2
3

1
Hn. 2
3

1
B♭ Tpt. 2
3

1
Tbn.2
3

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.

E6

Fl. 2

Ob. 2

B♭ Cl. 2

Bsn. 2

Hn. 2

B♭ Tpt. 2

Tbn. 2

Tuba

Cr.

Glock.

Vibr.

Hp.

Pno.

Vln. I

Vln. II

Vla.

Vc.

Cb.