Creative Music Production

Professional Project

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Rhys Mayes

Interpreting Gialli as Music

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Abstract

This project explores the idea and details the process of interpreting Giallo films as music. Gialli are highly expressive, Italian horror films which reached the peak of their popularity in the 1970s, and are known for their powerful suspense, plot twists, and artistic murder scenes. This work will detail the process derived in order to successfully capture the data required to create a composition from these films, and will detail the composition process utilised in the final piece. The physical work of the project will manifest as an 8-minute electronic piece, serving as a representation of 'Suspiria': a 1977 Giallo film directed by Dario Argento. At its core, this piece is an artistic endeavour which explores the world of data-driven composition processes in an incredibly abstract way. This open-ended approach leaves opportunities for other composers to build off the ideas presented in this thesis, to extend them into more complex processes, and to employ them in other areas and other mediums.

Artwork by Faith Nico (@cess.pit)

The code, score, and collected data can be viewed at [this GitHub link](reezmaize/GialloMusic) (reezmaize/GialloMusic).

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Introduction

The purpose of this project is to explore the idea of representing a piece of cinema as a piece of music, specifically the visually and sonically striking world of the Giallo; "*A genre of Italian thriller or horror film typically involving a murder mystery and characterized by graphic violence, eroticism, an atmospheric, sometimes dreamlike blend of suspense and horror elements, and often a prominent, intense music score"*.

Gialli lend themselves to this abstraction due to their exceedingly expressive visual style, frequent depiction of graphic murder scenes, and ability to genuinely conceal the killer's identity from the audience, creating enormous suspense before the identity is revealed at the very end of the film. The three films selected were originally: *"Suspiria"* (1977)*, "Deep Red"* (1975)*,* and *"Seven Blood-Stained Orchids"* (1972), the latter of which being directed by Umberto Lenzi, and the former two by Dario Argento, hailed as the most prominent director of the genre. However, this has been scaled back to only include 'Suspiria'.

The project will manifest as an experimental, electronic piece, with the original vision that there would be one for each film chosen. The musical content and structure of which will be determined by data gathered from the film and the accompanying soundtrack, condensed into an approximate time limit of 4-7 minutes. The piece will be scored traditionally in an engraving software package, and then orchestrated in Csound in order to allow great control over the complex sound design required to illustrate themes.

In the literature review section of this work, other works that are relevant to the completion of this project will be addressed. This includes works that make reference to plotting out narrative structure, the relationship between colour and sound, Csound DSP techniques, word painting, and some more specific to Gialli themselves. These works will be analysed, critiqued and their relevance to the project outlined. The methodology section will provide an understanding of the process behind gathering the data and completing the composition process.

Literature Review

As the pieces being written to accompany this thesis are scored and not procedurally generated, most of the pieces that will be reviewed in this section will be more relevant to narrative structure, the plotting of narrative and linking visual content with aural content, as the evolution of each film's narrative is imperative to the structure of the accompanying composition. There is also information pertaining to the process of translating visual content into aural content, and one Csound related work to guide synthesis processes.

The first piece of research to be addressed is 'The emotional arcs of stories are dominated by six basic shapes' (Reagan et al., 2016). This work takes 1,327 works of fiction from the fiction collection of Project Gutenberg. As an example, the authors generate emotional arcs by analysing windows of 10,000 words. Using this method, they are able to take the complex plot of 'Harry Potter and the Deathly Hallows' and clearly display the overarching emotional arc of the story.

The purpose of the research presented is to study a culture's evolution through a 'big data' lens. They state that as humans, our communication relies on a shared emotional experience, with stories forming significant patterns that resonate emotionally with us. In their studies they find that there are six key patterns commonly formed by analysing these plots, and cross-reference these findings with today's works of fiction, indicating that certain emotional arcs enjoy greater commercial success than others.

The authors use highly detailed but clear diagrams to illustrate the findings of their primary research. Great detail is exercised to properly demonstrate their methodology, even presenting the complex mathematical formulae used in selecting works for analysis. Considerable care was taken to ensure the findings would be accurate, with very rigorous analysis carried out. The research is presented in full, and although it makes for arduous reading, it is a very reliable and detailed piece.

The research presented here will be easily transferable to the medium of film. The use of this resource in relation to this project will allow insight on how to accurately plot out the narrative of the films selected for analysis, although due to the compact and somewhat brief nature of film narrative when compared to books, the process will not be as intensive as what is presented here.

The second resource to be reviewed is ‘Color and Sound: Physical and Psychophysical relations’ (Caivano, 1994). This work explores the relationship between colour and sound, comparing the variables that sounds and colours are composed of. The piece relates luminosity to amplitude, saturation with timbre, and the size of the coloured object to duration of sound. The author also illustrates the correlation between the individual hue scales or ‘colour circles’ and musical scales.

The piece expands on previous work done in the field, adding the aforementioned comparisons to the precursory comparison of relating a sound of a specific frequency with a spectral colour. The author presents what he has found, and encourages further research to be done into the field. It is also suggested that composers may utilise the psychological perspective of this research, that engineers may utilise the physical perspective, and suggests that it could be a beneficial tool in teaching music through associations with colours.

Similarly to the previous work, this piece makes highly effective use of comprehensible diagrams and tables to illustrate the relationship between colours and sounds. The work frequently refers to previous researchers by name, and knowledgeably discusses their findings, comparing them to each other confidently.

This piece will prove to be a highly valuable resource during the composition process, with the diagrams specifically being incredibly informative. According to the work’s conclusion, this project is certainly within the bounds of what the piece was written to inform.

The third work to be reviewed is 'Media Aesthetics and Fulldome Filmmaking' (Yu, 2001) which is an exploration of applying traditional filmmaking techniques to the medium of fulldome cinema. The author explains that the focus of fulldome technology prior to the writing of the work has been almost entirely rooted in education, and that work should be done to introduce emotional reactions in a similar fashion to traditional filmmaking.

The work serves as a springboard for further research to be done in the area, and to encourage fulldome filmmakers to embrace this idea. The work observes how motion, editing pace, use of colour, and image quality provoke a reaction in the audience in terms of arousal and valence, and charts the results on a graph along with a multitude of other emotions. It also addresses narrative intensity, relating this to the studies on emotion.

The piece has no relation to the audio world at all, but provides some solid investigation into the emotional reactions of audiences based on narrative content and aesthetics. The work will provide insight on what emotional states are provoked by certain sections of the selected films, and therefore what emotions should be accented in the corresponding sections of the compositions.

'Comparative Theories of Visual Art and Music: May I Play You a Picture?" (Lill, 2012) is the fourth work that will be analysed here. The piece analyses the link between visual arts and aural arts. The author mentions that this comparison can function as a tool for a musician to understand visual art in more familiar terms and vice-versa. Works of art that exploit this relationship are also mentioned, along with many references to the studies of ancient greeks.

The work presents many ideas of how the two mediums could be related, but discounts each of them individually. The conclusion states that there is no intrinsic connection between visual and aural art, as they are inherently different and rely on inherently different physics. However, the author does note that creative comparisons can easily be made between the two, and can be used as a valuable tool for an artist of either medium to enrich their style and create interesting work.

The research goes fairly in depth on what past research has been done on the topic, as well as providing sufficient examples of works of art that have taken advantage of this relationship. As mentioned previously, the author makes frequent reference to the ideas of the ancient Greeks regarding this topic, and fills in the blanks with more modern research. The author clearly has an assured knowledge on the topic, confidently expressing his ideas and backing them up with plenty of reference. However, there are no diagrams used in the text at all, making it somewhat more difficult to understand at first compared with previous works analysed.

This work will be very useful when compared and combined with 'Color and Sound: Physical and Psychophysical relations' (Caivano, 1994), being very useful in the composition process and deciding how to translate the films into scored music.

The fifth resource presented here is an invaluable resource to anyone working with csound. Virtual Sound (Bianchini, Cipriani, 2000) is a book detailing core principles of csound, with many code examples to allow easy learning of complex ideas. It covers the most basic of synthesis techniques and spans to very complex audio manipulation techniques, presenting them in their most basic forms to allow expansion on each concept.

The book acts very much as an introduction to csound for the beginner, even providing information on simply starting the program on your machine. However it also serves as an instrument to allow already experienced csound users to expand their repertoire, offering something for every kind of csound user. Not only is it of key relevance to csound, but is written in a way that allows non-users of csound to explore digital synthesis techniques in their own context.

The text is divided into very distinct chapters, making it effortless to find whatever piece of information the reader is looking for. It also provides highly useful blocks of code demonstrating each topic, and frequently provides diagrams and flow-charts demonstrating DSP functions and detailing the signal flow of a csound orchestra respectively. However, the age of the text does manifest itself occasionally, especially when talking about computers in a general sense. There have been many opcodes and concepts added to csound in the twenty years since this was written, and therefore some of the concepts detailed in it may be quite outdated.

Virtual Sound will prove especially useful in the sound design stage of the project, easily teaching how to implement some complex synthesis techniques, and providing some fascinating insight into audio manipulation which will be highly applicable to including elements of film soundtrack in the pieces. Its section on 3-D sound will be of great use when setting up csound to output to a multichannel speaker setup.

'Sound, Screams and the Score: An Exploration of Sound in Classic Horror Slashers' (Shehan, 2017) explores sound design and composition in the world of horror movies. The text makes reference to 'The Texas Chainsaw Massacre (1974)', and 'Halloween (1978)'. These are both American films, although they appear in the same time period as Giallo.

The piece begins by giving an introduction to horror movies, the tropes that both the screen and sound indulge in, and briefly covers what sound in movies had been in the past. The author goes on to talk about 'The Texas Chainsaw Massacre', especially focusing on the sound effects and diegetic sounds. The text addresses the use of silence in the film, and its sparse scoring. This is then contrasted with 'Halloween', addressing its fleshed-out score and lack of reliance on diegetic sound.

'Sound, Screams and the Score…' is a valuable study into the sound worlds of these two films. Although these films are not Gialli and in fact bear little resemblance to the expressive, erotic, and artistic features of the European school of horror cinema, the study into these scores is certainly a valid one and will guide decisions in composition and sound design in this project, aiding the process of translating the visuals into music.

The penultimate text to be analysed in this section is 'An Essay on Word Painting' (Godt, 1984), the purpose of which is to highlight the importance of considering the text when analysing or appreciating a piece of vocal music, with a focus on orchestral music.

The text gives examples of word painting and picks them apart, periodically comparing how composers of different generations and movements would approach word painting in their own way. The text also mentions that word order and sentence structure can influence how effective word painting is. Another notable point is that word painting does not only rely on accenting key phrases and words, but may also employ the practice of leaving these key phrases unaccented, making just as compelling a statement, if not more so than an accented phrase.

The piece seems very much rooted in the common practice period of western classical music. A world foreign but not completely irrelevant to the ideals of this project. However, although the compositional approach and sound world of this music is entirely different to this project, the word painting techniques remain relevant and may still be deployed in this project in a different context.

The examples of word painting presented here may be employed in a somewhat more abstract way than traditionally done. Although the techniques will be applied to lines of dialogue, character names, et cetera, they will also be applied to the overarching plotline, emotional arcs, and other more abstract variables that must be represented in the music. This will prove exceedingly valuable in effectively translating these non-musical features into musical phrases.

The final work to be looked at in this section is 'The Giallo and Postmodernism' (Castañé), the purpose of which is to link the Giallo film with the Postmodernist movement in film. The author explains that in film, the 1960's called for a change to a more artistic and expressive style of filmmaking, breaking the established rules in both visuals, and narrative structure.

The article suggests that this need to go beyond the norms of filmmaking, became somewhat of a norm, and led to filmmakers embracing the highly expressive visual style, but falling back to a variation on the more traditional narrative structures, using the visuals to subtly develop the films narrative. The author takes Dario Argento's quintessential giallo 'Deep Red' or 'Profundo Rosso' and draws comparisons to how serial killing is portrayed in it, to David Fincher's 'Zodiac'. The observation is made that in the Postmodernist world, the plot tends to function as a foundation for the director to create art around, whereas in the more typical and faithful representation of serial killing in 'Zodiac', the plot is the main feature of the film, suggesting that the giallo is more of an experiential work than anything.

The piece is written very much based on first-hand research, and contains few references to other works. This lack of reinforcing its point with other research makes it more difficult to label the piece as credible work. However, the piece does back up the ideas presented by analysing the films, and presenting information in a very comprehensible and persuasive way.

The piece points out visual tropes in Giallo, and explains to the reader that the key to understanding 'Deep Red' lies in areas like mise en scène and editing choices. Being aware of these things and having the ability to see them and measure them will be key to understanding and accurately plotting out the narrative of the chosen film.

Methodology

In order to successfully translate the essence of a film into the context of sound art, great attention must be paid to the accurate collection and employment of data. It is incredibly important to have an accurate representation of the chosen measured parameters in order to faithfully communicate the director's vision, the visual style, the narrative, and any other measurable parameters that the composer may wish to illustrate.

The same sentiment applies for sound design, especially when illustrating the visual style of a film. Care must be taken to use or design instruments with timbres that reflect or compliment the aesthetics of the film, or the part of the film that is currently being focussed on. Although the notes themselves are not incredibly significant in capturing a film's feeling, the amount of notes, their rhythm, the intervals between them, and how they are deployed can certainly be used to effectively capture a mood.

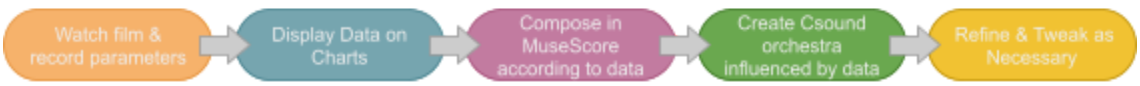

Fig. 1: A flowchart detailing the composition process.

The process in creating these pieces has been divided into four distinct sections. The first of these is the data gathering process, in which the films will be watched and analysed critically, and data recorded for later use. Once this has been done, the second section of composition may begin. In this, the information gathered from the films is used to inspire the actual composition of the piece, this is where narrative will have the most influence. The penultimate period is used for sound design, where the visual style and atmosphere of the film will have the most influence. Finally, this is followed by a period of refinement, making small tweaks in composition and sound design in order to perfect the finished pieces. This process is detailed in Fig. 1 above.

During the data gathering and composition phase, it is imperative that synthesis and sound design techniques are practiced in Csound in order to become familiar enough with them to deploy them to their full potential in the sound design phase. *"Virtual Sound"* (Bianchini, Cipriani, 2000) will be instrumental to guiding this process and providing the detail and contextual information on these synthesis processes that the Csound manual does not.

To achieve a realistic representation of the films as data, a simple Csound script was written which takes input from a MIDI controller and writes the data to files. The films were watched and values were recorded in real-time according to ‘The emotional arcs of stories are dominated by six basic shapes’ (Reagan et al., 2016). These variables included overall intensity, level of violence, the audience’s awareness of the witches, the presence of the colour red in the current frame, and the use of magic by the witches. This provided an incredibly easy way to get decent readings, however there is an element of human error in the process, meaning that although the final readings are an accurate representation of these variables in the films, they are not a 100% perfect recording of them, and the data presented on charts does not result in smooth curves. This is partially owing to the low resolution of the data saved. Data is written to the given file at intervals of one second, meaning that a curve that was entered smoothly while recording the data, may result in an immediate spike in the curve. In order to amend this, a portamento of one second was added to the data while being read back during the sound design phase.

Once all the data had been collected, these values were displayed on graphs. This made it easy to see the curves of the information and immediately gave somewhat of a ‘skeleton score’ of the pieces in terms of dynamics and structure. The opcodes used to record this data were the *‘dumpk’* family of opcodes. These opcodes have counterparts known as the *‘readk’* family. *dumpk requires* a parameter to decide the frequency of writing to the output file, and *readk* requires a similar parameter for the frequency of reading. This means that the recorded values can be read from the file at any speed desired, making it very easy to adjust the data to the required length of the piece.

The film ‘Suspiria’ was chosen to be the subject of this study due to its striking visual style, which although strictly following giallo conventions (as well as being held as a model representation of the Giallo genre), the film’s aesthetics go beyond what is expected from a giallo. Being among the last films to be processed using Technicolour, the film’s colour palette is absolutely key to the aesthetics of the film, creating an unnatural and other-worldly visual style which perfectly reflects the use of supernatural themes. It is these same supernatural themes which lend themselves to the unfamiliar sonic worlds which can be created using csound, and are key to the reasoning behind this choice of film.

Seven-Note Scales

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5

Octatonic Scales

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2

Fig. 2: The key used to generate motifs from words

In order to generate some relevant musical content to work with, character names and keywords from each film were chosen. Each letter of the alphabet was assigned a pitch (fig. 2) and these values combined were used to create musical phrases to be used throughout each piece. In order to do this, a spreadsheet was made in which a word is entered and the spreadsheet returns the value for each letter. The piece will then be scored in musescore (fig. 3), with the form and structure being informed by the graphs generated with the recorded parameters. This somewhat traditional approach to scoring was chosen to ensure that the pieces have a solid structure, and are not too vague.

Fig. 3: An example of a motif created with the phrase "Mother Suspiriorum"

Another method of generating musical information was taking key shots from key moments in each film and analysing the colour palette (fig. 4). Using a process derived from the work presented in 'Comparative Theories of Visual Art and Music: May I Play You a Picture?" (Lill, 2012) and 'Color and Sound: Physical and Psychophysical relations' (Caivano, 1994). The colour palette of each shot was displayed on a colour wheel, and compared with diagrams found in 'Color and Sound: Physical and Psychophysical relations' (Caivano, 1994). This enabled chords and motifs to be created using the colour hue to determine pitch, and luminosity to determine dynamics.

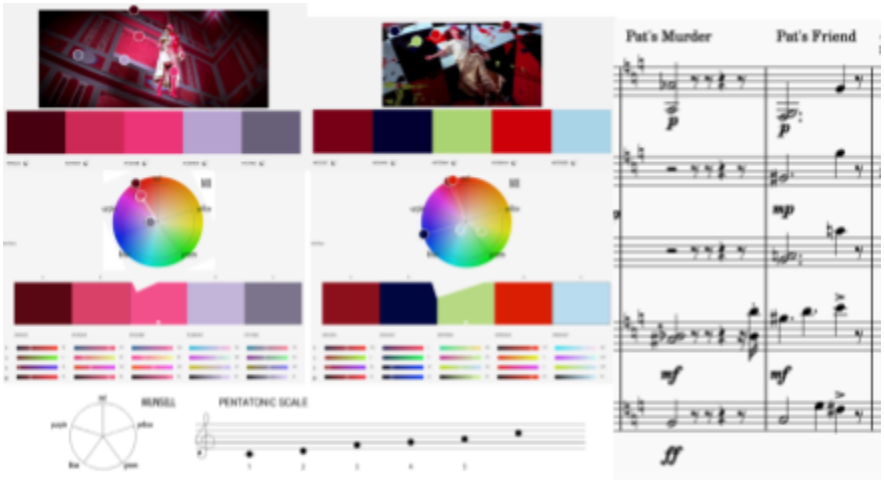

Fig. 4: An example of a chord sequence created by analysing the colours of two key murder shots.

In order to spatialise the piece into an octophonic setup, the *VBAP* (Vector Based Amplitude Panning) series of opcodes were used in csound. These opcodes can be used to move audio between up to 64 virtual loudspeakers. In this context, the *VBAP* system was set up to output to 8 virtual loudspeakers, with the possibility to directly route the output of these virtual loudspeakers to 8 physical loudspeakers. *VBAP* was chosen as the equipment and space required for a physical 8-channel setup was not readily available, and so a headphone-orientated approach was more desirable. The knowledge required to implement a system of this sort, was acquired from the csound manual pages for *VBAP* (Pulkki, 2000), *hrtfstat* (Carty, 2008), and *hrtfreverb* (Carty, 2011). This documentation gives a brief, but suitably in-depth overview of how spatial audio and virtual loudspeakers work, specifically in the context of *VBAP*, and gives detailed instructions on the setup, customisation, and implementation of the systems.

MIDI files were exported from musescore to allow csound to play the pieces using the most simple method available, rather than manually scoring the piece in csound, making it very easy to make changes to the pieces. As each staff in musescore is allocated its own MIDI channel, the *massign* opcode was used to assign each MIDI channel to a csound instrument, each of which were contained in a separate ORC file. The information required to set up the MIDI based system is found in the csound FLOSS manual (Cabrera et al, 2011).

The use of separate ORC files for each instrument was decided upon as keeping the csound code organised was essential for painless troubleshooting and experimentation. Each of these were included in the main CSD via the use of *#include*. This results in a very tidy main CSD, which only contains code such as global variables, include lines and a reverb instrument. Not only does this prevent messy code, but allows instruments to be easily swapped for new instruments while experimenting with sound design, establishing the synthesis system as what could be described as a modular setup.

The csound instruments used in the piece are relatively simple. For the most part, their core consists of MIDI parsing code, two lines of synthesis, followed by a filter, and finally *VBAP* processing. The amplitude envelopes of these instruments are always created with *madsr*, as it is arguably the most simple and effective method of producing envelopes in csound. The celeste and cello instruments both include a short delay line just before *VBAP* processing, which is modulated randomly at i-time between 0 and 0.03. This serves to incorporate a slight simulation of human error, reducing the likelihood of two notes from the same instrument being triggered at exactly the same time.

In regards to synthesis, the techniques used remain simple concepts. The celeste instrument makes use of FM synthesis in the form of two of csounds packaged fm opcodes: *fmbell* and *fmmetal*, The former of which being a tubular bell simulator (Ffitch, n.d.), and the latter simulating a piece of metal being struck (Ffitch, n.d.). The cello instrument contains two instances of *pluck*, which is a plucked string simulator based on the Karplus-Strong Algorithm. The oboe instrument contains two instances of the *vco2* oscillator opcode. These instances both use the sawtooth mode on the opcode, the outputs of both oscillators are then multiplied together and run through a bandpass filter. The flute instrument again uses two instances of *vco2*, but this time the parameters of each instance are modulated according to the global red variable *(gkred)*. Finally, the contrabass instrument acts as a sub, and consists of an instance of *vco2* set t the sawtooth mode, and an instance of *oscil* playing an octave below using a sine wave. The outputs of these are then dramatically filtered off using *lpf18* and then sent off to be processed by *VBAP*.

The *VBAP* system contained in each of these instruments consists of four main steps. In each instrument, the final mono signal to be output is processed by the *vbap* opcode according to a random pan value modulated by the intensity curve. This opcode distributes this mono audio signal across eight channels, which are in turn sent off to eight global audio signals. These eight globals are then used as an input in a block of eight *hrtfstat* lines found in 'vbap.orc'. Each *hrtfstat* binaurally spatialises one of eight 'virtual loudspeakers' and outputs a stereo signal, all of which are combined while outputting to the dac.

Most of the musical phrases found in the pieces were written using the octatonic scale. This scale was chosen due to the disjointed and unfamiliar environment it creates, and to increase the likelihood of dissonance in phrases and chords, supplementing the dark themes of 'Suspiria'. The piece also makes great use of contrasted dynamics, in order to shock and disorientate the listener. These dynamic jumps are representations of peaks in intensity in the films, and frequently contain heavy dissonance and bear little to no relation to what comes before and after them. Some phrases found in the less intense sections of the piece use the standard D major scale, which gives a more familiar and harmonious result, somewhat grounding the piece for the listener.

The peaks in intensity mentioned in the previous paragraph mostly correspond to murder scenes in the films. Giallo films are known for their artistic portrayal of grisly murders, and it was a necessity to attempt to capture these in the pieces. When scoring these 'murder passages', the murdered character's name would be made into a musical phrase in one instrument, with other instruments mimicking this phrase, or perhaps playing a different musical phrase created from another character's name who bears relation to the murdered character. This serves as somewhat of a countermelody, and often provides the desired dissonance between the parts. A key shot from each murder was also used, and analysed according to the second paragraph in this section, using ideas originating from 'Color and Sound: Physical and Psychophysical relations' (Caivano, 1994). This could be used to create highly dissonant chords, often used as stabs in these sections. The notes generated from these shots were also used in conjunction with a rhythmic element to create musical phrases to be used in these sections.

It is worth mentioning that the sonic palette is somewhat limited, and the final piece is limited to five parts. On the whole, the instruments found throughout the piece do not deviate much from what is originally presented, however, using the data recorded from the film as parameter automation does allow a satisfactory degree of timbral flexibility. The massively diverging sections of the piece also serve to extend the limited timbral variation in the csound instruments, through the use of contrasting dynamics, rhythmic unison, and the effectively limitless frequency range of these instruments. Another compositional technique employed was the use of very fast, repeated motifs in the celeste instrument. Due to the percussive nature of the instrument, it is not possible to hold notes for a long period of time. This use of fast repetition at a low volume, combined with the long release and reverb tails, create a sound with a vague, pad-like quality. Accenting certain notes in the repeated phrase additionally allows for some degree of timbral modulation.

The data gathered by analysing the film in real time included Intensity, Use of Magic, Violence, Audience awareness of the witches, and presence of the colour red on-screen. This data was used mainly as a guide while composing, but was used in a few instances as automation curves. The data was read by csound using the *readk* opcodes (the counterparts of *dumpk*), was scaled between 0 and 1, and had portamento added to make the curves smoother. For example, the curve representing the amount of red on the screen was used to automate the pulse width of the oscillators used by the flute instrument, and the presence-of-magic data was used to automate the vibrato depth and rate in the celeste instrument. Also, the intensity curve was used to open up the panning range for each instrument in more intense sections. This allows the piece to open up more, and prevents muddiness to an extent.

Discussion

Although the original vision for this project involved three pieces composed according to three different films, It was decided that choosing one of the films and focussing more time on illustrating it would result in a better representation of the film, and that piece should be used to demonstrate the compositional process in a more detailed way. This was due to the fact that the analysis process took longer and was more in-depth than expected. It was decided that this process merited more focus and detail, as really it is the crux of the project.

While working on this project, it became apparent that the process behind the generation of musical content was more of a key focus than the actual output. More time was put into the systems used to generate this content than the sound design itself. Although csound makes it possible to create a sonic world reflective of the film's atmosphere, the final piece would work just as well in an orchestral context. It should also be noted that the original timeline for composition described in paragraph 3 of the Methodology section was not fully abided by. Careful observation of this timeline could have greatly benefitted the quality of work presented, and could have resulted in a slightly more coherent piece.

A somewhat minimal limitation of the binaural spatialisation code used, is the reverb that was employed. *Hrtfreverb* was used to create the reverb heard in the final piece, which takes a mono signal as input, and outputs a stereo signal. This is a very simple method of creating reverb, and a method which completely lacks spatialisation. An alternative method would necessitate the use of *hrtfreverb* in conjunction with *hrtfearly* and *hrtfmove*, which involves using multiple *hrtfmove instances* to binaurally position the signal to be processed, multiple instances of *hrtfearly* to create spatially accurate early reflections, the output of which is then fed into a single instance of *hrtfreverb* to fill out the reverb tail.

A major drawback to the scoring process used, is that all musical events must be scored in the MIDI file in order to be time-flexible. Anything triggered in the csound score was subject to change while composing, for example: If the tempo is changed before the event, then the score event's start time would have to be adjusted to suit the changes. Partially as a result of this, the final piece consisted of a minimal orchestration, with only five parts total. This is not to say however, that a system could be designed to correct this issue, possibly using the 'tempo' and 'miditempo' opcodes.

The original idea for this project was conceived as simply a way to generate musical content from a piece of media other than music. Some of the ideas used could be easily applied to other forms of narrative driven media, such as books or plays, due to the abstract nature of the idea. The csound script used to gather this data is easily modifiable, and it would absolutely be in the realms of possibility to combine csound with other software to allow automated analysis of visual content. Alternatively, the process could also be done completely manually, which allows for greater control by the person who is recording the data.

Unfortunately, human error affected some of the data collection, specifically when measuring the intensity, and other time-based variables of the film. The curves recorded for most of these variables were not smooth curves, and therefore provided little potential as automation curves, however using some smoothing algorithms in csound enabled the curves to prove some use, however not as much as originally desired.

An issue immediately recognisable in the final output of the project, is the lack of a second piece. Although the project was scaled back successfully to one piece, a second, contrasting piece would have had great advantages for the project, such as using these compositional techniques in a context where more traditional harmony is the focus, or simply using a contrasting sonic palette. This would provide some insight on the flexibility and potential for recontextualization which the composition system holds.

Conclusion

For the most part, the project materialised as originally planned. Although it was somewhat scaled back, as mentioned in the previous section, it still stuck to the fundamentals of the original vision for the most part. The core objective of the work was to translate and capture important plot points, and the general atmosphere of a Giallo film, and to incorporate this into a piece of modern electronic music, which was done successfully, albeit with a limited musical output.

Most of the techniques employed in this work are largely simplistic, especially in the context of synthesis. The intention of the work was never to provide groundbreaking innovations in the field, but purely an experiment into data-driven composition processes, in a somewhat artistic and abstract context. Reflecting the aforementioned emphasis on 'process-over-product', csound for the most part, is used simply as a method for realising these compositions in a way which enables straightforward interaction with the recorded data, and allows detailed but painless implementation of multichannel and binaural sound.

The musical context chosen for this specific piece of music is a highly experimental and dissonant electronic piece, due to the piece of cinema chosen. However, as previously touched on, the process behind composing this piece can easily be recontextualised, and could be implemented to compose more coherent and accessible music. The process could also be employed to compose parts of a piece, rather than acting as the main compositional method for a full piece. Due to the open-ended nature of the idea, there are numerous ways that this concept can be deployed. The basis for the idea stemmed from attempting to musically interpret quotes from 'A Scanner Darkly' by Philip K. Dick, a science fiction novel published in 1977, incidentally the same year that 'Suspiria' was released. Therefore it is tried-and-tested that the process is flexible enough to be applied to works of literature.

The area of interpreting one form of media as another form of media is an incredibly fascinating one, and is one that certainly merits more work to be done. Frequently, the projects that attempt this kind of practice are realised as experimental pieces in the domain of high art, and as touched upon previously, there is certainly something to be said about attempting an interpretation of this kind in the domain of pop culture.

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suspiria.csd

```
<CsoundSynthesizer>
<CsOptions>
-odac                          ;Selects DAC as output
-F "../../Scores/suspiria.mid"  ;Opens 'suspiria.mid' and plays it
</CsOptions>
; ==============================================
<CsInstruments>

sr      =       44100
ksmps   =       1024
nchnls  =       2
0dbfs   =       1.3

seed 0

gkintensity, gkmagic, gkviolence, gkwitches, gkred init 0, 0, 0, 0, 0 ;initialising global variables for storing data read from val files
ga1, ga2, ga3, ga4, ga5, ga6, ga7, ga8, gasig, averb init 0 ;initialising global variablss for reverb & octophonic setup

                                        ;Including .orc files

#include        "vbap.orc"
#include        "midi.orc"
#include        "celeste.orc"
#include        "flute.orc"
#include        "cello.orc"
#include        "readk.orc"
#include        "oboe.orc"
#include        "contrabass.orc"

                                        ;Initialising instruments that should be permanently on
alwayson        "vbap"
alwayson        "read"
alwayson        "reverb"

instr reverb                            ;Global reverb instrument

                    arevl, arevr, idel hrtfreverb gaverb, 10, 8, "Ears/CIPIC060l44100.dat", "Ears/CIPIC060r44100.dat"

        outs arevl*0.25, arevr*0.25
        clear gaverb

endin


</CsInstruments>
; ==============================================
<CsScore>
f 0 490                 ;Makes csound run for 490 seconds
f 1 0 32768 10 1        ;Sine Wave
</CsScore>
</CsoundSynthesizer>
```

utility.csd

```
<CsoundSynthesizer>
<CsOptions>
-odac    ;No audio is required but real-time processing is required
-M2      ;Recieve MIDI from all inputs
</CsOptions>
; ==============================================
<CsInstruments>

ksmps    =       32
massign 0, 1    ;Assigning MIDI input to instument 1
        gkintensity     init    0
        gkmagic         init    0
        gkviolence      init    0
        gkaudwitch      init    0
        gkred           init    0
instr 1
        kpause init 0
        kstatus init 0
        kchan init 0
        kdata1 init 0
        kdata2 init 0

;        Getting input from the MIDI Controller
        kstatus, kchan, kdata1, kdata2  midiin

;        Parsing MIDI data
        if (kstatus == 176 && kdata1 == 21) then
                gkintensity = kdata2                    ;Overall intensity

        elseif (kstatus == 176 && kdata1 == 22) then
                  gkmagic = kdata2                            ;Use of magic

        elseif (kstatus == 176 && kdata1 == 23) then
                  gkviolence = kdata2                  ;Violence-o-meter (good for murder scenes)

        elseif (kstatus == 176 && kdata1 == 24) then
                    gkaudwitch  = kdata2                     ;Audience's awareness of witches

        elseif (kstatus == 176 && kdata1 == 25) then
                  gkred = kdata2                       ;Presence of the colour red
        endif

        dumpk   gkintensity,    "susintensity.vals",    7,      1
          dumpk4  gkmagic, gkviolence, gkaudwitch, gkred, "suspiria.vals", 7, 1
endin
</CsInstruments>
; ==============================================
<CsScore>
i1      0       36000
</CsScore>
</CsoundSynthesizer>
```

vbap.orc

```
vbaplsinit 2, 8, 0, 45, 90, 135, 180, 225, 270, 315     ;initialise vbap setup & virtual loudspeaker angles

instr vbap

        Sl = "Ears/CIPIC060l44100.dat"          ;Selecting Ears
        Sr = "Ears/CIPIC060r44100.dat"

         al1, ar1 hrtfstat ga1, 0, 0, Sl, Sr     ;Performing Spatialisation of virtual loudspeakers
        al2, ar2 hrtfstat ga2, 45, 0, Sl, Sr
        al3, ar3 hrtfstat ga3, 90, 0, Sl, Sr
        al4, ar4 hrtfstat ga4, 135, 0, Sl, Sr
        al5, ar5 hrtfstat ga5, 180, 0, Sl, Sr
        al6, ar6 hrtfstat ga6, 225, 0, Sl, Sr
        al7, ar7 hrtfstat ga7, 270, 0, Sl, Sr
        al8, ar8 hrtfstat ga8, 315, 0, Sl, Sr

                             outs  (al1+al2+al3+al4+al5+al6+al7+al8)  *  .5, (ar1+ar2+ar3+ar4+ar5+ar6+ar7+ar8) * .5     ;Outputting to the DAC

                                                                          gaverb      = ((al1+al2+al3+al4+al5+al6+al7+al8)+(ar1+ar2+ar3+ar4+ar5+ar6+ar7+ar8))*.5 ;Sending output to reverb

          clear ga1, ga2, ga3, ga4, ga5, ga6, ga7, ga8     ;Clearing global variables for next use

endin
```

midi.orc

```
;Assigns MIDI messages to certain instruments depending on the MIDI channel

massign 1, "flute"
massign 2, "celeste"
massign 3, "cello"
massign 4, "oboe"
massign 5, "contrabass"
```

celeste.orc

```
instr celeste

        idel     random, 0, 0.03          ;Generating note start delay time
        kdepth   =        gkmagic

         inote    notnum                      ;Receiving MIDI note value from MIDI message
        iamp     veloc    0, 0.8          ;Receiving MIDI velocity value
        ipan     random   25,     75      ;Panning for vbap (range is 0-360)
        kang     init     0

        kamp     madsr    0.01,   0.6,    0.1,    6        ;Amplitude Envelope
         kfreq    =        cpsmidinn(inote)                ;Coverting MIDI note number to cycles-per-second

            asig1     fmbell   (kamp*gkwitches)*iamp,   kfreq,   40*kdepth, 100,    kdepth, 6*gkintensity, 1,1,1,1,1,6      ;Bell Synthesis
            asig2     fmmetal  (kamp*gkwitches)*iamp,   kfreq*1.1,  4,    70, kdepth, 6, 1,1,1,1,1                              ;Metal Synthesis
        asig     =        asig1 + (asig2)

        asig     delay    asig, idel      ;delaying audio signal slightly

         a1, a2, a3, a4, a5, a6, a7, a8 vbap asig*0.005, ipan*gkintensity ;spatialising with vbap


        ga1 = ga1 + a1          ;outputting vbap signal to global vbap
        ga2 = ga2 + a2
        ga3 = ga3 + a3
        ga4 = ga4 + a4
        ga5 = ga5 + a5
        ga6 = ga6 + a6
        ga7 = ga7 + a7
        ga8 = ga8 + a8

endin
```

```
instr flute

        inote   notnum
        iamp    veloc   0, 0.8
        ifreq   =       cpsmidinn(inote)
        ipan    random  260,    350
        idur = p3

         kpw      =        gkred                    ;Assigning red value to pulse width

        kamp    madsr   0.35,   idur*0.5,       0.3,    3

        asig1   vco2    iamp,   ifreq*2, 4, kpw
        asig2   vco2    iamp,   ifreq*1.25,     2, kpw

        asig    =       (asig1 * asig2) * kamp
         asig     butbp   asig,   (ifreq*2)*gkviolence, 500       ;Bandpass Filter

        a1, a2, a3, a4, a5, a6, a7, a8 vbap asig, ipan*gkintensity


        ga1 = ga1 + a1
        ga2 = ga2 + a2
        ga3 = ga3 + a3
        ga4 = ga4 + a4
        ga5 = ga5 + a5
        ga6 = ga6 + a6
        ga7 = ga7 + a7
        ga8 = ga8 + a8

endin
```

cello.orc

```
instr cello

        idel    random  0, 0.05                 ;Time for delayed signal

        inote   notnum
        iamp    veloc   0, 0.8
        ifreq   =       cpsmidinn(inote)
        ipan    random  135,    225

        kamp    madsr   0.01,   0.6,    0.3,    4

        asig    pluck   kamp*iamp, ifreq, ifreq, 1, 6
        asig2   pluck   kamp*(iamp*0.5), ifreq*1.970, ifreq*2, 0, 1

        asig    =       asig + asig2

        asig    lpf18   asig, 3000*kamp, 0.2,   0.3     ;Lowpass filter

         asig    delay   asig, idel              ;Delaying output to create human error

          a1, a2, a3, a4, a5, a6, a7, a8 vbap asig*0.75, ipan*gkintensity ;spatialising with vbap


        ga1 = ga1 + a1          ;outputting vbap signal to global vbap
        ga2 = ga2 + a2
        ga3 = ga3 + a3
        ga4 = ga4 + a4
        ga5 = ga5 + a5
        ga6 = ga6 + a6
        ga7 = ga7 + a7
        ga8 = ga8 + a8


endin
```

readk.orc

```
instr read

	iport init 1	;Initialising portamento time

/*	Reading values from suspiria.vals

	Reading interval is determined by dividing the total length of the piece in seconds by the number of lines in each file
				eg: 8:00 in seconds = 480
					478 / 2602 = 0.18370....
*/
		kmagic, kviolence, kwitches, kred readk4 "../../Data\ Collection/Suspiria/suspiria.vals", 7, 0.183
			kintensity			readk		"../../Data\ Collection/Suspiria/susintensity.val", 7, 0.136

	;Adding portamento to read values

	kintensity	port	kintensity, iport
	kmagic		port	kmagic, iport
	kviolence	port	kviolence, iport
	kwitches	port	kwitches, iport
	kred		port	kred, iport

	;Scaling values between 0 and 1 for use with most opcodes

	gkintensity	scale	kintensity, 2.99, 1.11, 127, 0
	gkmagic		scale	kmagic, 0.99, 0.11,127, 0
	gkviolence	scale	kviolence, 1.99, 0.11,127, 0
	gkwitches	scale	kwitches, 1.5, 0.5,127, 0
	gkred		scale	kred, 0.99, 0.11,127, 0

endin
```

oboe.orc

```
instr oboe

        inote   notnum
        iamp    veloc   0, 0.8
        ifreq   =       cpsmidinn(inote)
        ipan    random  90, 180

        kamp    madsr   0.05,   0.85,   iamp, 0.5

        asig1   vco2    kamp*iamp,      ifreq,  0
        asig2   vco2    kamp*iamp,      ifreq*2,0
        asig    =       asig1   *       asig2

        asig    butbp   asig,   (ifreq*2)*kamp, 150


            a1, a2, a3, a4, a5, a6, a7, a8 vbap asig*2, ipan*gkintensity ;spatialising with vbap


        ga1 = ga1 + a1          ;outputting vbap signal to global vbap
        ga2 = ga2 + a2
        ga3 = ga3 + a3
        ga4 = ga4 + a4
        ga5 = ga5 + a5
        ga6 = ga6 + a6
        ga7 = ga7 + a7
        ga8 = ga8 + a8

endin
```

contrabass.orc

```
instr contrabass

inote   notnum
        iamp    veloc   0, 0.6
        ifreq   =       cpsmidinn(inote)

        kamp    madsr   0.2,    0.6,    0.5,    0.5

        asig1   vco2    kamp*iamp,      ifreq, 0
        asig2   oscil   kamp*iamp, ifreq*0.5
        asig    =       asig1 + asig2
        asig    lpf18   asig,   kamp*ifreq*1.5, 0.4, 0.25


        a1, a2, a3, a4, a5, a6, a7, a8 vbap asig, 0 ;spatialising with vbap (always centre panned)


        ga1 = ga1 + a1          ;outputting vbap signal to global vbap
        ga2 = ga2 + a2
        ga3 = ga3 + a3
        ga4 = ga4 + a4
        ga5 = ga5 + a5
        ga6 = ga6 + a6
        ga7 = ga7 + a7
        ga8 = ga8 + a8


endin
```

Suspiria

Giallo Music

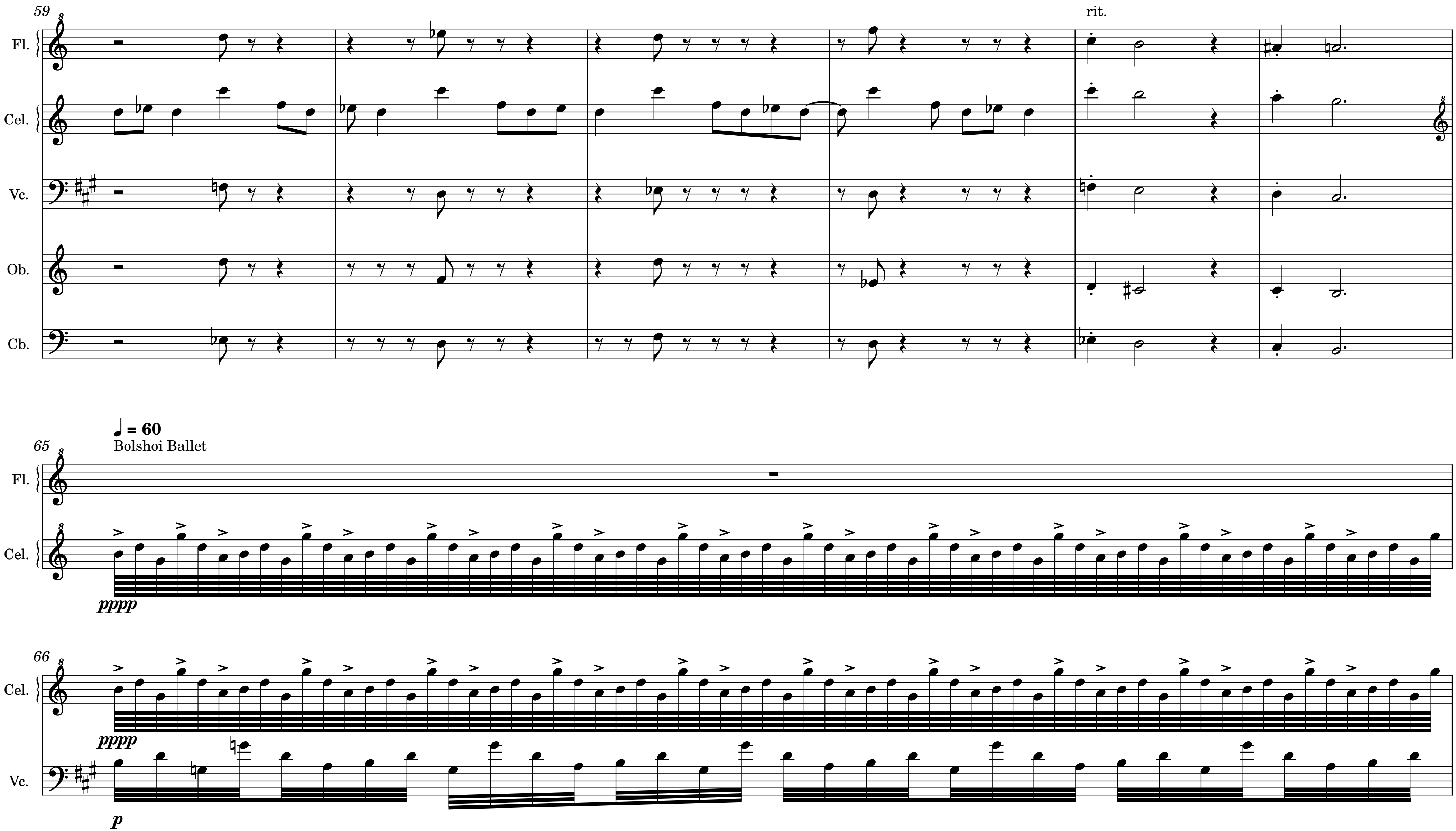
Rhys Mayes

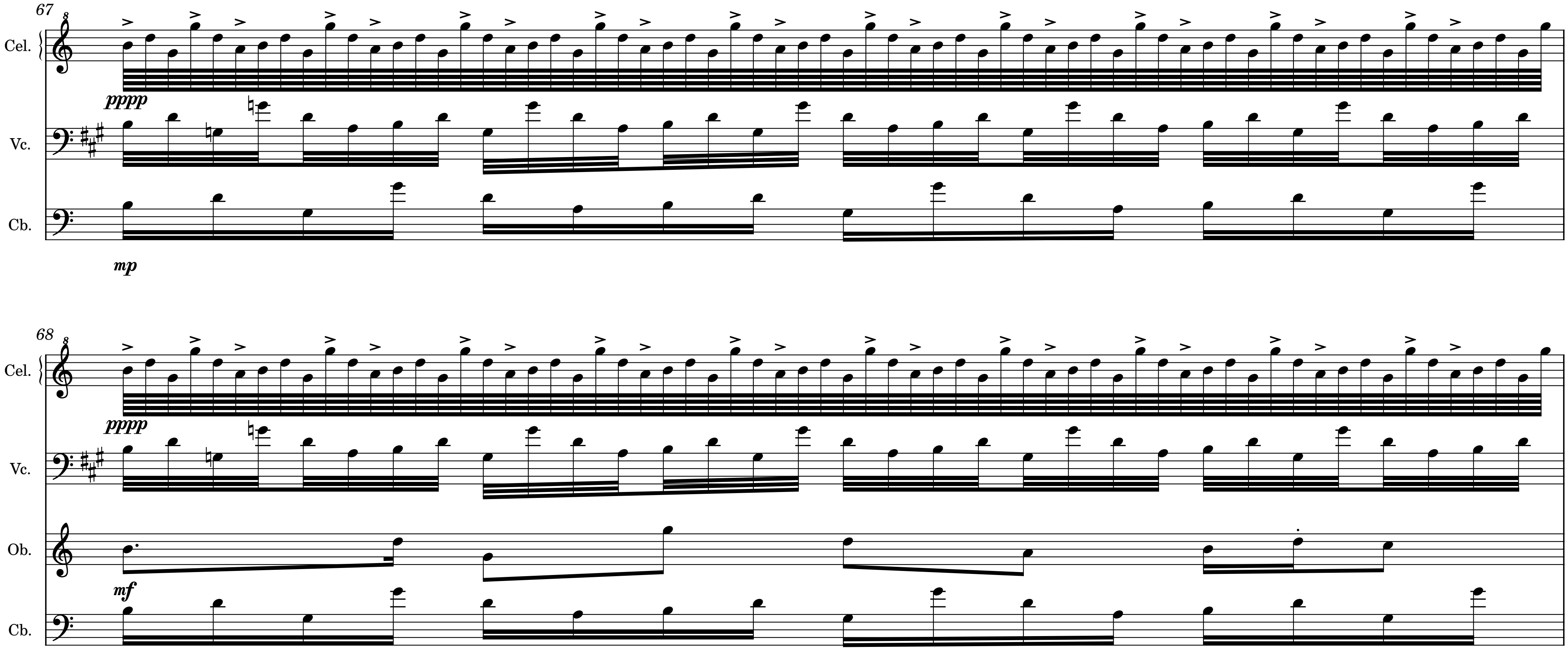

16
Pat's Murder
Pat's Friend
rit.
Lento
To Coda
Fl.
Cel.
Vc.
Ob.
Cb.
sfz sfz
f
ppp
mp
mf
ff
p
pp
23
fz

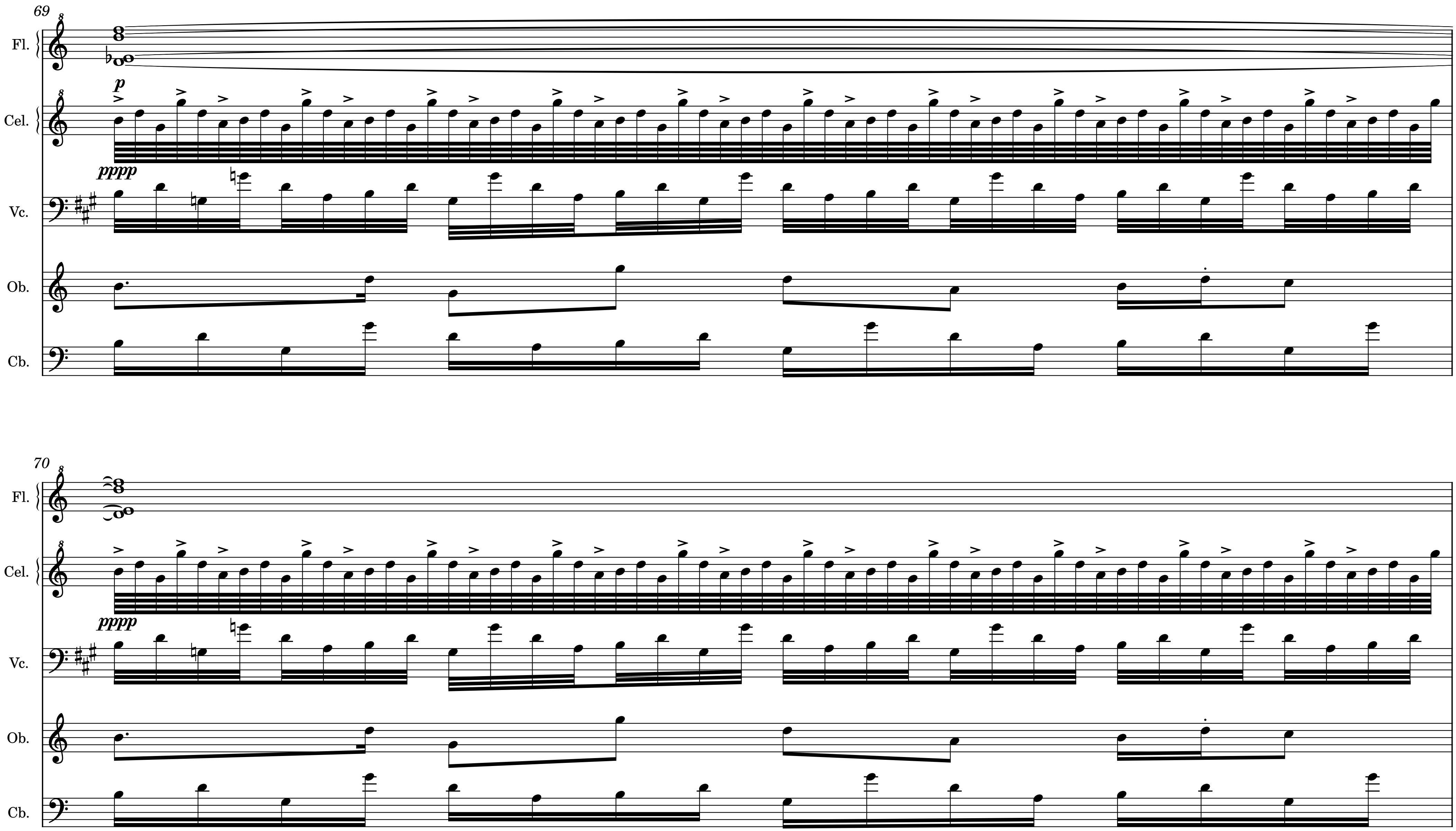

30
D.S. al Coda
Fl.
Cel.
pp
f
Vc.
Ob.
f
31
Larghetto
mf
ff
mf
mf
pp
f
mf
ff
mp
6
6
6
pp
Cb.
f
mf

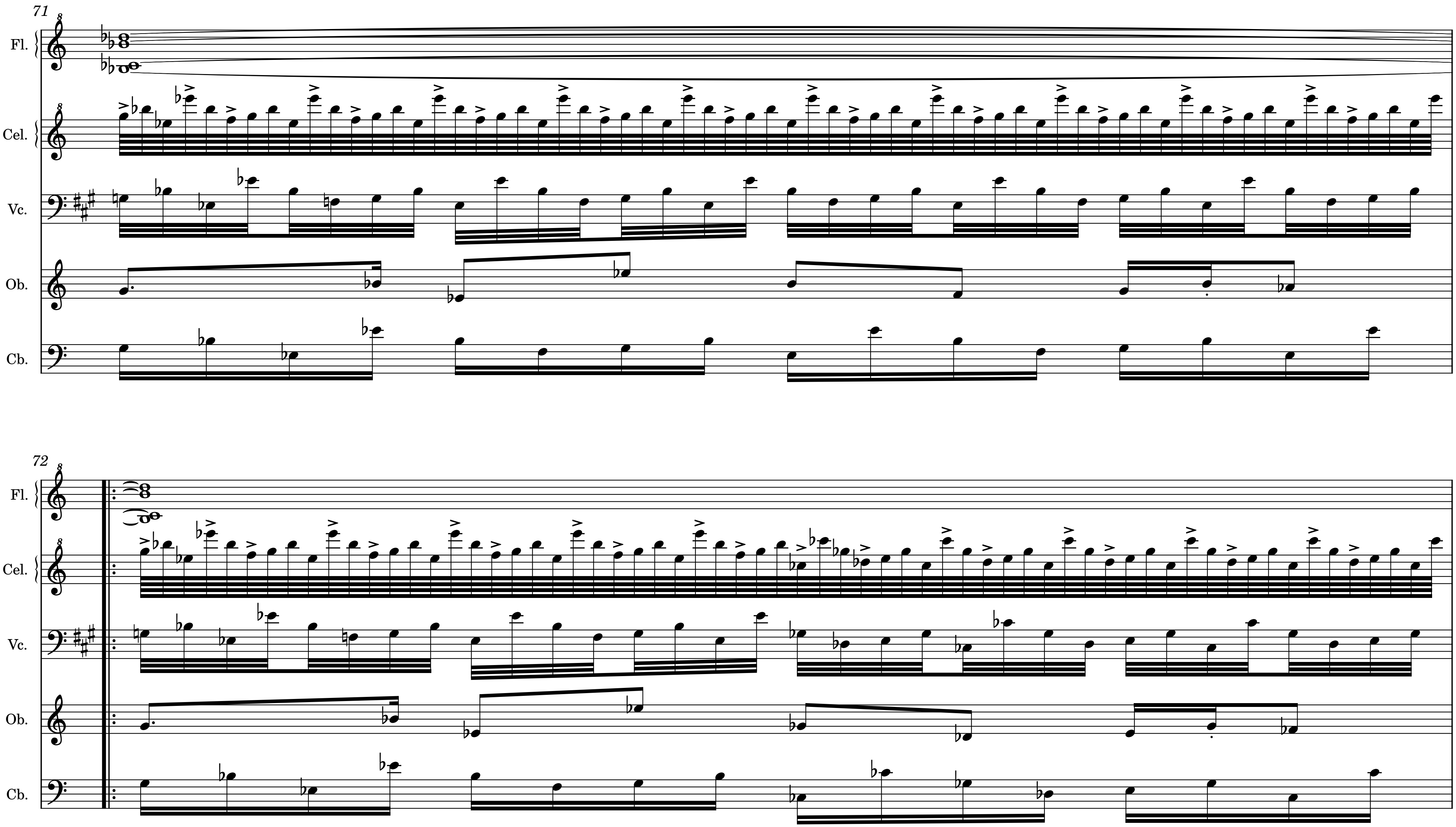

33
1.
2.
rit
♩ = 50
Fl.
Cel.
Vc.
Cb.
39
Daniel Walking with Dog
rit
Ob.

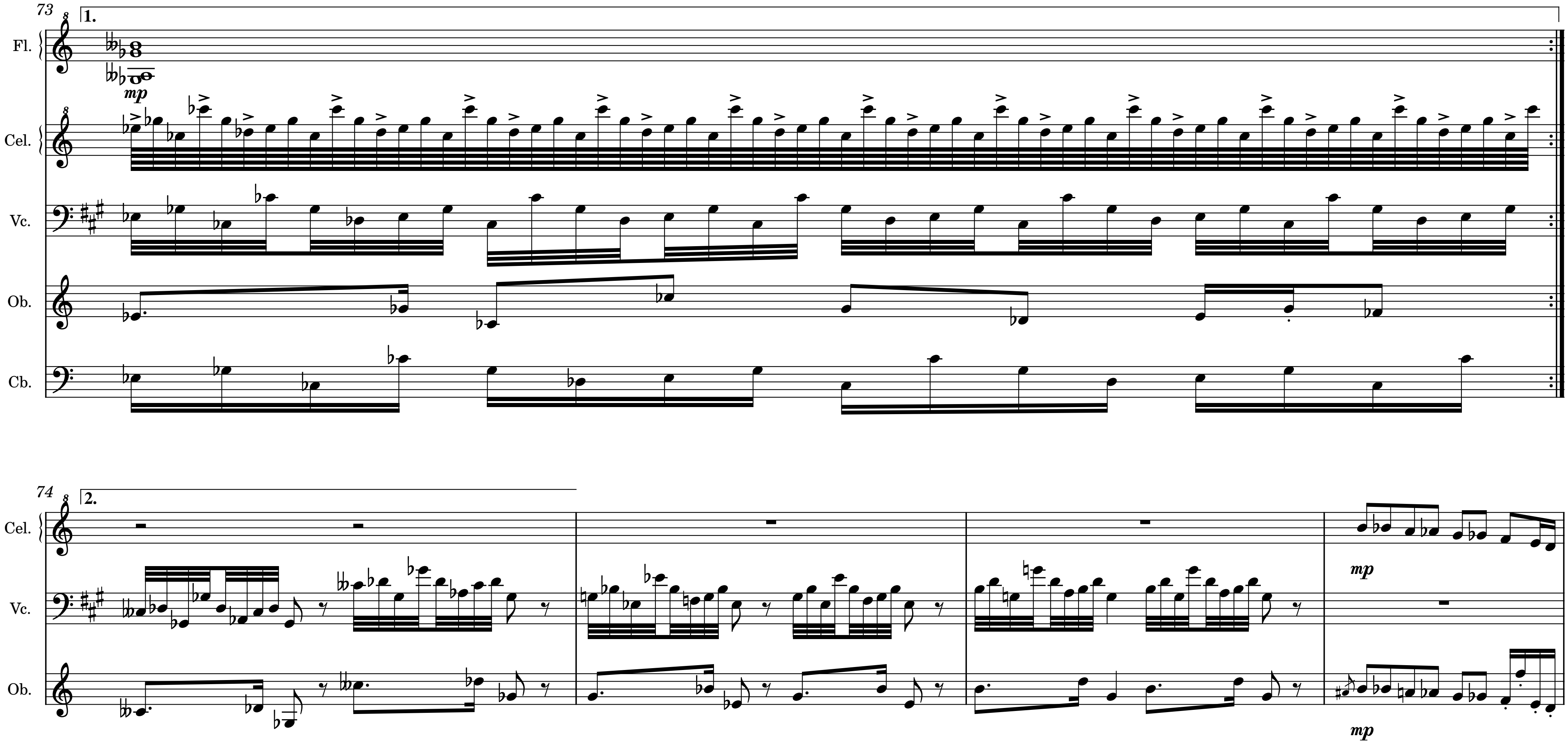

48
♩ = 40
Fl.
Cel.
Vc.
Ob.
Cb.
49
♩ = 80
Daniel's Murder
Allegretto
Sarah's Murder


59
rit.
Fl.
Cel.
Vc.
Ob.
Cb.
♩ = 60
Bolshoi Ballet
65
Fl.
Cel.
pppp
66
Cel.
pppp
Vc.
p


67
Cel.
pppp
Vc.
Cb.
mp
68
Cel.
pppp
Vc.
Ob.
mf
Cb.


69
Fl.
Cel.
Vc.
Ob.
Cb.
p
pppp
70
Fl.
Cel.
Vc.
Ob.
Cb.
pppp


71
Fl.
Cel.
Vc.
Ob.
Cb.
72
Fl.
Cel.
Vc.
Ob.
Cb.


73
1.
Fl.
mp
Cel.
Vc.
Ob.
Cb.
74
2.
Cel.
Vc.
Ob.
mp
mp

Allegro

Markos' Chamber


100
rit.
♩ = 92
Grave
Fl.
Cel.
Vc.
Ob.
Cb.
mf
pp
p
mp
sfz
111
f