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PUT THE PEDAL TO THE METAL:
EXPLORING THE RESOURCES OF THE MODERN ELECTRIC VIBRAPHONE

by

Andrew Dean Gilstrap

A Dissertation
Submitted to the Graduate School,
the College of Arts and Sciences
and the School of Music
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Musical Arts

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ABSTRACT

The process of applying pickups to acoustic vibraphones began in the early twentieth century in order to provide means of amplification for live performances other than the use of microphones alone. Artists and innovators in the industry quickly realized the possibilities of adding effects, such as tremolo, reverb, delays, and other sound processing devices, to create a pallet of sounds not possible on an acoustic vibraphone. This concept applied to modern signal routing, yields a copious amount of sonic possibilities, extending the creative universe of the performer.

Due to the amount of technology involved with the electric vibraphone, it is critical the performer has a working knowledge of live sound reinforcement techniques, analog signal processing, gain staging, along with proficiency in MIDI and non-MIDI software applications, in order to achieve the best results. The use of effects on the electric vibraphone presents a unique set of challenges: most effects utilized are designed for guitar, thus the performer must be aware of not only the types of effects, but how to perform with them.

The purpose of this study is to identify the strengths and weaknesses of different signal routing possibilities, discuss effects classification and application and to provide a composition for electric vibraphone and percussion ensemble entitled *Put the Pedal to the Metal*, that highlights the electric vibraphone as a solo instrument.

From this study an individual should ascertain the information needed in order to achieve optimum results with this instrument and obtain skills needed to utilize effects appropriately.

ACKNOWLEDGMENTS

The vigor found within The University of Southern Mississippi School of Music and Percussion Department has had a profound impact on my professional career and life. I would like to thank my many mentors who have taken the time to shape me into the person I am today. Namely, Dr. Wooton who is a constant inspiration to me, and has taught me lessons beyond the realm of percussion: for this I am most thankful.

I would also like to thank my previous teachers in percussion and life: thank you to Dr. J.C. Combs for giving me a chance, to Jerry Scholl for instilling a diligent process, and to Steve Hatfield for getting me started.

This study is abnormal in the sense I am applying guitar and live sound reinforcement techniques to an instrument not originally designed for such treatment. I would like to thank Dan Weller, Jace Wilbert, Gooding, Steve Green and Jason Hobaugh for invaluable insight and amazing aural inspiration. I would also like to acknowledge Carl Hebert, Rob Farmer, Luc Brust, and Jake Frazee for their constant support throughout this process.

Most importantly, I would like to thank my family. Without Michelle and Atticus's patience, this project would not be possible. I would also like to thank my parents Richard and Caroline Gilstrap, along with my sister Katie for their continuous support and encouragement. I am extremally humbled by this process, and forever in debt to those mentioned.

DEDICATION

It is not often one meets a person quite like Jared Hobaugh. From a very early age I was able to apprentice, perform, and partner with Jared, in multiple LLC's, tours, and investments. I would not have the opportunity to compose this document, let alone have the opportunity to teach, learn, play and produce music in the capacity I am blessed with today. This study is dedicated to the memory of Jared Hobaugh, thanks for everything!

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CHAPTER I - INTRODUCTION

In the early 20th century, vibraphonists began experimenting with amplifying the vibraphone in order to achieve a louder stage presence and utilize extraordinary effects. The first method consisted of using microphones with an acoustic vibraphone; however, this posed several problems. First, the microphone technology and availability in the early 20th century was limited to *ribbon microphones* which were delicate and undoubtedly picked up more than the vibraphone alone. Second, the sound reinforcement systems were new and the speakers and amplification systems available were inconsistent. Third, if microphones were utilized, the process would require an experienced sound engineer to help produce a good sound. This is why players and manufacturing companies began experimenting with methods of amplifying the acoustic vibraphone with methods other than the use of microphones alone, in order to produce a more consistent and organic sound.

Clair Omar Musser was one of the first vibraphone artists to explore and develop this technology. Musser was not only a composer and avid performer, but he was also known to develop instruments for the Deagan company. Two early experimental Musser instruments are recorded as having appeared in 1925 and in 1931.[1] A pioneer designer of instruments, far ahead of his time, Musser designed and built the "MARIMABA-

[1] Harold Howland, "The Vibraphone: A Summary of Historical Observation with a Catalog of Selected Solo and Small Ensemble Literature, "*Percussionist* 15, no. 1 (Fall 1977): 23.

CELESTE" in Reading Pennsylvania in 1925 and 1926. Its keyboard was of special design—having a range of 87 tones in two manuals—and incorporated both wood and metal alloy keys. Sustained tones, volume, and auxiliary tremolo (were) controlled by foot pedals and electric excitation.[2] This first model was not strictly a vibraphone, but employed alloy metal keys that would correlate with the tremolo effects provided by the system. The second early example fabricated in 1931, consisted of a five-octave marimba and a two-octave vibraphone with microphonic pickups, which ran through two large horns, operated by a foot pedal.[3] Musser's intention was to create a way for the acoustic vibraphone to sonically stand out with large orchestras he was known to perform with.

These two original concepts were proprietary and undoubtedly cumbersome to maneuver in and out of venues. Aside from the physical limitations of the instrument, the technology used to amplify the vibraphone at the time was in the process of developing and undoubtedly inconsistent. This comes as no surprise considering that in the mid 1920's and 30's advanced electronic concepts, amplification, and sound manipulation were cutting edge, not to mention the vibraphone itself was in its infant years. Although unsuitable for the open market, Musser's early experimentations provided a fundamental concept from which to build upon.

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[2] Harold Howland, "The Vibraphone: A Summary of Historical Observation with a Catalog of Selected Solo and Small Ensemble Literature, "*Percussionist* 15, no. 1 (Fall 1977): 24.

[3] Ibid.

Musser was the Deagan Sales Manager from 1 January 1931 to 1947.[4] This new responsibility shifted his attention to more marketable aspects of the vibraphone including aesthetics and practicality. Although many improvements to the instrument including the dampening pedal and vibrato mechanism were implemented during this time, interest in applying amplification to the vibraphone seemingly came to a halt for more than a decade. In 1955, Deagan made an attempt to apply a means of direct electronic amplification to the vibraphone. A research firm in Evanston, Illinois produced wafer-thin gold chips called "strain gauges" which were attached to the bars with fine wires. Although successful in amplifying the sound, this system was abandoned.[5] The sonic and physical limitations of the strain gauges did not warrant production of this system. Due to the continued process of failure, one might suspect this concept was finished; however, early Musser and Deagan instruments provided an argument for the necessity of the electric vibraphone.

During the 1970's the processes of amplifying the acoustic vibraphone returned and sparked interest amongst many established vibraphonists. By this time, live sound reinforcement and amplification technology was remarkably better than the concepts found in Musser's time and provided a medium for creativity. The first commercially feasible realization of continuing efforts to produce an electronically amplified

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[4] Ibid.

[5] Harold Howland, "The Vibraphone: A Summary of Historical Observation with a Catalog of Selected Solo and Small Ensemble Literature, "*Percussionist* 15, no. 1 (Fall 1977): 24.

vibraphone appeared at the National Association of Music Merchants Convention in Miami Beach, 1970, in the form of the Deagan 515 ElectraVibe.[6] The instrument rests inside a self-contained carrying case without resonators; amplification of the sound is achieved solely through the use of piezoelectric transducers, attached individually to the undersides of the bars.[7] Since pickups were installed on the nodal point of each bar, every note could speak equally. Perhaps the clarity and consistency of note production was the biggest advantage to the ElectaVibe over the use of microphones on an acoustic instrument. This system was beneficial to performers in several other ways; the ElectraVibe pickup system allowed for line level output that could route directly to the front of house, or through an independent amplification system similar to guitar setups. These features yielded more sonic control to the performer and expanded the possibilities for the use of effects.

It is difficult to pinpoint who first promoted the ElectraVibe, but its popularity grew rapidly. Prominent vibraphone artists that performed with the ElectraVibe during the early 1970's include Tommy Vig, Bobby Hutcherson, and David Samuels, who all strived for a louder stage presence beyond the capabilities of conventional microphones. Samuels purchased an ElectraVibe during his stay at Boston University. He not only wanted to be heard, but also wanted an instrument that would be able to use effects with.[8]

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[6] Ibid, 26.

[7] Harold Howland, "The Vibraphone: A Summary of Historical Observation with a Catalog of Selected Solo and Small Ensemble Literature, "*Percussionist* 15, no. 1 (Fall 1977): 26.

[8] Rick Mattingly, "Mallets, Amplification and MIDI: Dave Samuels recalls the Ongoing History of mallet-keyboard electronics," *Percussive Notes* 35, no.3

To other players the ability to sonically compete with other musicians on stage was the enticing element. Unamplified, the acoustic vibraphone has difficulty competing dynamically with a tenor saxophone, let alone an entire big band. Mike Mainieri describes his argument for amplification as follows: "I don't think that the acoustic volume of an instrument should dictate what music we should play or dictate what volume fellow musicians should play."[9]

The ElectraVibe was a tremendous improvement to previous models but did not incorporate resonator tubes and the overall sound quality was lackluster; however, the interest in applying effects inspired yet again the growth of this concept. Mike Mainieri was one of the first artists to make modifications to a pre-existing acoustic vibraphone. In the late 60s a company called Barcus-Berry created "Hot Dots" pickups, which Mainieri glued to the nodal points of the bars, eventually drilling a small hole in the nodal point to nestle the pickup.[10] This process allowed for a more organic sound of the vibraphone while still allowing the use of effects. David Samuels utilized Baracus-Berry pickups as well during a recording session for Frank Zappa in 1976. The electronics were of better quality than what Deagan and Musser were using. Zappa had tech guys on the road who were able to shape the sound so that the instrument sounded impressive live.[11] Aside

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(June 1997): 66.

[9] Robert Schietroma, "Mike Mainieri," *Percussive Notes* 22, no. 1 (October 1983): 58.

[10]Rick Mattingly, "Mike Mainieri: The Paths Less Travled," *Percussive Notes* 35, no.4 (August 1997): 12.

[11]Rick Mattingly, "Mallets, Amplification and MIDI: Dave Samuels recalls the ongoing historyof mallet-keyboard electronics," *Percussive Notes* 35, no. 3

from the technology improving, the interest in sound manipulation increased as the possibilities of amplification and electronic variety of tone opened up many more ideas.[12] Popular effects utilized on the amplified vibraphone during the 1970's include but are not limited to ring modulators, wah-wah pedals, echoplexes and phase shifters.[13] These effect units were often guitar pedals and required the performer to have an understanding of amplification, gain staging, and signal routing.

Major advancements enhanced the capability of the electric vibraphone significantly in the early 1980's. Dieter Kaudel built his first vibraphone amplification system in 1983 using 37 individual magnetic pickups, one for each tone bar, and a three-channel preamplifier.[14] This process was much more consistent and offered greater control of the mix. It did not take long until he received requests for his vibraphone amplification system from other musicians, so Dieter began to manufacture and sell these systems, ultimately forming the company *K&K Sound Systems* in 1984.[15] In 1984 K&K Sound began building vibraphones that interfaced with MIDI equipment. The first of which was designed in 1987, but was not velocity sensitive. The MIDI Master was

(June 1997): 66-67.

[12] Gary Burton, "Evolution of Mallet Techniques . . . . .1973," *Percussionist* 10 no. 3 (Spring 1973): 81.

[13]Rick Mattingly, "Mallets, Amplification and MIDI," 66.

[14] K&K Sound, "The K&K Story," http://kksound.com/kkstory.php

[15] Ibid.

introduced in 1989 and was velocity sensitive. Later came the Vibe Wizard, which was a great unit but there were quite a few bugs in its system due to brand new technology.[16] Electronic technology advancements coupled with sophisticated amplification transformed the acoustic vibraphone into a veritable MIDI driver while retaining the sonic integrity of the vibraphone.[17] Many prominent vibraphone artists utilized this technology in the mid-nineties, including Steve Rehbein, Mike Mainieri, David Samuels and David Friedman, due to the copious amount of routing possibilities allowing for multi-dimensional solo performances, or complex textures within an ensemble when desired.

[16] Dieter Kaudel, email message to author, May 22, 2017.

[17] Rich Holly, "Steve Rehbein's MIDI Vibes," *Percussive Notes* (October 1994): 63.

CHAPTER II - COMPARISON OF MODERN SYSTEMS

Throughout the early 21st century as discussed previously, there were practical and some not so practical systems available on the open market. The technology used across multiple platforms is similar, but can include subtle differences greatly impacting the outcome to the performer. The players live performance wishes will greatly dictate which direction they wish to pursue. At the front end of this personal exploration several key factors should come to mind: performance venue size, use of analog or digital signal processing, and amplification process all have great importance on selecting a system for optimal outcome. Other than homegrown electrical engineers "inventing new processes," which is evident amongst a few elite modern artists, there are three commercially available options. This portion of the study seeks to identify these three systems, explore their similarities and differences, and identify strengths and weaknesses between them, in order to provide options for the modern performer to produce a desirable outcome.

The K&K Vibraphone Amplification Systems:

K&K Sound was founded after Dieter Kaudel fashioned his first vibraphone pickup system in 1983. The company today is known for producing a wide variety of extremely high- quality pickups for a multitude of instruments, including the K&K vibraphone systems. The current systems come in two formats, the "Split-Rail Vibraphone Amplification System", and the "Straight-Rail Vibraphone Amplification System." Both systems share similar attributes, but considerations concerning the performer's instrument it will be fixed to and logistical requirements will dictate which system is best suited for the individual utilizing the K&K.

The K&K "Straight Rail" system consists of 42 pickups (one for each of the vibraphones 37 tone bars) and 5 spare pickups, two collecting rails, and the Mini Mixer.[18] A pickup at its most basic level, is anything that captures sound vibrations and converts them into a sound that can be amplified or recorded.[19] Pickups work particularly well with instruments that vary in amplitude, thus the vibraphone is an excellent candidate for this method of sound amplification. As stated in the introduction chapter of this study, the first K&K vibraphone pickup systems were magnetic in nature. These function in the same way as a pickup on an electric guitar, and in the beginning provided a mass improvement upon earlier, more archaic ideas. Although the magnetic pickups worked, Kaudel then chose to implement the "piezoelectric" pickup for the vibraphone specifically. Magnetic pickups capture sound vibrations through a magnetic field that pulses in time with the vibrations around it. Piezoelectric pickups work by conducting vibrations directly from the instrument to the pickup, which is made of materials that are particularly sensitive to this force.[20] Thus, this ultimately lead to better bar response, articulation, and a more organic, or natural, feel for the vibraphone reacting like an unamplified acoustic instrument.

Another great advantage to the K&K straight rail system is that they are built to order. In the case of my instrument, which is an early 2000's *Adams* vibraphone, Kaudel

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[18] K&K Sound, "Straight-Rail System: About the Vibraphone System," https://kksound.com/products/vibesstraight.php

[19] K&K Sound, "What is a Pickup and How Does it work?," https://kksound.com/support/pickups101.php

[20] Ibid.

custom made the collecting rails to fit my instrument. This process was critical to the success of the instrument sounding organic and sonically true due to the precise measurements required for this process. In fact, marimbas, glocks, non-graduated instruments can also utilize the K&K straight-rail system.

The K&K "Split-Rail" system is another option currently available. This option is very similar to the straight-rail system with several differences. Instead of two collecting rails that a permanently affixed to the frame, this system comes with four shorter collecting rails to perfectly compliment the Musser or Yamaha Traveler vibraphone models, as well as any Musser M55 or regular full-size Yamaha frame. The rails are equipped with hangers and suspend on the frames of these instruments.[21] This design is beneficial to those who travel with their bars and collecting rails, and rent a frame on location, or to those who own these particular models, which are very common.

Perhaps the most important element of any K&K system is the "Mini Mixer." This is the device responsible for the multitude of different routing possibilities. The first unique option offered with the Mini Mixer is the separate output options. The three octave sections of the vibraphone's tone range (F3-F4, F#4-E4, and F-4-F5) can be separately adjusted and routed with the Mini Mixer. It provides a mono line out as well as three separate octave outputs.

[21] K&K Sound, Split Rail Vibraphone System, https://kksound.com/products/Vibesplit.php

These octave outputs allow an impressive stereo surround effect by setting the low octave to the left, the mid octave in the center, and the upper octave to the right.[22] The three octave outputs can work in conjunction with the mono output, creating multiple routing options depending upon the performers needs. The Mini Mixer also has separate tone adjustments (EQ) for each of the octaves, allowing the player to fine-tune the sound of their particular instrument. Lastly, the Mini Mixer includes a main output gain control. This allows for a gain adjustment before the signal is routed. Each octave also has independent gain adjustments, but the main gain control sums all outputs to one final gain stage.

The Malletech V3PS Pickup System:

The Malletech V3PS was unveiled to the percussion world at the Percussive Arts Society International Convention in November of 2015. It all started because Joe Locke was stopped by TSA and was not allowed to board a flight with his last pickup system.[23] After gathering Joe Locke's detailed specifications, Malletech assembled a team in order to create a product that is designed with the player's needs in mind.

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[22] K&K Sound, Vibraphone and Marimba, https://kksound.com/instruments/Vibraphone.php.

[23] Malletech, V3PS Pickup System, https://malletech.com/instrument/v3ps-pickup-System/.

Mike Pope and Joe Locke hunkered down in Mike's studio, and developed a system by experimenting with different circuitry creating an organic sounding system.[24] It captivated attendees in the exposition hall, and was featured in the Friday night concert with performers including Tony Miceli and Stephon Harris and of course Joe Locke.

The V3PS system is considerably similar to the K&K Split-rail system, but is different in several ways. One similarity between these two systems is they both employ piezoelectric pickups, however; the K&K pickups are all hand crafted, while the V3PS pickups are mass produced. Repairs, when needed, are much easier with the K&K as opposed to the Malletech pickups that are not possible to get into without cutting the shielding around the 1/8" tip sleeve connecting point. Another difference between these systems is the collecting rails. As discussed, the K&K offers the Straight-Rail and Split-Rail, but the V3PS rails are designed to fold up in a three-way fashion in order to pack easy into a mallet bag. This is a big bonus for those who will travel with their system. The rails hang, and fit most modern vibraphone models, however; with an older model vibraphone, or a model out of the ordinary, fitting might be problematic.

The main difference between the K&K and the V3PS is perhaps in the routing possibilities. While the K&K Mini Mixer offers some options that are proprietary to Kaudel's electrical engineering genius, Mike Pope added several features unique to the V3PS. One advantage to the Malletech system is that it employs a 3 band EQ, adjusted from the front panel of the device. The K&K Mini Mixer has a 2 band EQ adjustment, but one must take the mixer apart to reach the adjustment parameters. With the option of

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[24] Joe Locke, Vibraphone and Pickup System, https://joelocke.com/music/endorsements/.

the mid-range adjustment on the V3PS, the performer is afforded another point to dial in the sound depending on the performance situation. Another feature unique to the V3PS is how the signal path is routed. While the V3PS does not offer three individual octave outputs, it does offer a DI balanced output for front of house, and a separated monitor output for the performer. This allows for two separate gain stages, and since they are separate they do not affect one another. The V3PS preamp also includes an isolated effects return. This functions more like an effect send and return on a live sound mixing console in the sense the effects can route through the pre-amp, instead of post EQ and preamp gain-staging. One other big difference between the V3PS and the K&K is the method of collecting the analog signal from the pickups to the preamp. The K&K systems use a four-pin connector and is one hundred percent analog. The V3PS utilizes a digital based connection, which means at some point the signal path is converted to digital and then back to analog for the output. This method is not discussed publicly as the process is undoubtedly proprietary. Thus, if this connection fails, or is-in-need-of a new connecting cable, it will be difficult to locate, and soldering to fix is not a possibility. One other option the V3PS employs is an option to run the DI output pre, or post EQ. This is beneficial in the sense that it gives the performer one more element of control before the signal is gain staged. The performer may wish to control EQ for the monitor send, but depend on the EQ in front of house for the final mix.

VanderPlas Percussion:

The final commercially available vibraphone pickup system is designed by a company called VanderPlas Percussion. These are different from the K&K and the V3PS

in many ways, foremost these systems are sold as an entire instrument instead of retrofitting a system to a previously existing instrument. VanderPlas systems are often custom made for the performers specific parameters and are currently hard to find on the open market. These systems are completely different from others in how they operate. The differences are as follows.

Unlike the previous systems mentioned, the VanderPlas outfit produces a digital signal path instead of analog. The pickups themselves are similar in nature to the piezoelectric transducers found on the K&K and V3PS, but with the VanderPlas the signal is converted to digital at each contact point. This means that every tone bar on this system contains an analog to digital converter. Once the signal is converted to digital, it then routes to general MIDI.[25] This then requires the use of a MIDI sound generator or a DAW (Digital Audio Workstation). After the signal is manipulated through the DAW, it is then converted back to analog with the use of a digital to analog converter. These are also known as "interfaces" or "DA converters." The quality of the sound will depend upon the quality of the DA converter, as this device is ultimately responsible for converting digital code to an audible sine wave.

Since the VanderPlas system works in the same fashion as any other MIDI controller such as a synthesizer, Mallet Station, or MalletKat, the MIDI mapping can partner with DMX protocol to control visual elements such as lighting fixtures or video elements.[26] This gives the performer a unique opportunity to control separate parameters

[25] MIDI is an acronym for "Musical Instrument Digital Interface".

[26] DMX is an acronym for "Digital Muliplex", this is the standard protocol for intelligent lighting control.

with the strike of each individual bar. For example, if the MIDI signal path is paired correctly with DMX the low F of a vibraphone could start a video or engage a lighting fixture. Velocity can also trigger different reactions. This process is extremely complex, but is worth mentioning because it is possible with the right gear.

All three systems offer unique parameters. It is important for the performer to have a general idea of individual performance goals when selecting a system. Having a general knowledge of the technical aspects is critical when considering a system for performance. If a player wishes to simply have a more significant sonic presence the K&K Straight-Rail system may be the best option, however, if portability is a factor, the player may wish to select the V3PS or the K&K Split-Rail option. All three options are suitable for the use of effects to manipulate the sound further. This is perhaps one of the largest benefits to performing on an electric vibraphone, as this process expands the instruments capabilities, and can offer the performer opportunities in expression, timbre, and other aural excitement not possible with an acoustic instrument.

CHAPTER III – EFFECTS CLASSIFICATION, IMPLEMENTATION AND AMPLIFICATION

The use of effects is possibly one of the most intriguing aspects of performing on an electric vibraphone. An effect is an alteration of any original signal path manipulated by circuitry (analog) or an algorithm emulating circuitry (digital) to change the tone or timbre of the natural sound of an instrument. It is important for the electric vibraphonist to understand the different effect classifications and basic functions to achieve a good sound. Without this knowledge, this process can pose problems and in some cases, destroy gear used in the amplification process. The effects most commonly used are designed for the electric guitar and some work better than others with the electric vibraphone due to the high amplitude created by striking the bar. This portion of the study will mention several brands of effects, and will deliver results of personal experimentation.

Pitch Effects:

Pitch effects alter the actual tone produced by the instrument. When used with a vibraphone these effects can create interesting sounds because the sound of the actual pitch will coexist with the implemented pitch of the effect. This category includes, but is not limited to, octave, pitch shifters, and harmonizing devices. An octave pedal is a device that adds one or more octaves above or below the sounding pitch. These pedals or devices work particularly will with the electric vibraphone in the lower range of the instrument. If using the K&K system, one can utilize an octave pedal in the low range of the instrument only, to create a sound that represents a bass instrument along with the

sounding pitch. Examples of the octave pedal include the *Electro-Harmonix* "POG," the *Boss* "OC 5," and the *MXR* "M280." Pitch shifters and harmonizers work similar in fashion to octave effects, but contain more intervallic options other than a simple octave above or below the sounding pitch. The use of these effects on an electric vibraphone can produce sounds similar to electronic keyboard instruments, and offer a unique way to stand out as a soloist within an ensemble. Some common examples of pitch shifters and harmonizers include the *Electro-Harmonix* "Key 9," the *Electro-Harmonix* "Pitch Fork," the *Boss* "PS 6 Harmonist," and *Eventide* "Pitch Factor."

Modulation Effects:

This category of effects implements physical alterations to the EQ of the signal path. Within the modulation effect category, we find flangers, phasers, wah-wah, and vibrato. These effects work well with the electric vibraphone over the entire range of the instrument. Flangers offer an aggressive sweep of EQ, adjusted by a speed and intensity parameter. A slow speed and high intensity setting will yield an airy or hollow sound great for slower tempo musical moments. Phasers and phase shifters work in a similar way to flangers, and depending upon the model of effect used yield different results. The sound created with these effects can resemble an almost "cartoony" sound, especially when the speed is adjusted to a fast setting, and the intensity is adjusted aggressively. Wah-Wah pedals make an aggressive EQ alteration, but are manually controlled via a motion with the foot. One can engage this effect and dictate the outcome according to in the moment needs. These effects work great for guitar, but with the electric vibraphone, they are not as affective and don't boast a reasonable impact. Vibrato effects work well in

this process, but have a different “feel” from the vibrato produced from an acoustic vibraphone with a motor, tubes, and flaps. For the purpose of this study, I selected an *Electro-Harmonix* “Small Stone EH4800,” and an *MXR* “Phase 90.”

Reverb Effects:

Reverb, short for reverberation, is often used in multiple facets of music production. This effect works to simulate the natural decay of sound in an environment. It is commonly used in the post-production mixing process to “smooth” out or “fill” in the performance to add an element of live sound to a mix. Reverb units typically utilize standard settings, such as spring, plate, and hall. All three offer slightly different sounds and work well with the electric vibraphone. The effects are controlled by a decay time operation and can offer a beneficial color to short or long sounds. If the decay time is set to long, it works well with a dry non-pedaled approach, giving the sense of sustain without using the vibraphones sustain pedal. A long decay setting mimics a larger area of decay, and can create a delicate and atmospheric sound to the vibraphone. In my experimentation with reverb effects, I found that the *Electro-Harmonix* “Holy Grail Max” works great with the electric vibraphone.

Time Effects:

Time effects, applied to the electric vibraphone, have a profound outcome and provide a multitude of possibilities. A time effect works by manipulating or regenerating a signal path at a desired speed and intensity. This category includes delay, looper, and in some applications even reverb. Delay pedals are either digital or analog in nature, and

depending on the circuitry offer several outcomes that work great with the electric vibraphone. Digital delay pedals such as the *Boss* "DD-3 and DD-5" have several parameters that the player can experiment with to achieve desired outcomes. These adjustments include energy level, (the amount of effect added to the signal path) feed-back, (the intensity at which the delay works) delay time, (the length of time a particular delay will last, and speed of the delay, (the rate at which the delay occurs). Analog delay units function similar, however; in some pedals such as the *MXR* "Carbon Copy," bucket brigade circuitry allows for a constant regeneration of the signal until the effect is disengaged. One must really pay attention to the settings on this type of pedal because each time a regeneration occurs, the signal amplitude multiplies. If left alone with the wrong settings, this type of delay can and will destroy equipment by over excitement until the point of mechanical failure or fire.

Volume/Gain Effects:

The last general category of effects is volume and gain, otherwise known as overdrive, distortion, and fuzz. This effect is designed to simulate a signal path that hits a pre-amp so hard, that the sound becomes distorted due to a concept known as "overdrive," without having to actually overdrive and amplifier. First, if one actually overdrives and amplifier with any signal path it will create a extremely loud sound and there is again risk to damaging equipment. This type of effect simulates this process in a controlled fashion. In analog gain effects a rectifier is used to boost the gain and then is controlled by the output level designation. This concept allows for an overdriven or distorted sound without harming the audience or gear. Like the other effects classes, there

are many options to choose from. My experimentation led me to a successful sound using the *Ibanez* "TS-9," and the *Sovetek* "Big Muff-Pi." The TS-9 is perhaps one of the most common overdrive pedals in the guitar idiom, made to simulate an overdriven tube amp, and the Big Muff-Pi is an iconic "fuzz" pedal, (meaning extremely distorted) utilized on countless recordings. Both options work well with the electric vibraphone and break up differently in real-time depending on the velocity at which the bar is struck. Since this effect is designed to simulate an overdriven amplifier, I have found that less sustain pedal or half-pedal technique works best.

Digital Effects:

The effect units listed previously work in an analog capacity. This means the signal path runs through copper wire, circuitry proprietary to the model, and leaves the device via copper wire sustaining the analog element from start to finish. Digital effects, on the other hand, work to simulate said analog sonic manipulation with algorithm design. This concept is beneficial to many performers due to convenience and consistency within the signal path, however; some control of sound is lost due to pre-set parameters within the algorithm itself. The age-old adage, "you get what you pay for," certainly applies to the concept of digital effects.

The process of utilizing digital effects with the electric vibraphone, has two basic ways: one can send a "line level signal" to a digital effects unit, or send a pre-converted digital signal to a DAW. The first mentioned process takes the analog line level signal and utilizes a digital pedal board capable of producing all of the effects categories mentioned previously. Instead of investing in multiple effects units, supplying power to

each individual entity, and gain-staging the signal path, one can simply "plug and play" with a digital system containing these parameters in a "all in one" package. This may appeal to performers wishing to downsize physical gear, which undoubtedly makes logistics easier. The down-side to this process, is the sound quality is contingent upon the craftsmanship on any given unit.

Implementation and Signal Routing:

Once the desired effects are selected, the performer will need to establish a signal path. This is the process of routing the line level signal from the electric vibraphone, through a pedal chain or effects loop, and on to the amplification source. When using analog effect units, the sequence in which they are patched is an important factor to consider. One thing to keep in mind is that the last effect in the sequence will receive the attributes of previous effects if engaged at the same time. For example, a phase shifter and a delay used in tandem will create different outcomes depending upon the order they are patched in: if the delay is first, the signal of the delay unit will be phase shifted, if the delay is last the signal of the phase shifter will be delayed. For this reason, it is sensible to always run the delays last in the chain. This opinion is corroborated by other electric vibraphone artists including Laura Scarborough. In an interview with Kurt Gartner, Scarborough describes her signal path as vibrato first, then tremolo, then delay. If a distortion pedal is used, it goes in the middle, but the delay is always last.[27] For the purpose of this study, I found the signal chain best suited for my needs is in this order:

[27] Kurt Gartner, "Laura Scarborough: Sculpting Sounds, Shaping a Career," *Percussive Notes* 53, No.3, (July 2015): 42.

phase shifter, reverb, pitch shifter, analog delay, digital delay (DD-7), digital delay (DD-3), and last the TS-9. In the low octave, isolated with the K&K Mini-Mixer octave allocation, I implement an octave pedal on the low range only.

When using digital effects within a MIDI setup, this process includes some different procedures. If the instrument is constructed with AD converters on each individual bar, the signal path is digital from the beginning. It then connects to a computer via USB or Firewire and runs into a DAW. Within the DAW, one can utilize a multitude of effects, however; one must be cognizant of the parameters setup within the digital effect. Many times, compression an EQ is pre-set, and will dictate how the effect functions in amplification or post-production. If a quality digital effect is employed, the results will yield desirable sonic manipulation. Steve Shapiro is a pioneer in the world of digital manipulation utilizing the electric vibraphone. After a short meeting at PASIC in 2015, he afforded me an interpersonal communication regarding his current setup. His process is as follows. "The rails of the pickups go into a small mono mixer, and that signal goes into one input of the USB interface. That's line level and comes into Mainstage mono, but the effects and MIDI sounds are all stereo. To do live pitch to MIDI conversion, I just insert the Sonuus G2 box between the mixer and the interface, the signal passes through. Then there is a physical MIDI out from the Sonuus which can go into the MIDI input of the interface."[28] This process is unique in the sense it changes an analog signal path into a MIDI signal, while still sending a line level analog signal to the interface. This allows for a combination of digital and analog, ultimately providing total

[28] Steve Shapiro, email message to author, September 19, 2021.

control of sonic manipulation. From Mainstage, (DAW) any effects can manifest into the signal path with ease.

Amplification:

Once the initial signal path is established, it is ready to amplify. This process is the last in delivering the signal path to the audience or recording entity. Depending upon the performers signal path, system, and output desire, the electric vibraphone can be presented amplified in many ways. The size and scope of the venue, personalized routing, and overall sonic goals must be considered when establishing an amplification plan. This portion of the study seeks to identify the most common ways of electric vibraphone amplification, and provides advice when combining concepts.

The first way to amplify an electric vibraphone is to simply use the direct output to run a line level signal to a PA (public address) system. This process functions in the same way a bass guitar or keyboard amplifier would send a signal. The electric vibraphone signal is then patched into a channel on a mixing console and sent to the speakers used in the front of house mix. In order for the performer to hear the amplification of the instrument, an auxiliary channel is required for a monitor mix send. If the sound system utilized is large format in nature, this will not be a difficult task, but if the performer is using a stand-alone PA or a smaller system, it may not be possible for the performer to accurately hear the amplified sound. This process is more difficult to implement the use of effects and the sound quality is contingent upon the sound engineer's experience.

The second way to amplify the electric vibraphone is to use separate amplifiers. This method functions in the same way electric guitarists utilize amplifiers. The line level signal of the electric vibraphone can easily run through effects units and then into a guitar, bass, or keyboard amplifier. This treatment works great and gives the performer real-time control of the amplified sound produced. For the purpose of this study, this is the method I selected to use due to the implementation of effects. With the K&K Mini Mixer I run a line level signal containing the full range of the instrument through a pedal chain and into a Fender Twin Reverb guitar amplifier. I then run the bass octave only, through a separate pedal chain, into a Fender Bassman 500 full range bass amplifier. The amplifiers are placed directly behind the instrument to obtain a realistic aural impression to the audience.

The final way to amplify the electric vibraphone is to combine both of these processes. If the performer chooses to use separate amplifiers and effects, but is performing in a large venue, the amplifiers will need to run to the main mix. Many amplifiers have the option to run the signal direct out from the amplifier, but the tone and characteristic of the sound is often negated. To obtain an exact impression of the sound achieved by the amplifiers, one will need to use microphones on the speakers of the amps themselves.

The concept of gain-staging is paramount when achieving a quality sound through the process of amplification. This is the practice of adjusting every gain-point within a signal path. Gain, meaning volume, is located many times within a complex setup. To obtain the best possible result the performer must start with the instrument and continue on through the signal path, staying as close to unity as possible. The typical scenario may

include many points of gain, especially with the use of effects, and the performer must manage these properly. Not doing so, may create unwanted distortion, bad tone, and a signal that is too high in amplitude for the front of house mix.

CHAPTER IV – THE USE OF EFFECTS WITHIN MUSICAL APPLICATION

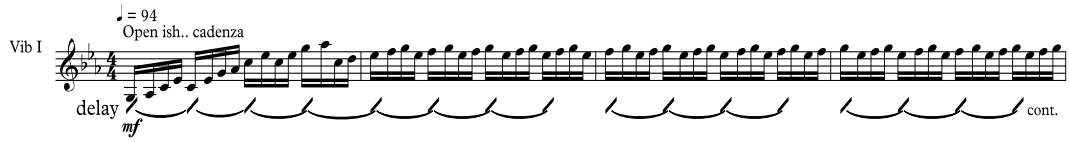
Upon researching an implementing this technology to my vibraphone as the basis for this study, I began searching for repertoire to perform. Since most performers ahead of my research sought to utilize this process in a proprietary setting, I quickly realized the scope of works written for the electric vibraphone was extremely limited. One previously existing work is entitled "Vibestring," composed by Luca Vincenzo Lorusso and was the winner of the 2013 PAS Italy Composition contest.[29] This work is scored for electric vibraphone with effects and string quartet, however; for the purpose of this study I found the parameters too simple and lacking in several ways as to provide a detailed explanation of said process. Thus, I composed a work entitled "Put the Pedal to the Metal," for electric vibraphone and mallet quartet. The work functions as a three-movement concerto performed attacca. Each section of the work employs different effect application techniques, and is designed to highlight the electric vibraphone as a solo instrument. Put the Pedal to the Metal is based around the idea of the foreboding element, as well as organic instruments mimicking effects used with the electric vibraphone. This portion of the study seeks to examine musical decisions made throughout the composition, to demonstrate the capabilities of effects utilized. The full score is located in the appendix.

The opening phrase of this work employs a *Boss* DD-7 to provide the initial ostinato. This sets the tempo for the introduction by using the delay to create a sixteenth

[29] Joshua D. Smith, *Percussive Notes*, (May 2015), 73.

note-based pattern. A small cadenza occurs before bar one, and is up to the performer on how to approach this introduction bringing the other players into bar 1.

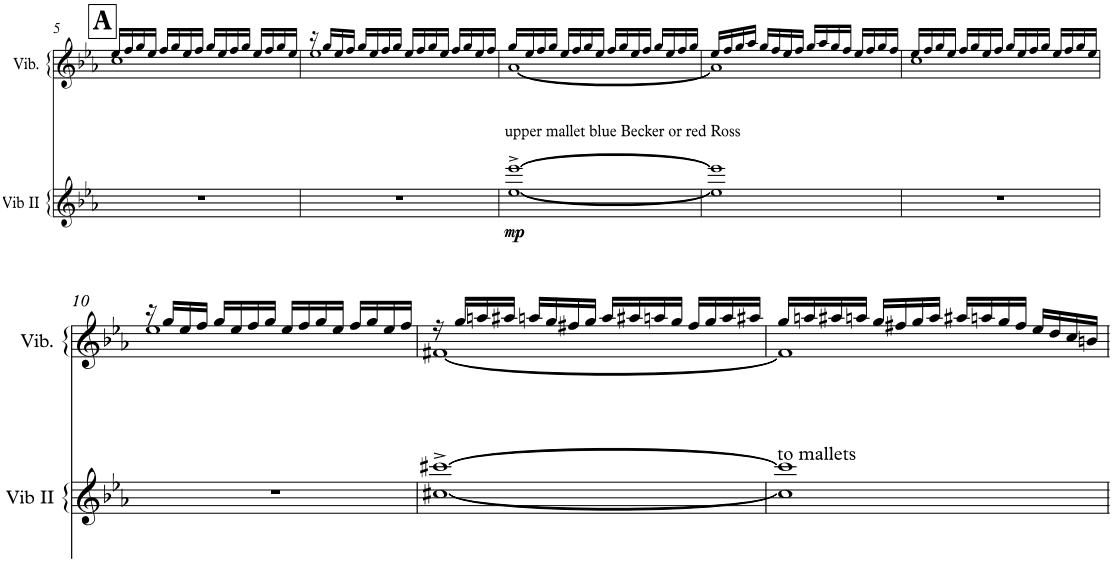
Figure 1: Opening cadenza featuring the DD-7



The slashes underneath indicate the rate of delay, and since sixteenth notes are the primary function, this is what the delay reproduces. The DD-7 is useful in this passage due to its disengagement process: when the DD-7 is disengaged, the delay fades out instead of an abrupt cutoff.

In measure 5, the first theme is presented. This simple theme is in the lower voice of the electric vibraphone and is delayed along with the sixteenth note pattern, but because it is constructed with longer note values, it speaks as repeating quarter notes.

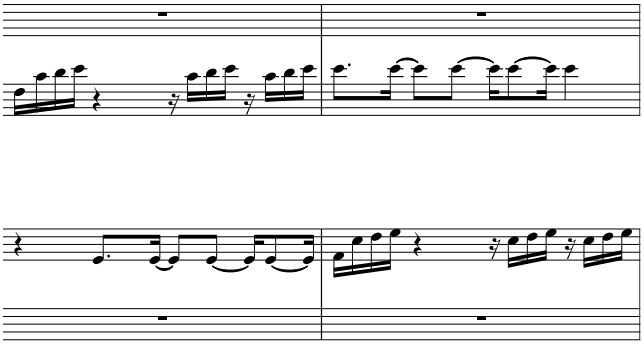
Figure 2: First theme in solo instrument



The vibraphone two part during this presentation of the first them is meant to embellish the arrival points of Eb and F# with the use of vibraphone mallet on the lower note, and a hard xylophone mallet on the upper note. The second vibraphone receives the tempo from the delay.

The marimbas enter with a pattern hinting at the next electric vibraphone accompaniment which comes later to support the melody. The two marimbas are juxtaposed to create a stereo effect, and mimic the use of the delay pedal with organic instruments. The common theme throughout this work is organic instruments interplay with the electric vibraphone and often simulate effects with the use of polyrhythms. Figure 3 shows the underling accompaniment between the two marimbas.

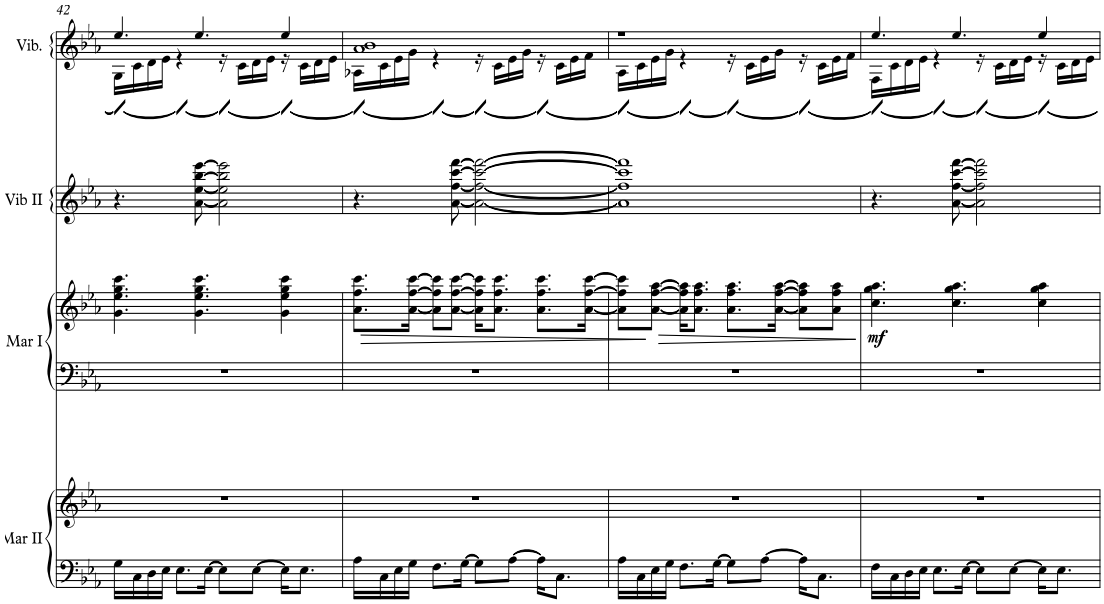
Figure 3: Marimba accompaniment



As the sections develops, the marimbas and second vibraphone take individual personalities, again mimicking the delay pedal with the use of across-the-bar-line phrasing and polyrhythms thickening the texture. Along with this concept the melody in the electric vibraphone begins to take a different shape as well with a dotted quarter-quarter note variation, continuing to create excitement. Note the ostinato in marimba 2 is the unchanged engine that drives the rest of the ensemble. Vibraphone 2 plays and reacts in tandem with the electric vibraphone, and marimba 1 goes back and forth between

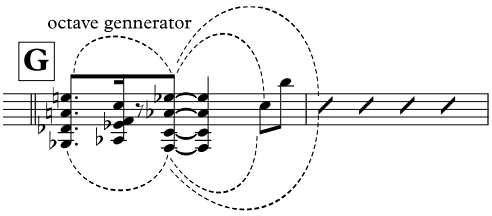
syncing with the electric vibraphone and having an across-the-bar-line rhythm. This interplay between ensemble members creates the energy needed to propel the ensemble to the next section which is different in nature with harmony and effect texture. See figure 4.

Figure 4: Ensemble sample in opening development



The next section of this work employs the *Electro Harmonix* "Pitch Fork." This provides a different texture, differing greatly from the sound of the delay. The setting of this particular effect pedal for this section adds an octave above and below written pitch of the electric vibraphone. For this reason, open voicings work best. Closed voicings with this particular effect get muddy and deviate from the overall impact. In this particular section, the pitch effect runs through the entire range of the instrument. See figure 5.

Figure 5: Vibraphone voicings with pitch effect

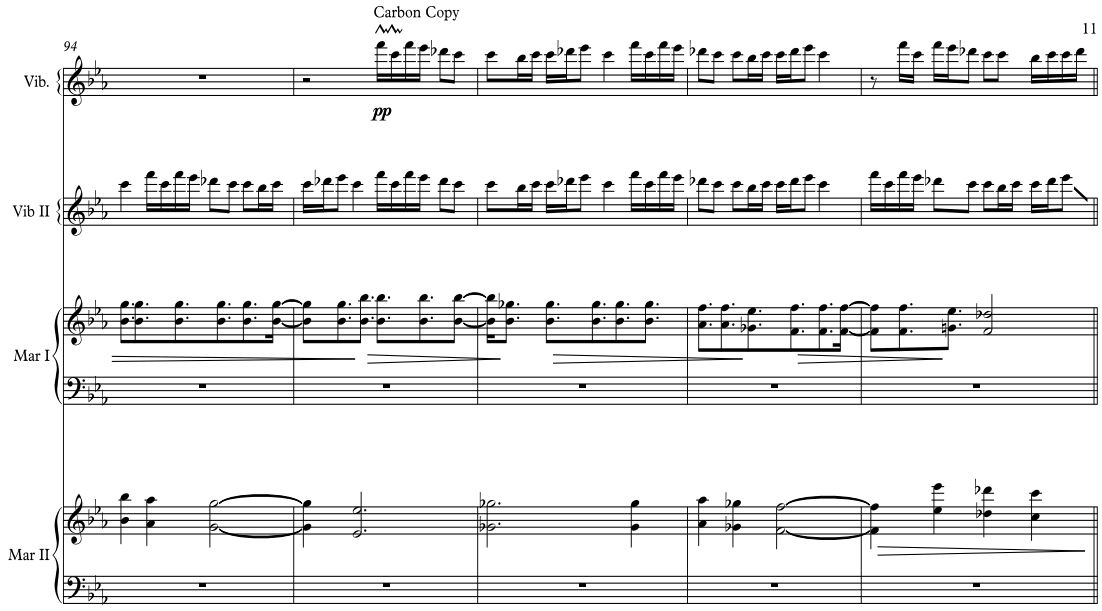


The semi-circular notation is designed to catch the eye of the performer without having to read text, and is merely a suggested notation tactic.

From this point in the composition, the electric vibraphonist has the opportunity to improvise a solo over both sections. The solo section utilizing the delay is up to the performer to create unique lines and ideas that will yield different results each performance. The second soloing opportunity utilizing the pitch effect is similar, but the performer should note that wider intervals are more affective.

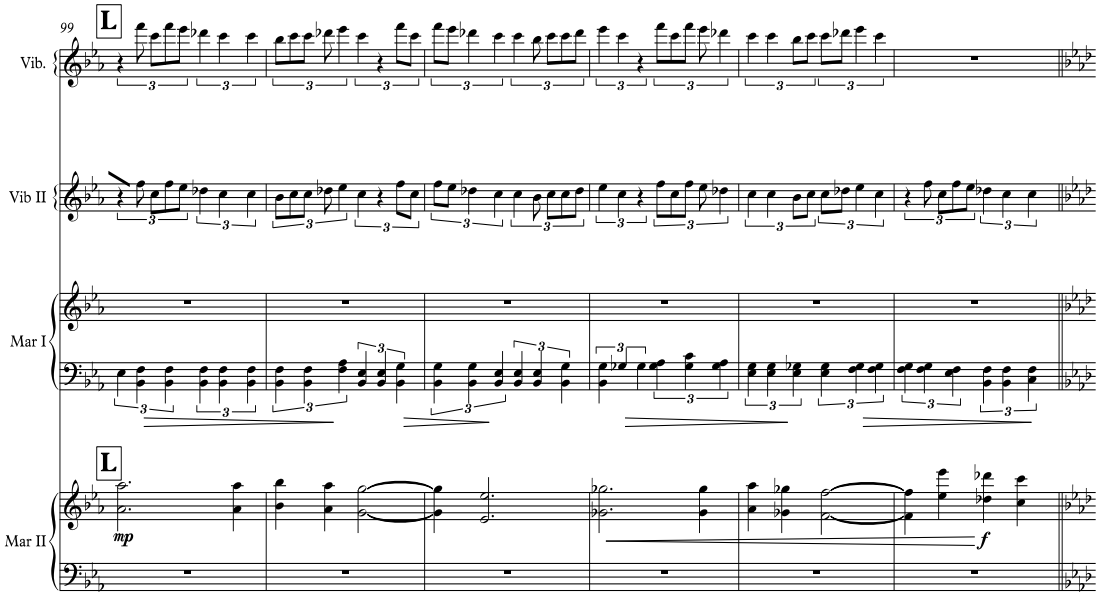
The transition to the second section of the work includes interplay between both vibraphones as well as the continued polyrhythms in the marimba accompaniment. At this point in the work, the *MXR* "Carbon Copy" is engaged set at a mild decay and at the tempo of the previous delay. This delay is analog in nature, and produces a different sound then that of the previous delay effect. See figure 6.

Figure 6: Ensemble interaction with analog delay in transition section



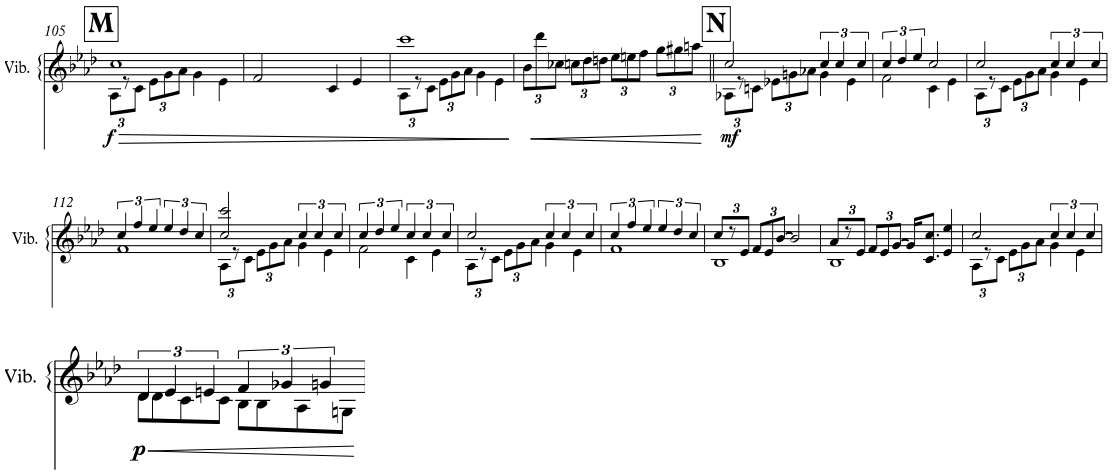
The notation above the electric vibraphone entrance suggests quicker decay time and is again a visual reference for the performer. This section is then expanded by rhythmic augmentation.

Figure 7: Rhythmic augmentation in transition



The second section of this work employs the use of the reverb effect. This creates a stark contrast to the opening section by creating a hollow tone with simple accompaniment. The theme is presented in the interplay between the different ranges of the electric vibraphone.

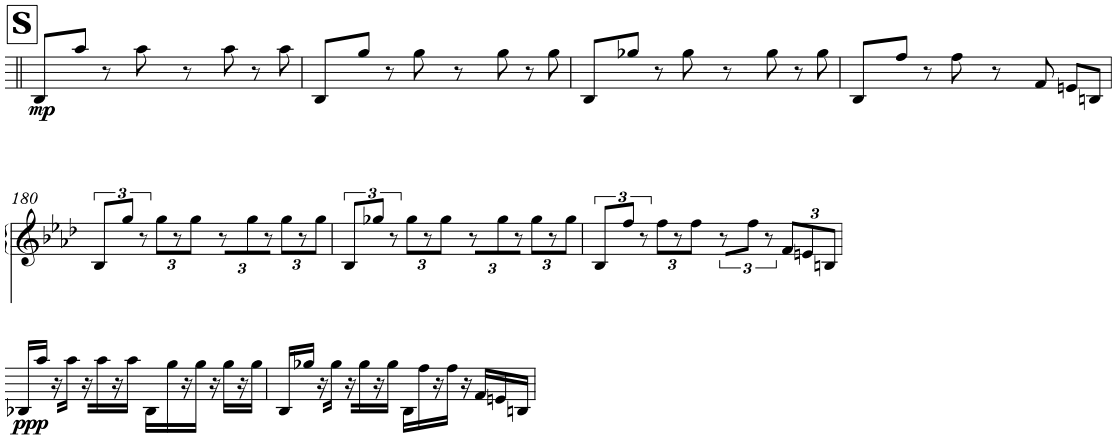
Figure 8: Second section theme featuring reverb effect



With the reverb unit engaged, the upper portion of the melody is able to stand on top of the musical texture, while the lower portion of the melody adds depth and warmth. The reverb effect is prominent throughout this section. The performer again has the opportunity to improvise over the second part of this work, allowing for exploration with this effect. For my performance on this work, I selected the "plate" type reverb parameter, however; future performers may choose to experiment further.

The transition to the third section of this work features the use of the *Electro Harmonix* "Small Stone," which is a phase shifter. The tempo is set moderately as the musical content builds intensity by the use of rhythmic diminution. During the slower portion of this passage, the phase-shifter has one characteristic, but as the rhythms become faster it boasts a different sonic flavor. See figure 9.

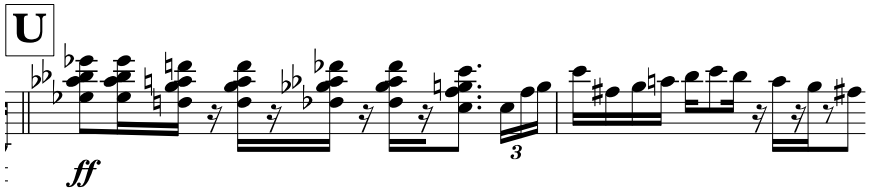
Figure 9: Transition to third part utilizing phase shifter



While the solo part gets smaller and quicker in note value, the accompaniment utilizes rhythmic augmentation, and works well to support the use of the phase-shifter.

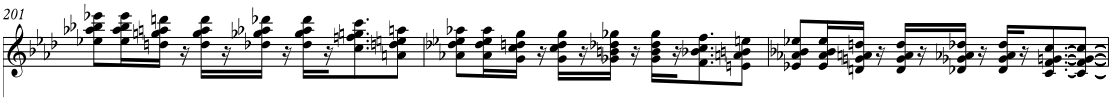
The second part of the transition to the third portion of this work is the only unison section, and aims to lead to the climax of the piece. For this section, the electric vibraphone engages the pitch effect, as well as the phase shifter. This provides an aggressive, yet undistorted intensity. The voicings in this passage are tighter, as they appear in the upper register of the vibraphone. See figure 10.

Figure 10: Unison section with phase shifter and pitch effect



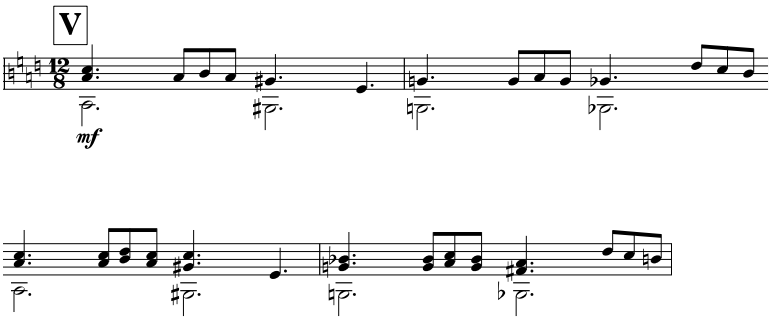
The decent down the range of the electric vibraphone with these two effects engaged, leads to a more aggressive sound in the lower range with these tight voicings. This factor continues to build intensity ultimately leading to the final section of this work. See figure 11.

Figure 11: Decent in transition changing the nature of the effects with range



The final section of this work employs the use of the *Ibanez* "TS-9" overdrive pedal. This adds an aural excitement different to previous sections. The theme appears in the upper portion of the soloist's part first as a one-note entity, then expands to thirds. In the middle range of the instrument, with modest settings on the TS-9, the thirds work to thicken the texture without getting too cluttered.

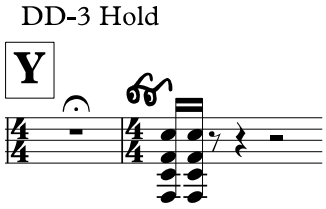
Figure 12: Final theme with the use of overdrive



The accompanying voices in this section are comprised of previous ostinatos in the vibraphone two part, and a dotted-eighth figure in the marimbas, giving one last nod to the idea of delay, without the use of delay. This provides a solid foundation for the soloist to improvise with the use of the overdrive effect.

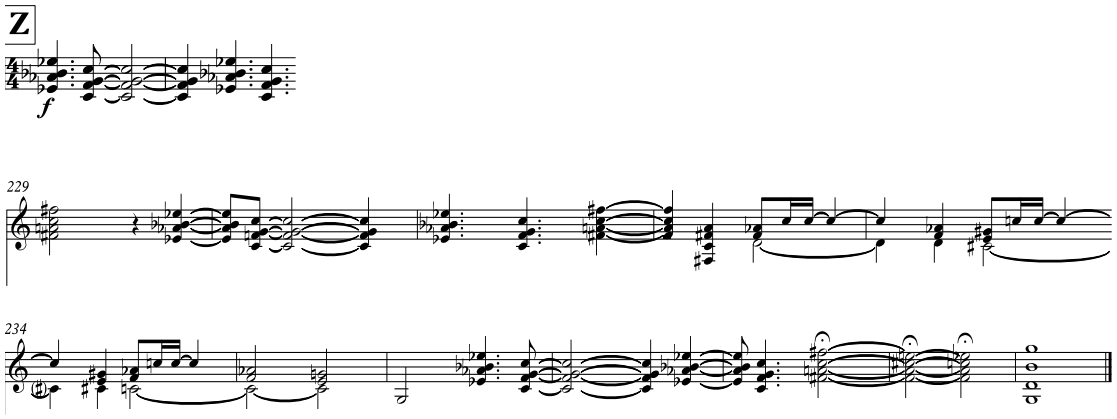
The closing passage utilizes the *Boss* "DD-3" in the hold setting. This is the process of playing a quick rhythm, then engaging the effect and holding the pedal down for the duration of the passage. This then delays what the performer captures enabling the layering of other musical elements on top of the delayed sequence. Figure 13 shows the captured rhythm. See figure 13.

Figure 13: Final delayed ostinato with the DD-3



From this point the soloist performs an organic passage without the use of any effects other than the held delay. This brings the work to an end with an energetic, yet mysterious feel. Figure 14 shows the passage performed in tandem with the held delay.

Figure 14: Closing accompaniment with the use of the DD-3



CHAPTER V – CONCLUSION

The future of the electric vibraphone is contingent upon those who utilize this unique technology. One important factor to consider is the multitude of ways one can be creative with not only physical setup, but also with how the technology is implemented. I have found in my personal experimentation and research this instrument, along with the use of effects, can spark creativity beyond the scope of an organic acoustic instrument. For younger players, perhaps the use of effects when practicing the basics would provide an experience more enjoyable. If a young vibraphonist was working on scales, the use of delay could serve as a device showing rhythmic intent, keeping the player in time and illuminating errors. Others may enjoy the use of overdrive or any of the other effects to step out as a soloist within an ensemble setting to create a unique musical experience for the performer and audience alike.

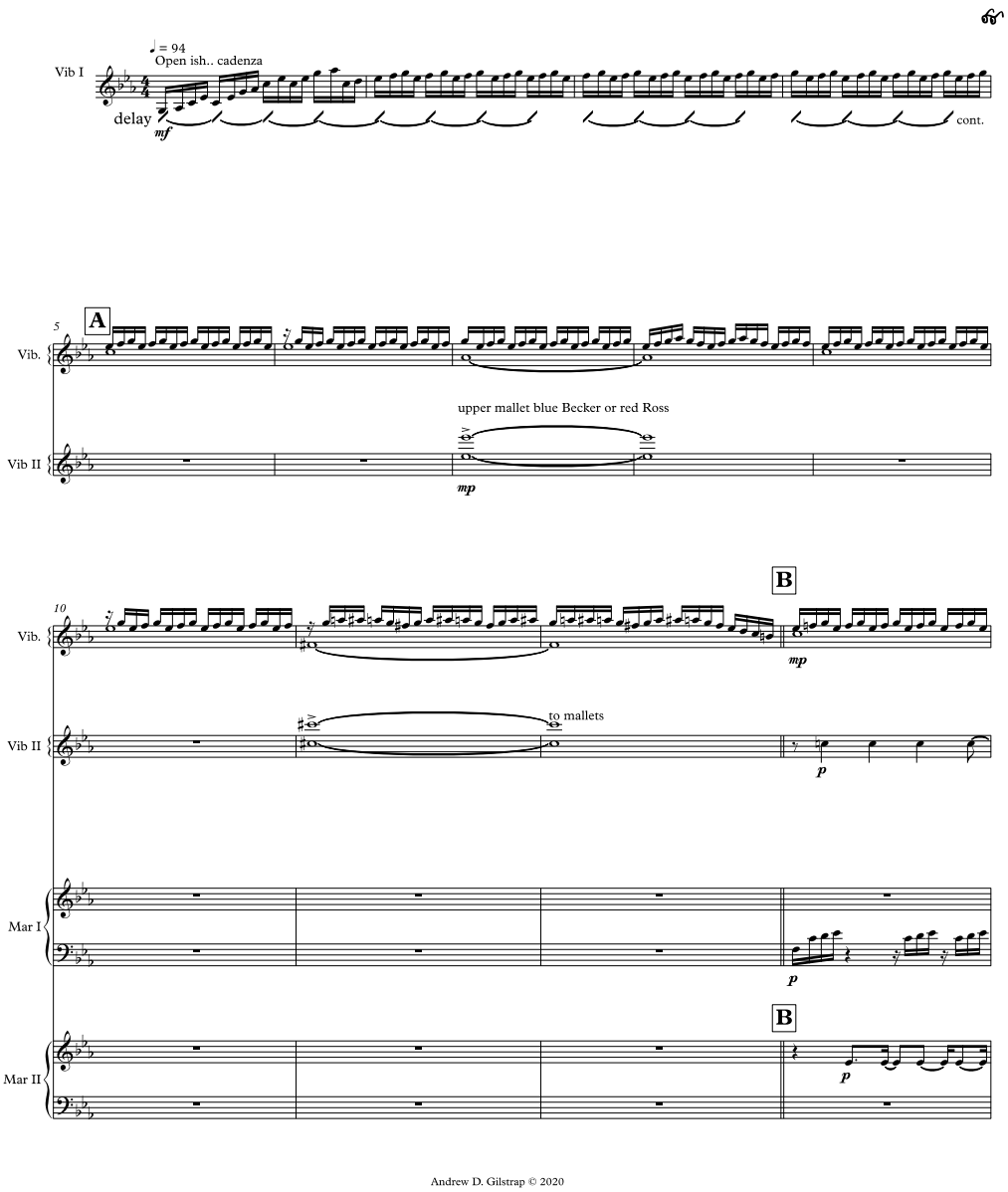
For other applications, the marching idiom could benefit from this technology. With a great focus on other effects such as samples and other live manipulation, the electric vibraphone could offer aural excitation unique to each performance. Others may dare to take the electric vibraphone into other venues out of the ordinary for mallet percussion instruments. This process could prove to provide and interesting experience for everyone from a DJ at a dance club, to a country band looking for an alternative to the steel guitar.

In closing I would encourage future electric vibraphonists to obtain inspiration from outlets other than vibraphone music. Guitarists, digital musicians, and keyboardists can provide sonic insight and inspiration for creativity on the electric vibraphone. For the

cost of a quality pair of stereo microphones, one can employ this technology and have a unique experience proprietary to personal creativity.

Put the Pedal to the Metal

Andrew Dean Gilstrap



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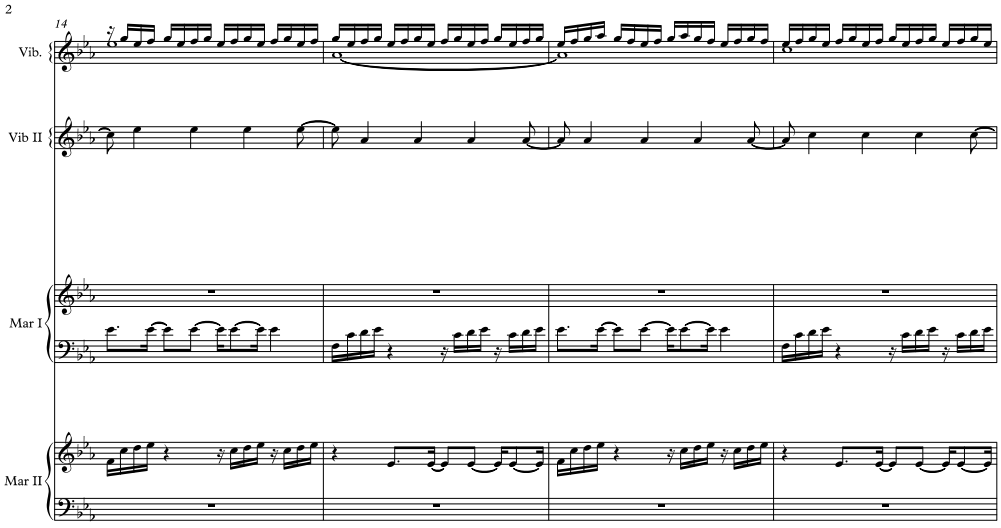
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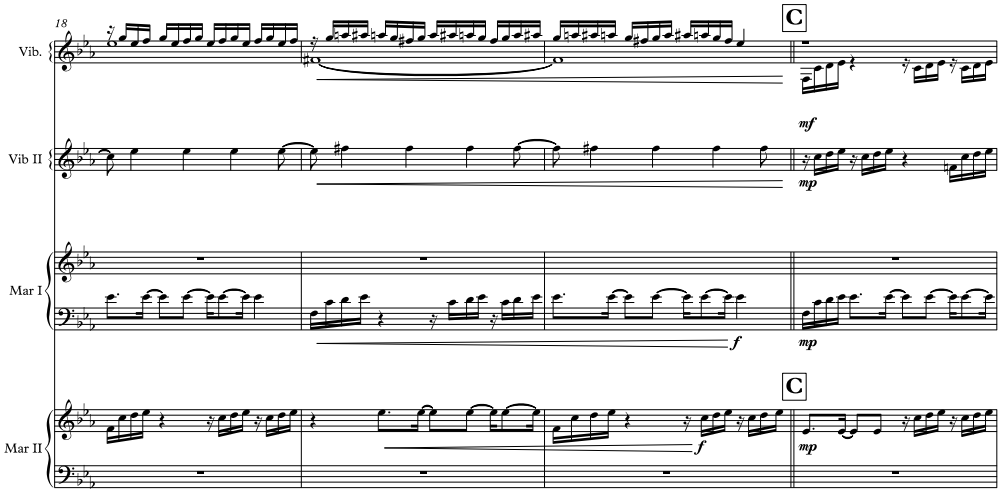
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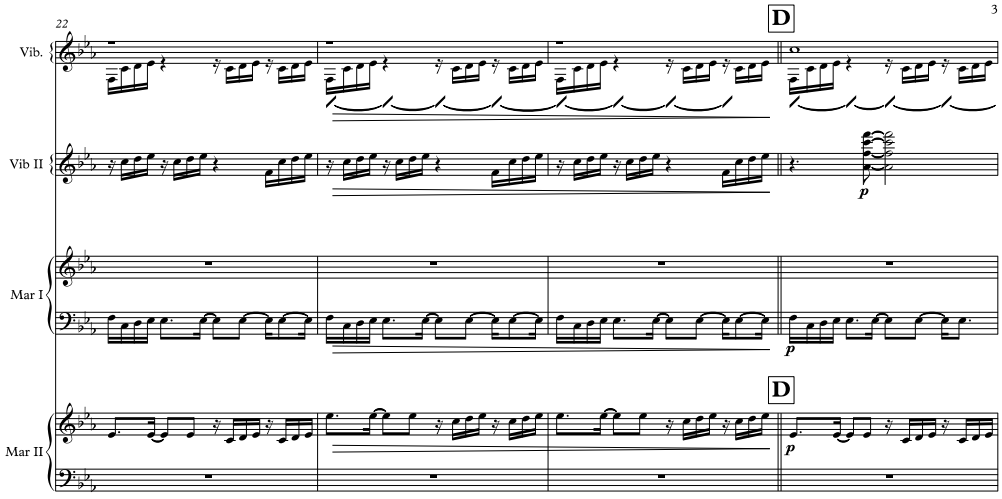
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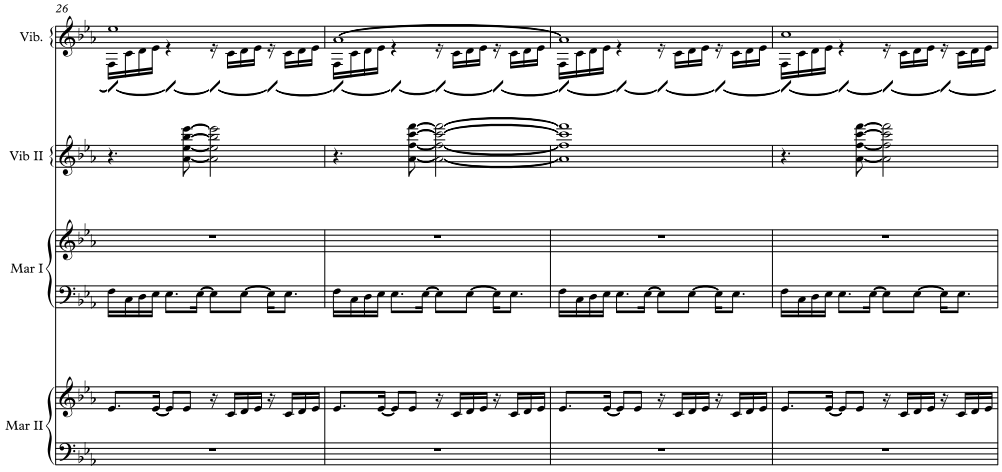
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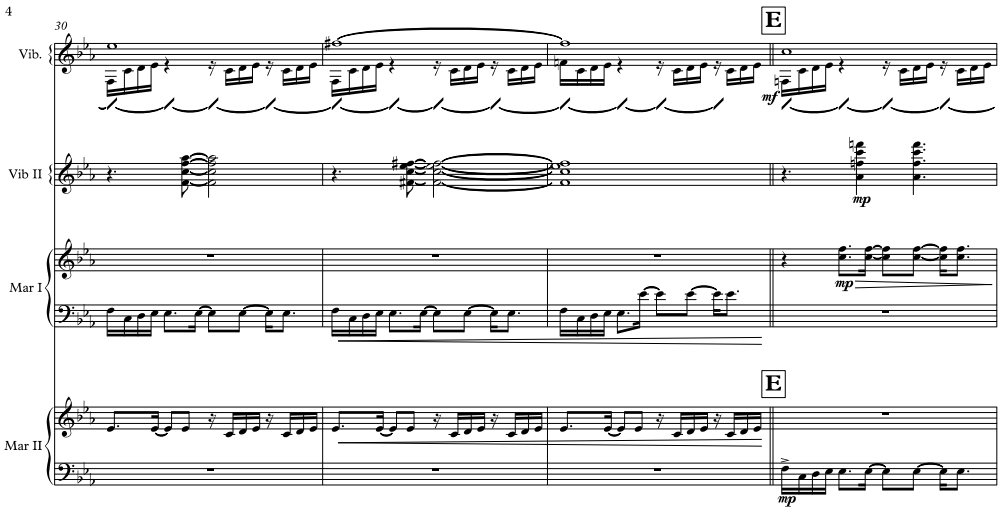
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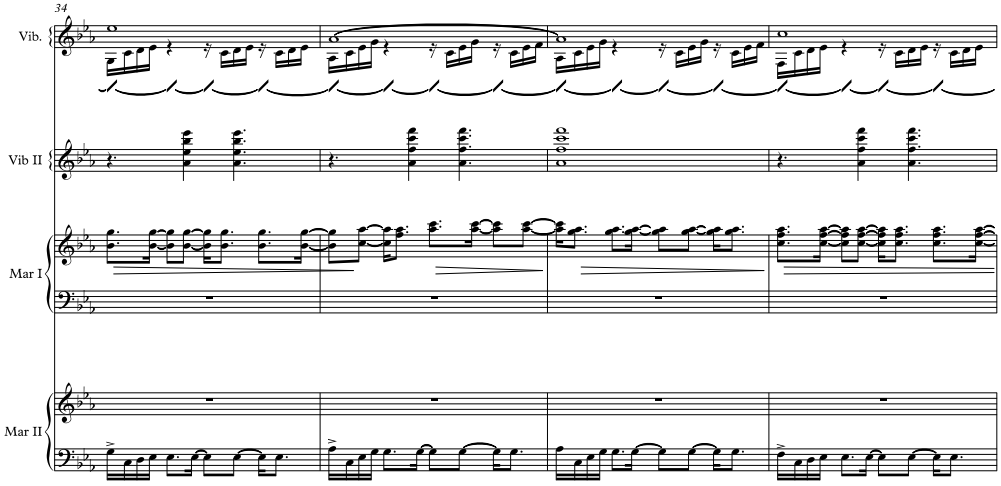
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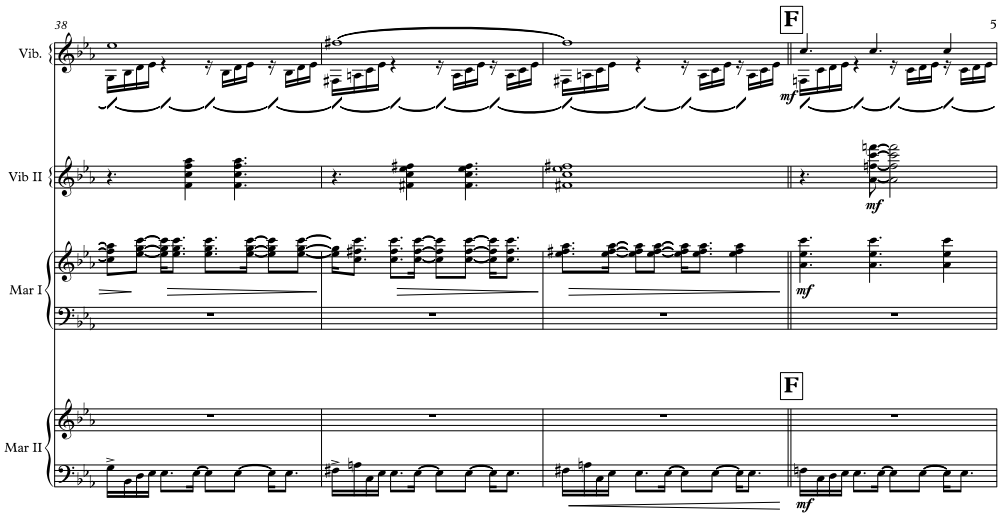
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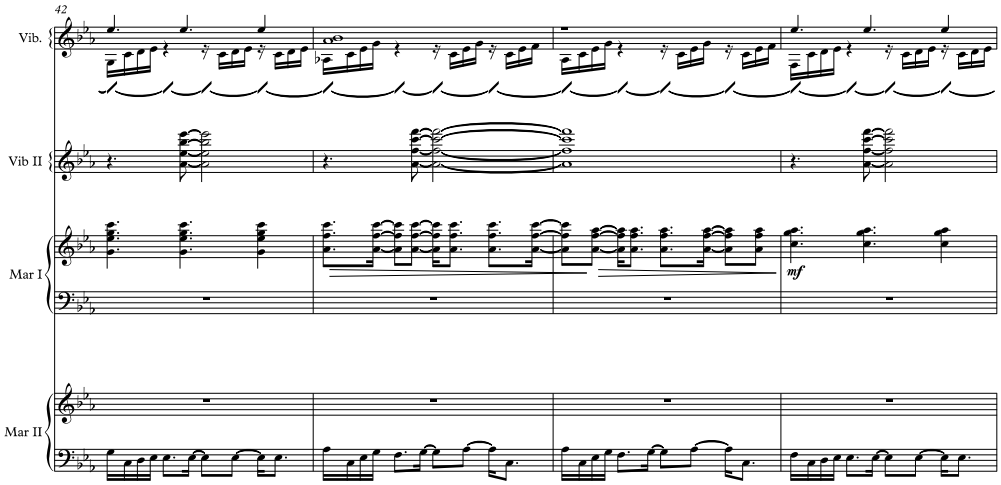
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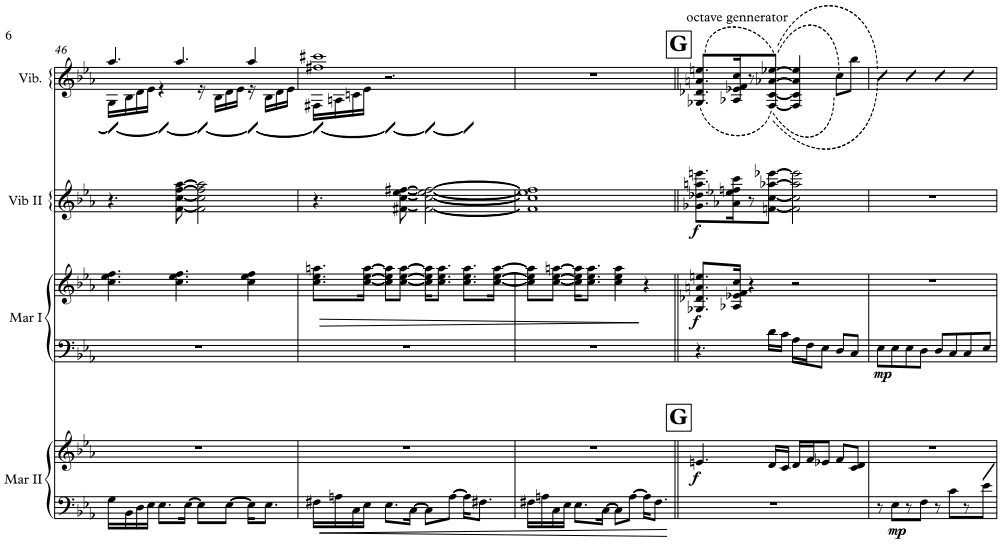
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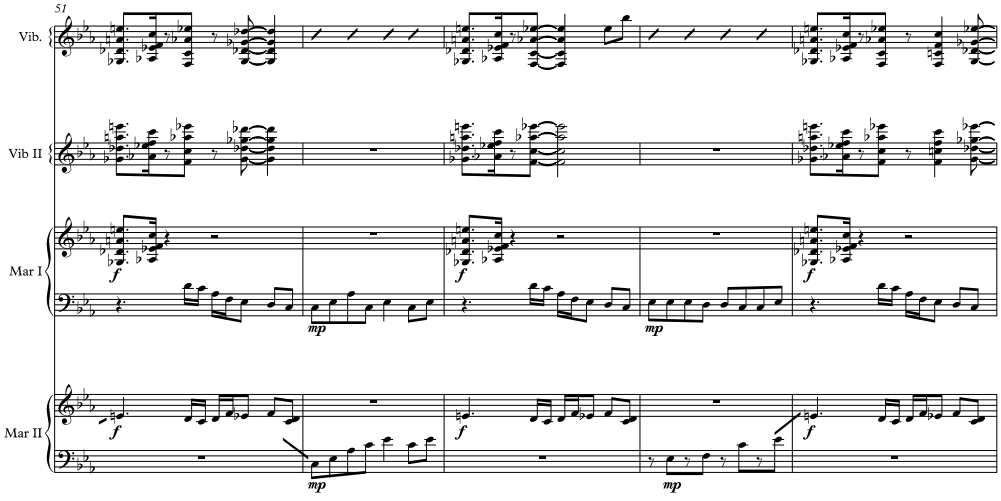
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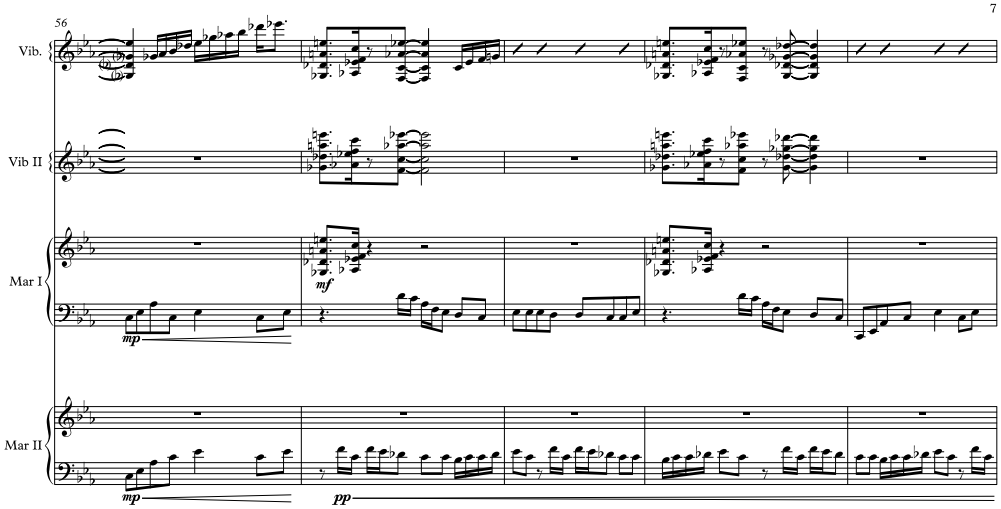
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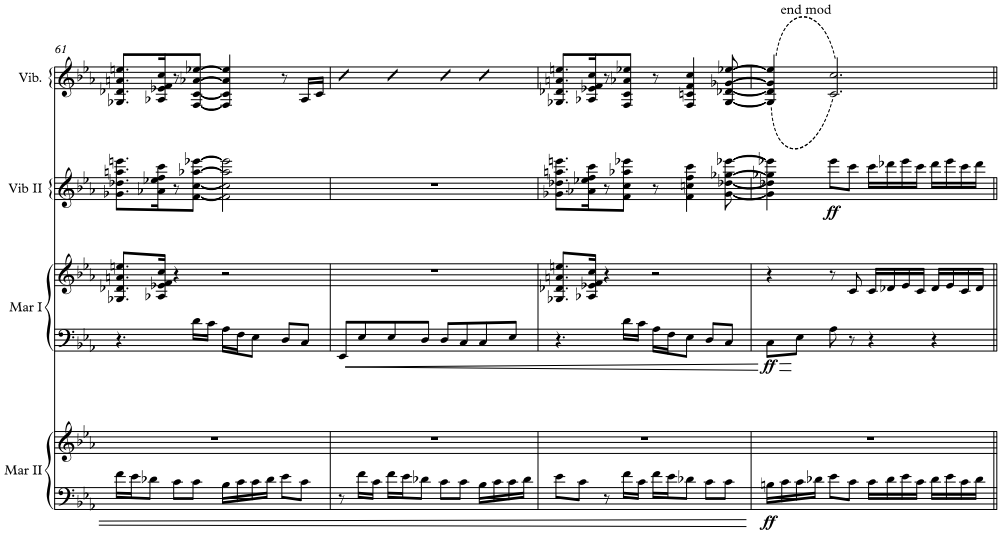
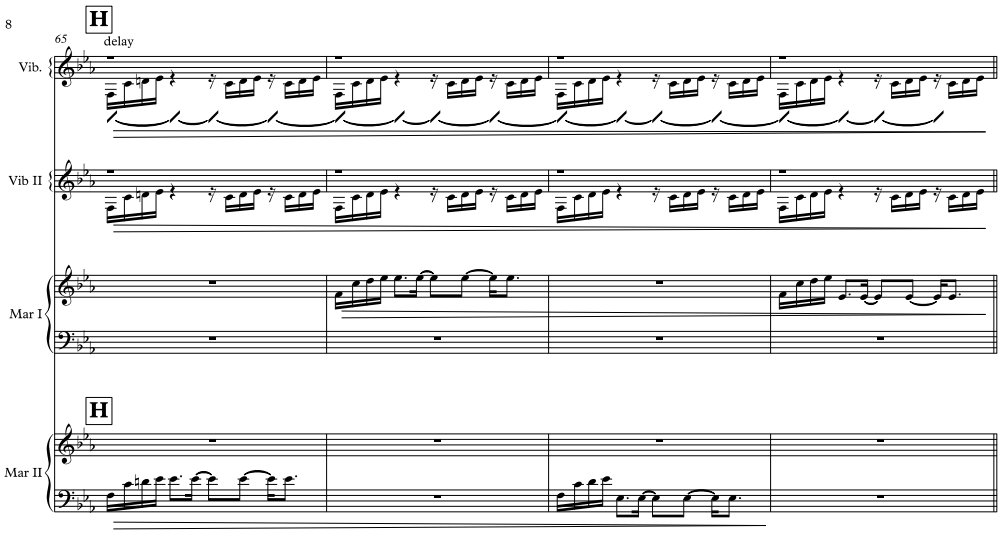
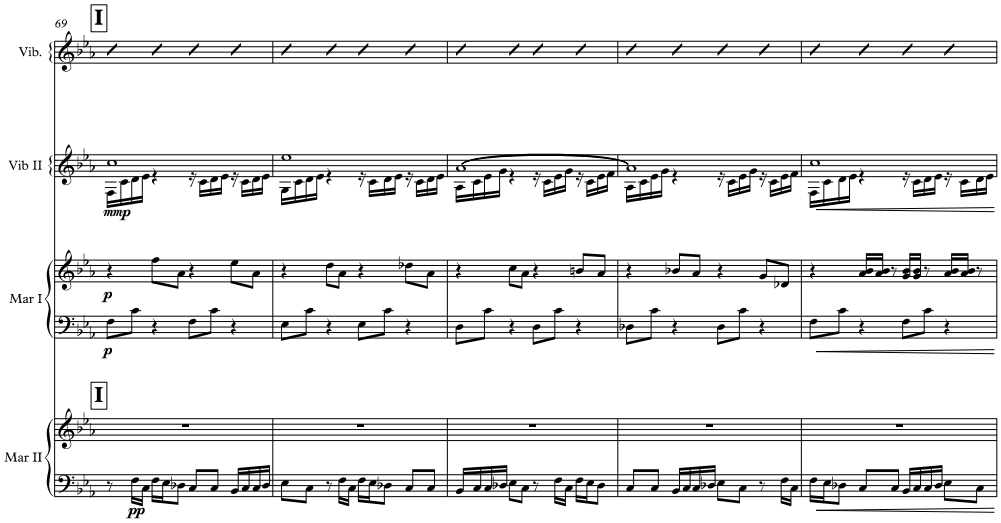
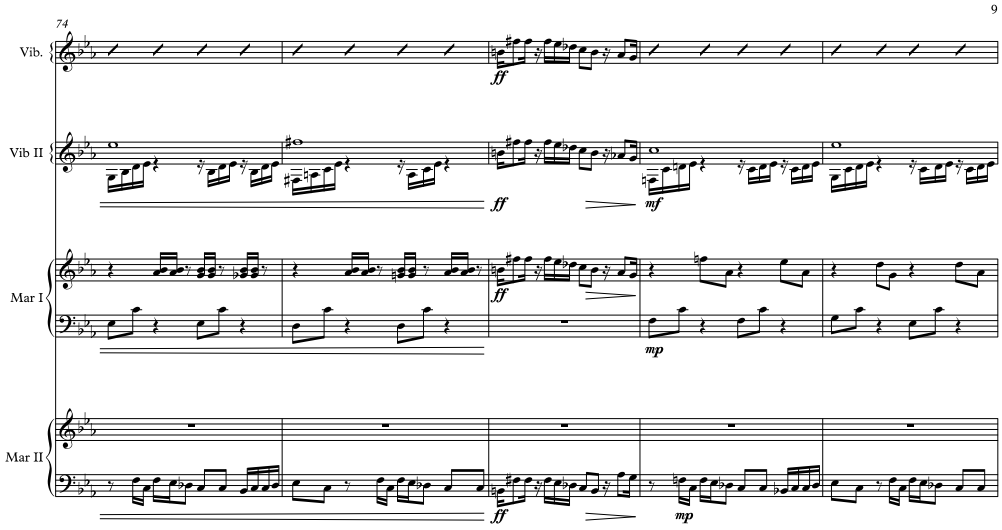
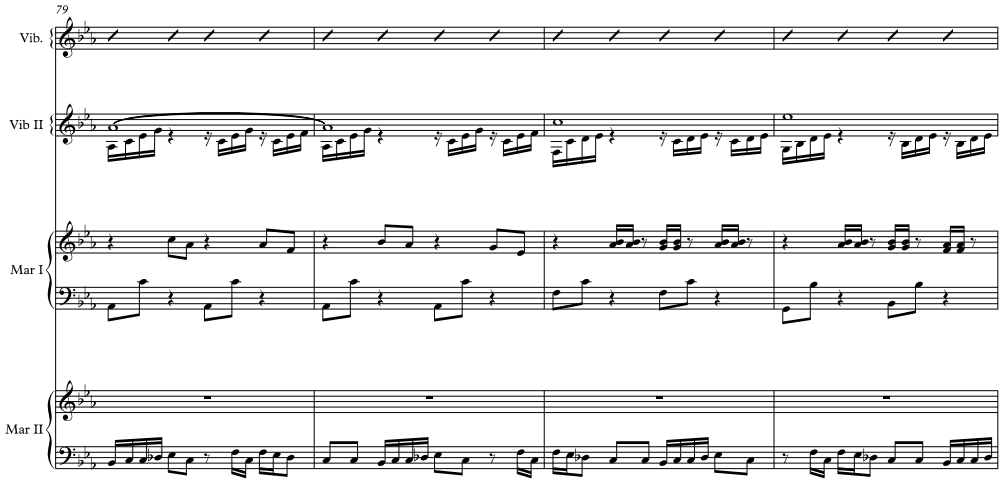
Vib II
Mar I
Mar II
mf
mp
mp
pp

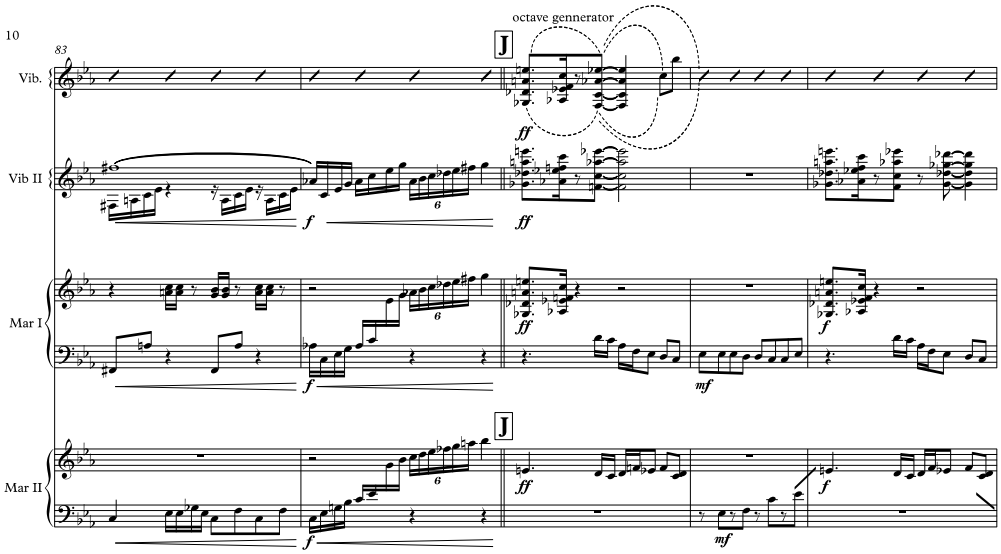

61
end mod
Vib.
Vib II
Mar I
Mar II
ff
ff
ff

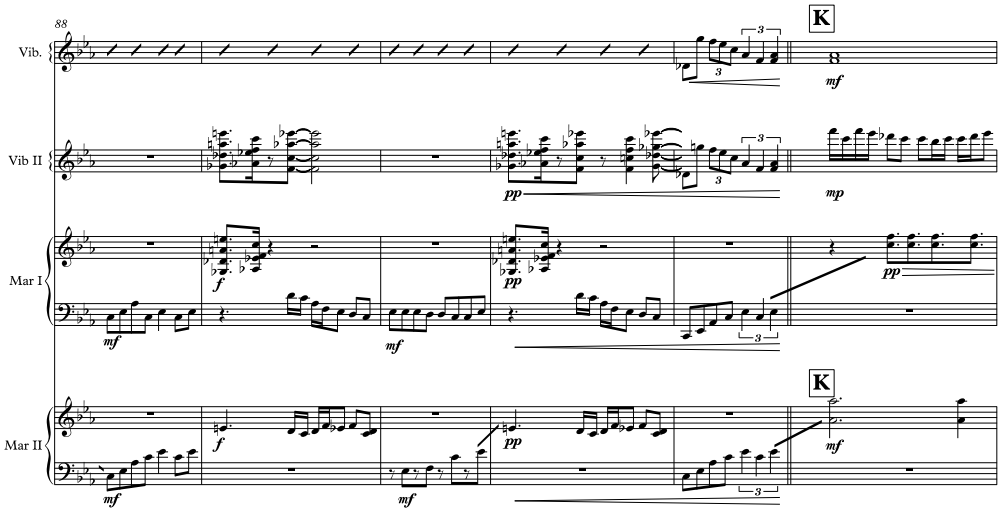

8
65
H
delay
Vib.
Vib II
Mar I
H
Mar II

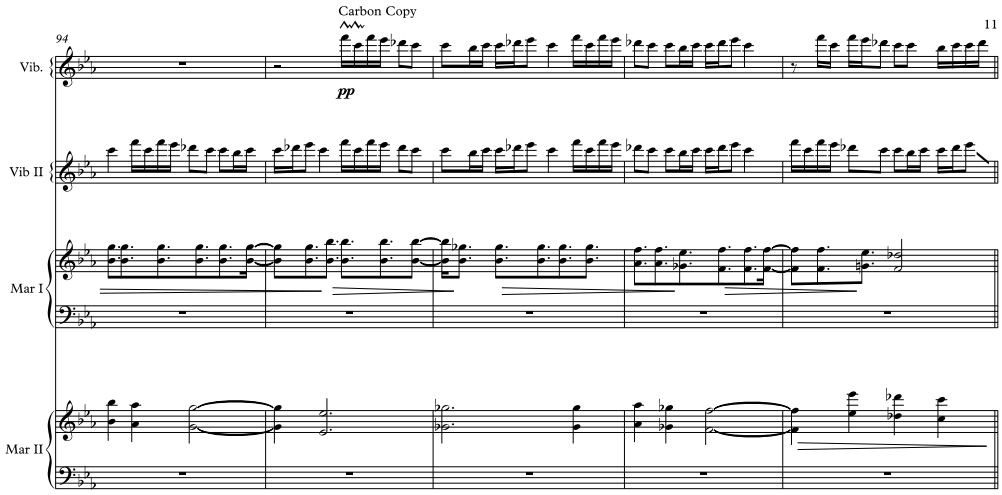

69
I
Vib.
Vib II
mmp
Mar I
p
p
I
Mar II
pp

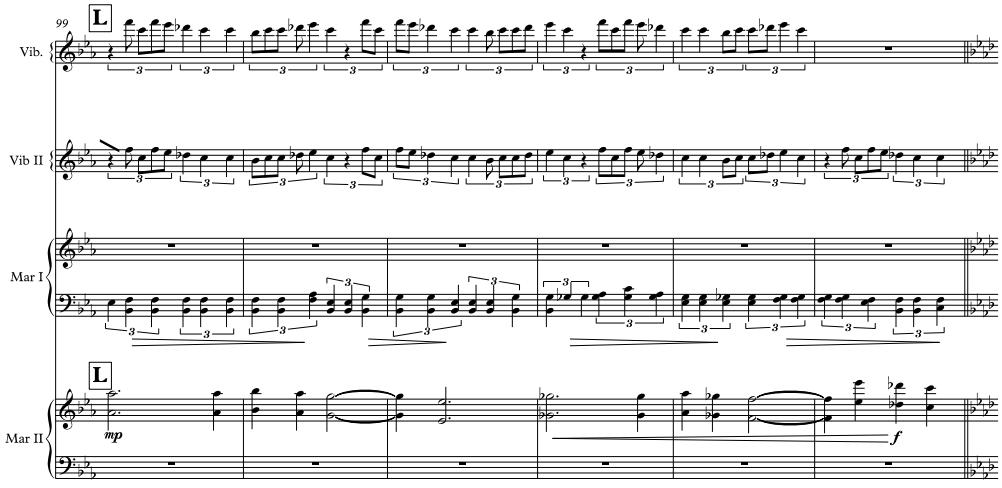

74
Vib.
Vib II
Mar I
Mar II
ff
mf
mp

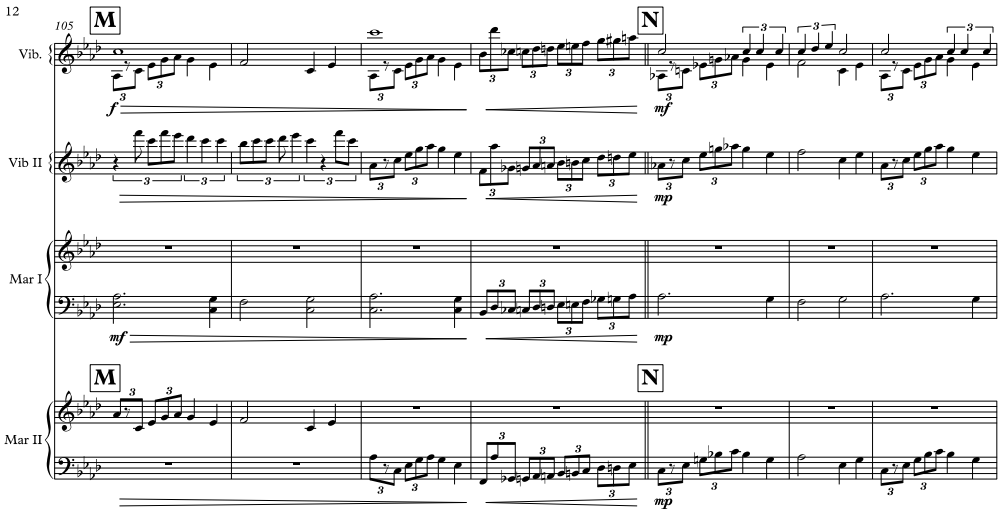

79
Vib.
Vib II
Mar I
Mar II

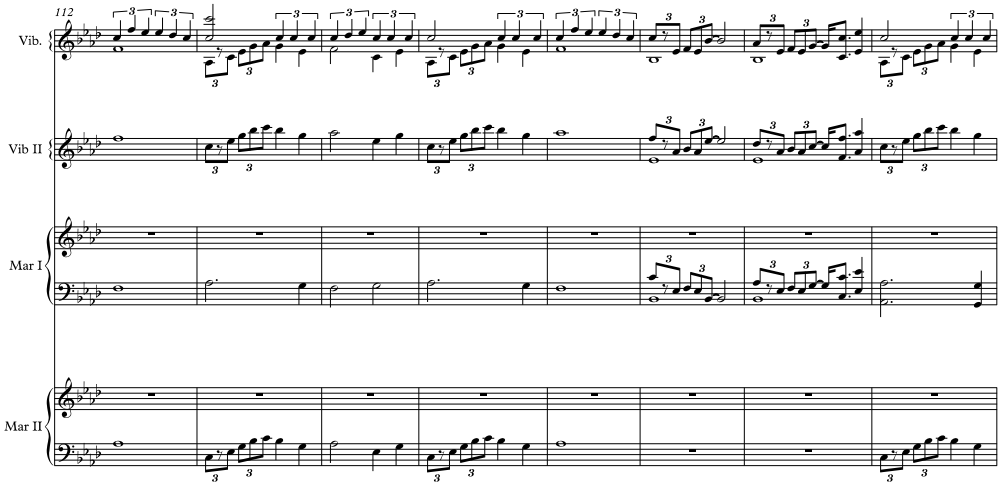

10
83
Vib.
Vib II
Mar I
Mar II
J
octave gennerator
ff
f
mf

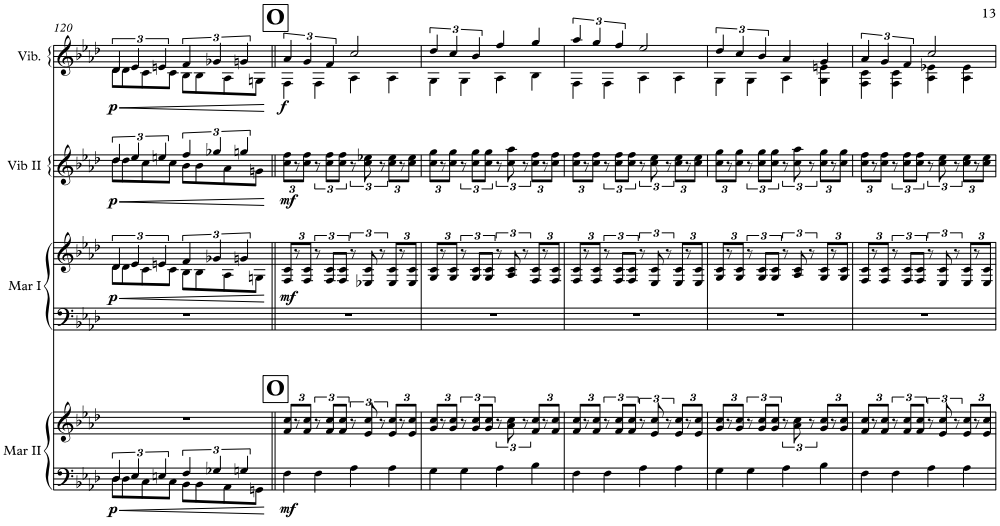

88
Vib.
Vib II
Mar I
Mar II
K
mf
pp
mp
f

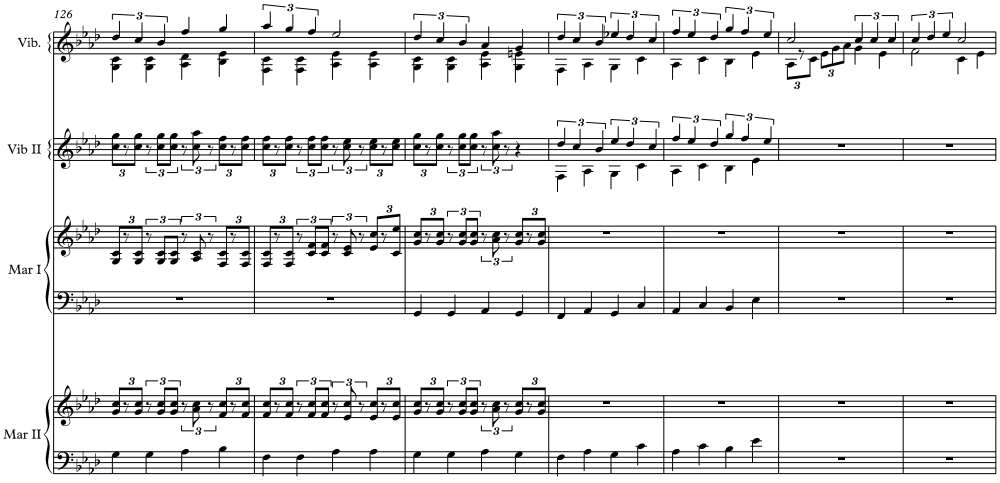

94
Vib.
pp
Vib II
Mar I
Mar II

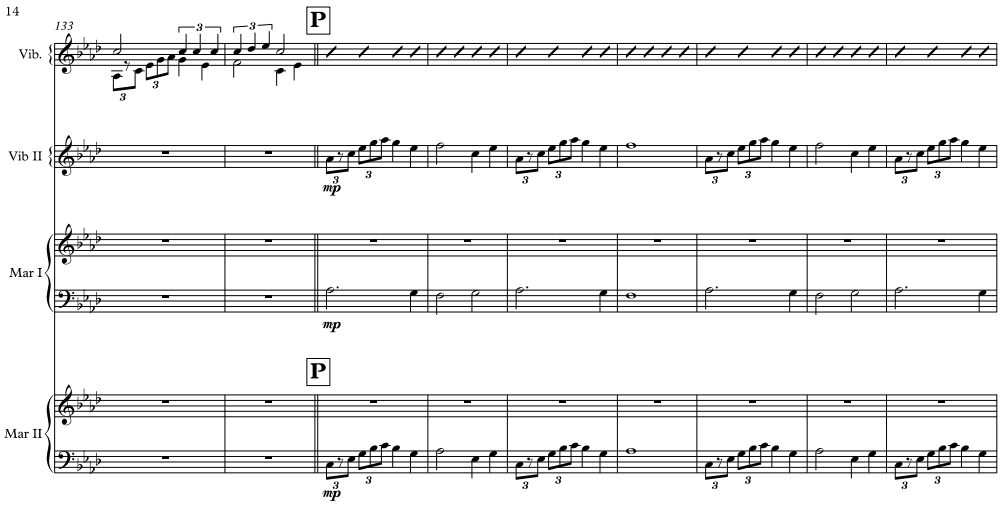

99
L
Vib.
Vib II
Mar I
L
Mar II
mp
f

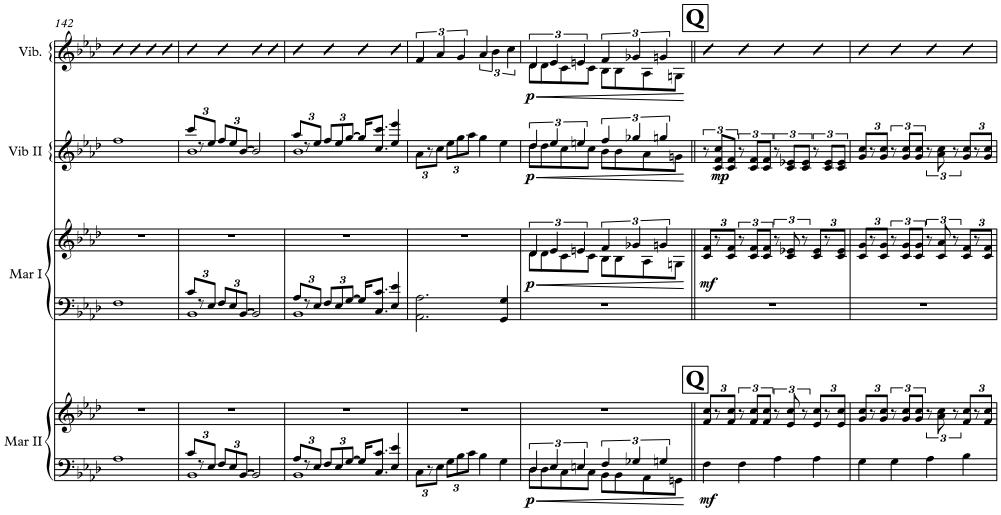

12
105
M
N
Vib.
Vib II
Mar I
Mar II
f
mf
mp

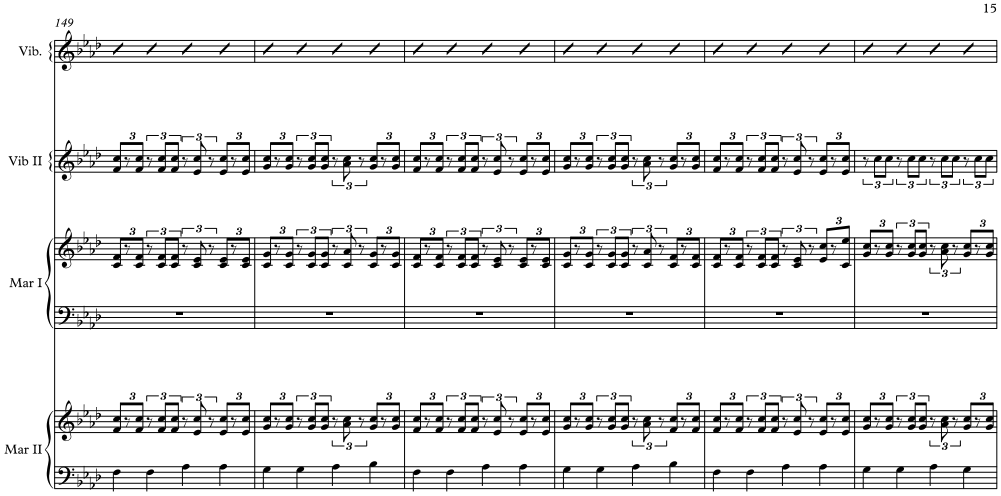

112
Vib.
Vib II
Mar I
Mar II

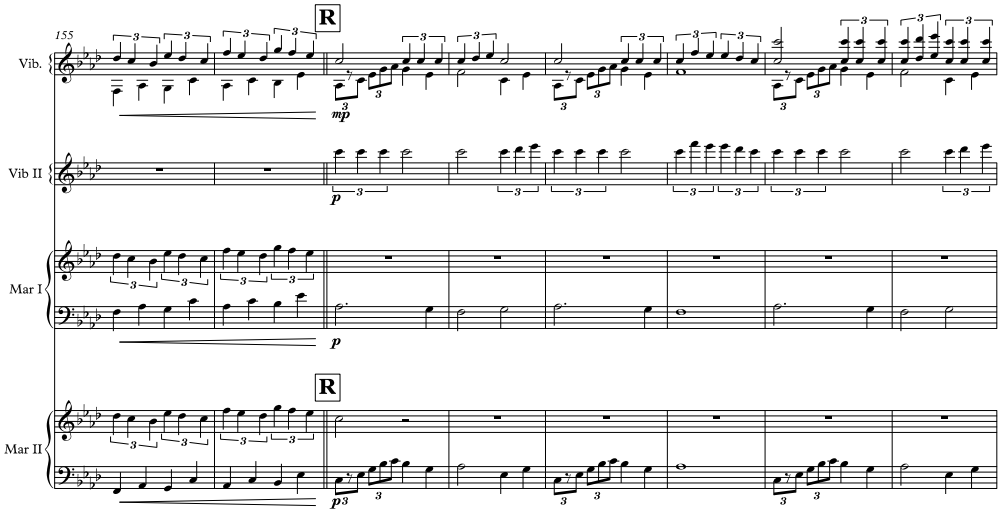

13
120
O
Vib.
Vib II
Mar I
Mar II
p
f
mf

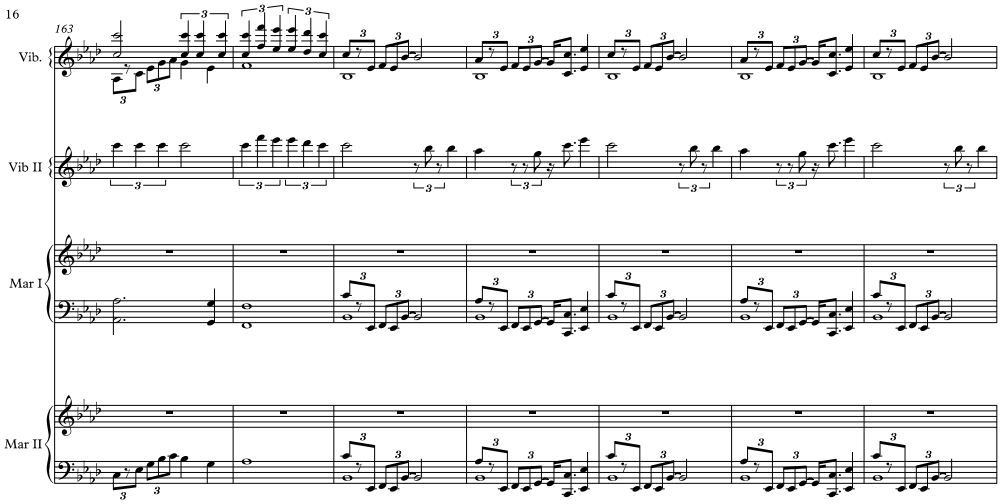

126
Vib.
Vib II
Mar I
Mar II

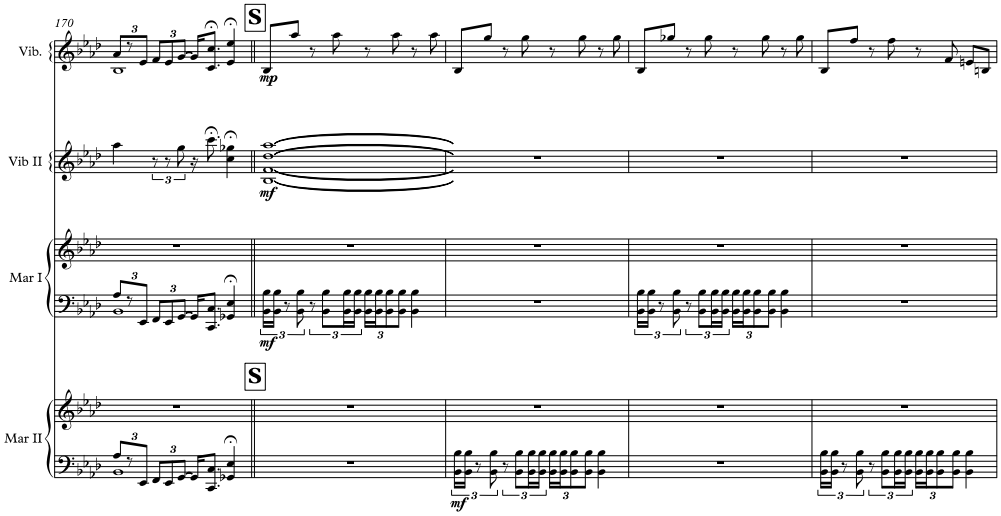

14
133
Vib.
Vib II
Mar I
Mar II
P
P
mp
mp
mp

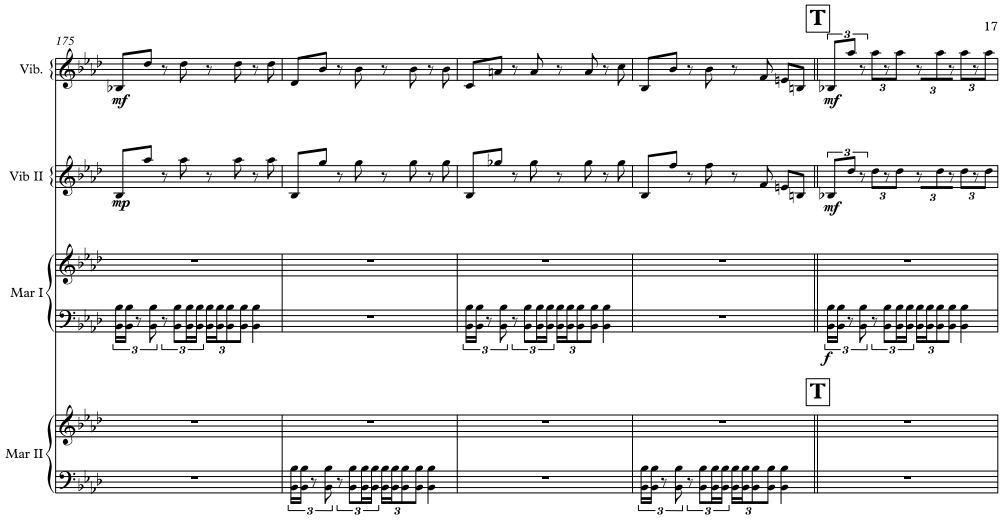

142
Vib.
Vib II
Mar I
Mar II
Q
Q
p
p
p
mp
mf
mf

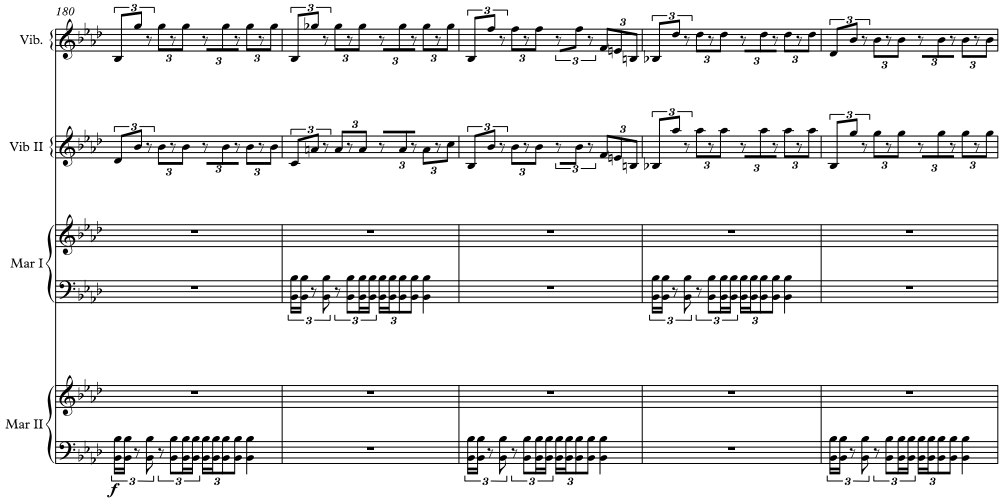

149
Vib.
Vib II
Mar I
Mar II

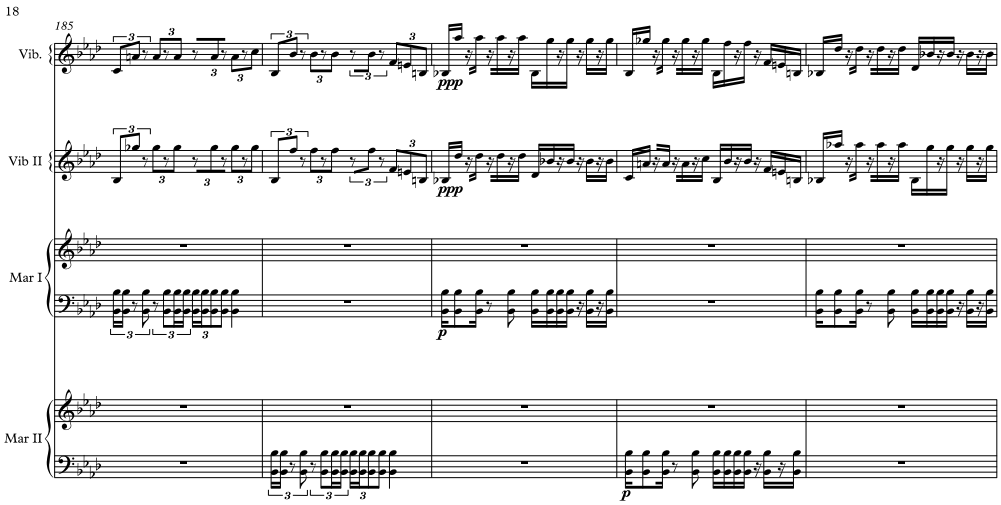

155
R
mp
p
p
R
p3
Vib.
Vib II
Mar I
Mar II

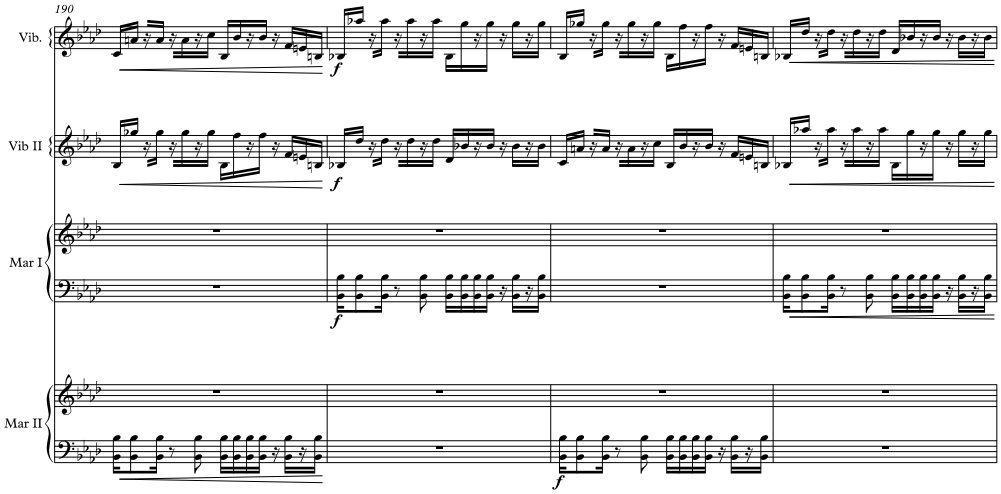

16
163
Vib.
Vib II
Mar I
Mar II

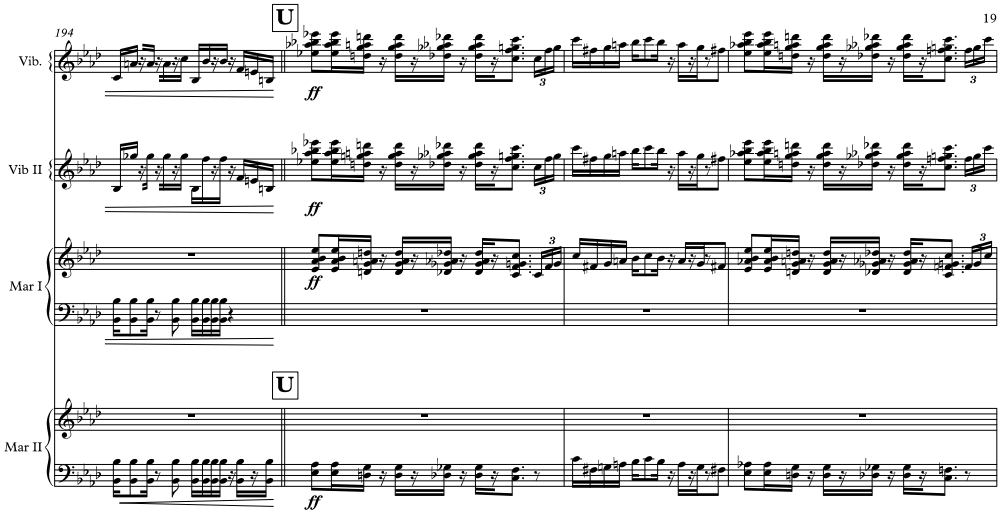

170
Vib.
S
mp
Vib II
mf
Mar I
mf
S
Mar II
mf

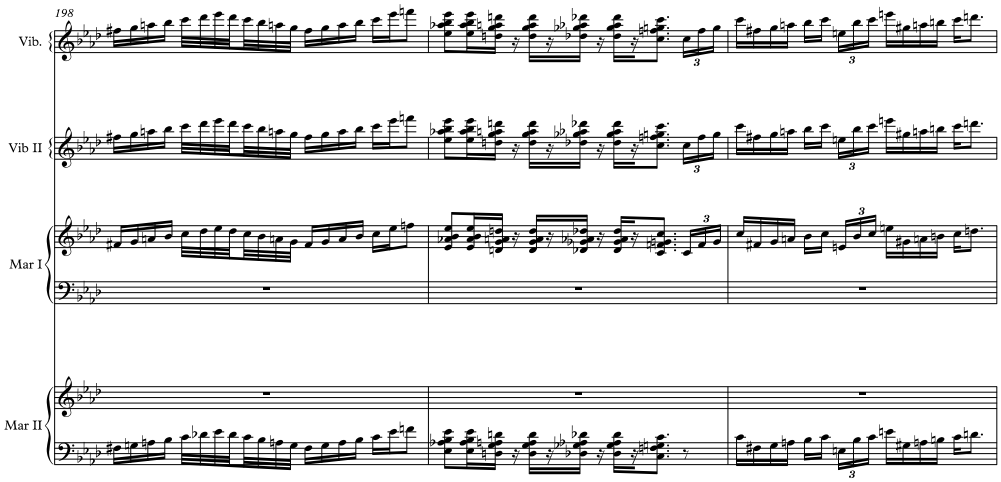

175
17
T
Vib.
Vib II
Mar I
Mar II
mf
mp
f

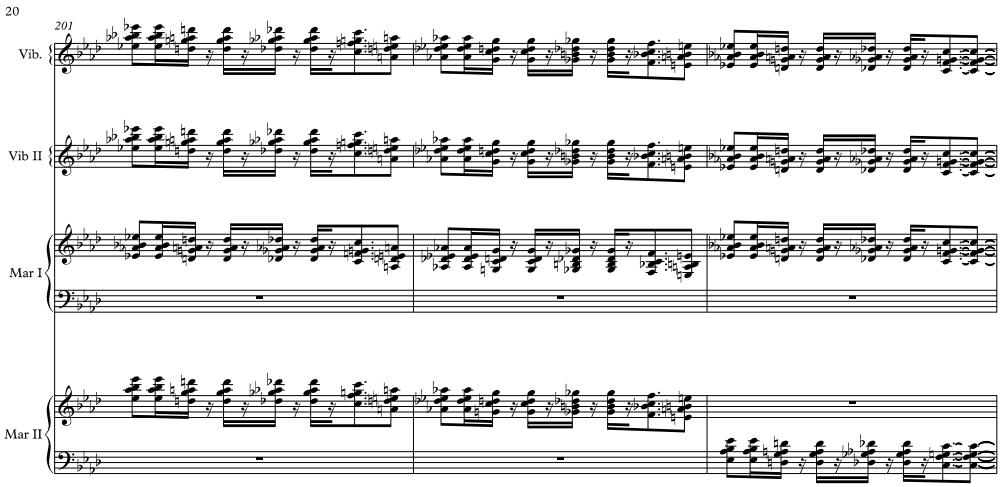

180
Vib.
Vib II
Mar I
Mar II
f

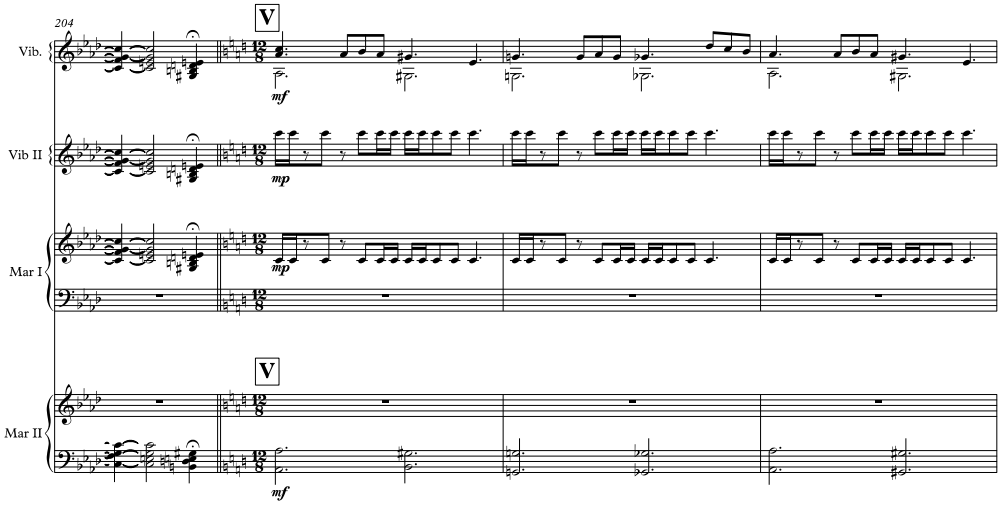

18
185
Vib.
Vib II
Mar I
Mar II
ppp
ppp
p
p

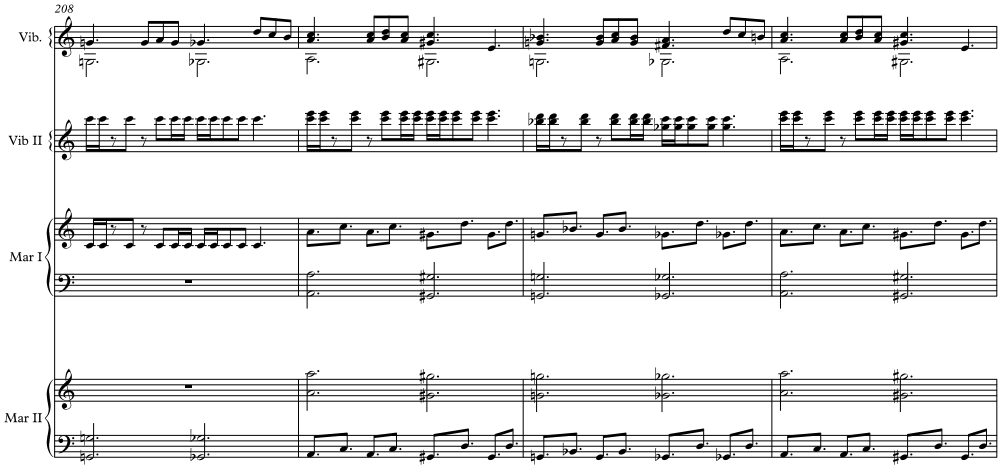

190
Vib.
Vib II
Mar I
Mar II
f
f
f
f

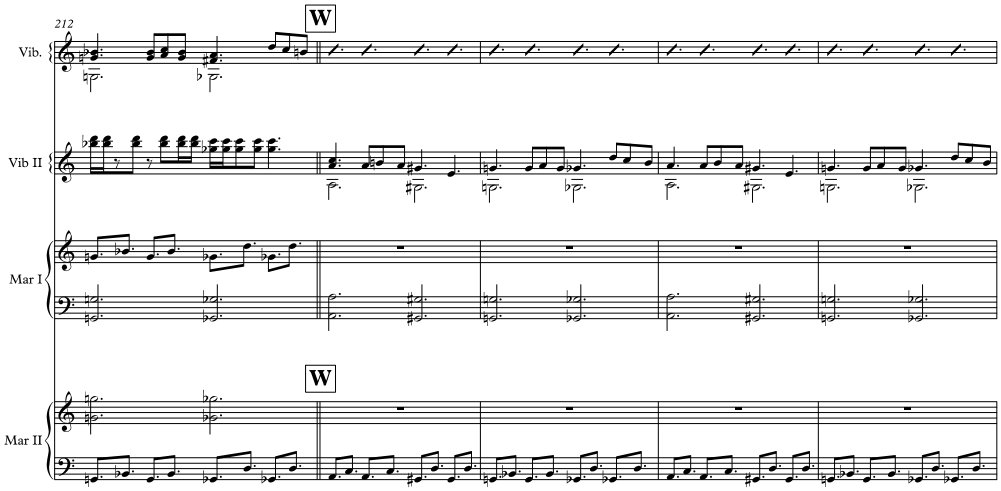

194
19
U
Vib.
Vib II
Mar I
Mar II
U
ff
ff
ff
ff

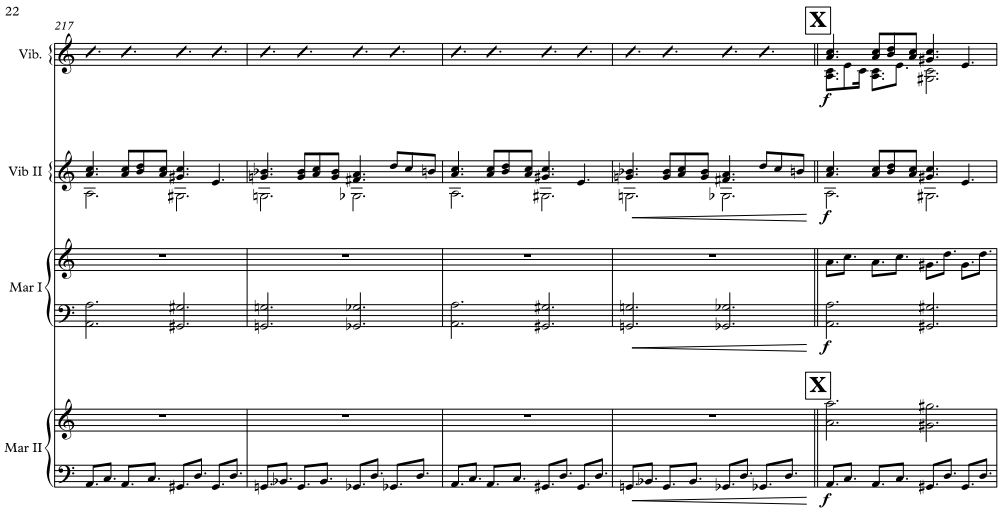

198
Vib.
Vib II
Mar I
Mar II

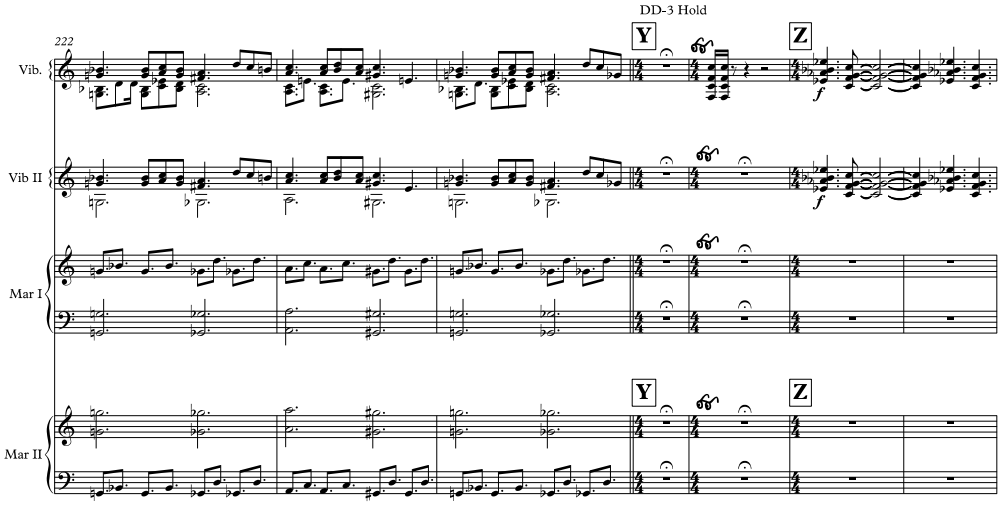

20
201
Vib.
Vib II
Mar I
Mar II

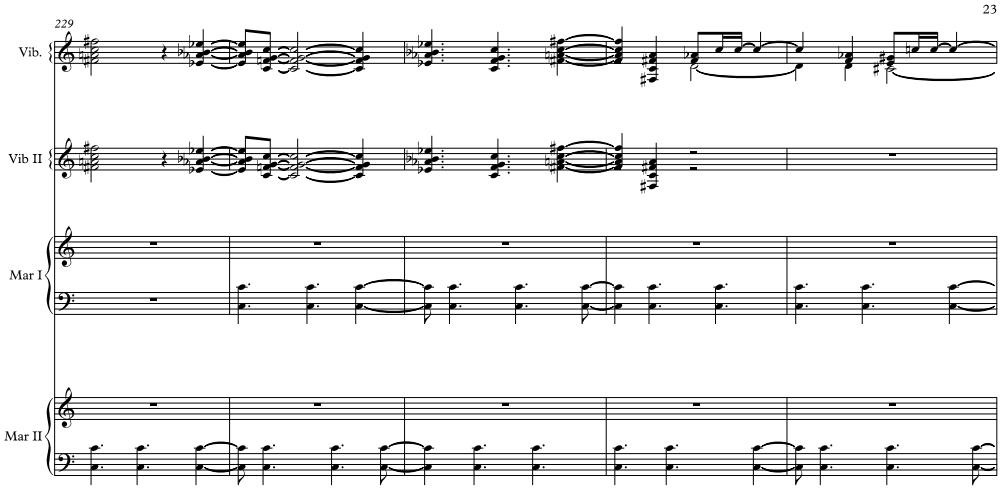

204
Vib.
Vib II
Mar I
Mar II
V
V
mf
mp
mp
mf

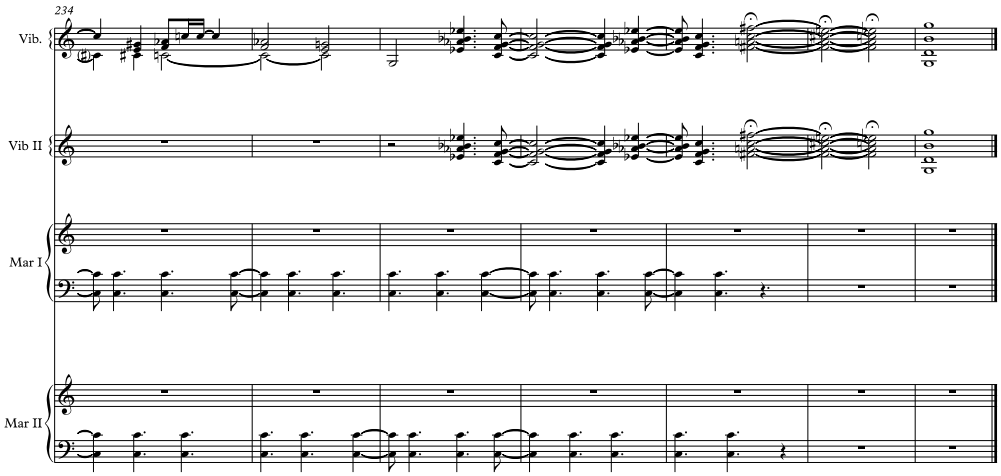

208
Vib.
Vib II
Mar I
Mar II


212
W
Vib.
Vib II
Mar I
W
Mar II


22
217
Vib.
Vib II
Mar I
Mar II
X
X
f
f
f
f


222
DD-3 Hold
Vib.
Vib II
Mar I
Mar II
Y
Z
Y
Z
f
f


229
Vib.
Vib II
Mar I
Mar II


234
Vib.
Vib II
Mar I
Mar II

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