TEMPORALITY AND RHYTHMIC STRUCTURE IN *THIRTEEN DRUMS*

BY MAKI ISHII AND *REBOND A* BY IANNIS XENAKIS

Yi-Jan Liu, B.M., M.M.

Dissertation Prepared for the Degree of

DOCTOR OF MUSICAL ARTS

UNIVERSITY OF NORTH TEXAS

August 2014

APPROVED:

Mark Ford, Major Professor
Daniel Arthurs, Committee Member
Christopher Deane, Committee Member
John Holt, Chair of the Division of
  Instrumental Studies
Benjamin Brand, Director of Graduate Studies
  of the College of Music
James Scott, Dean of the College of Music
Mark Wardell, Dean of the Toulouse Graduate School

This dissertation will focus on the concepts of musical time of two solo multiple-percussion compositions, *Thirteen Drums* (1985) by Maki Ishii and *Rebond A* (1987-1989) by Iannis Xenakis. The aesthetic experience of musical works is tied to the perception of musical time. Performers have to understand the concepts and methods of construction of musical time in order to interpreting composer’s works.

The model of cognitive process in neuroscience of music and the information processing theory from cognitive psychology is provided to explain the perception of musical time and its importance to the aesthetic experience of music. The rhythmic structure, which is essential in temporal structure to the perception of musical time, is examined in depth to show its significant influence on the aesthetic experience in both works. Rhythmic tension will also affect the aesthetic experience.
ACKNOWLEDGEMENTS

The process of working on this dissertation has been challenging, but at the end, this experience has been rewarding and priceless. I would not have succeeded without the help of many people. I would like to thank my committee members: Professor Mark Ford, Dr. Daniel Arthurs, and Professor Christopher Deane, who have given me valuable advice and support on this dissertation.

It has been a long and incredible journey studying in the United States. I would like to thank the professors with whom I have studied who have helped me become a better musician and prepared me for my future. I would like to thank my major professor Mark Ford and Professor Christopher Deane who have taught me great deal about percussion and have also served as my mentors for life. I would also like to thank Dr. Graham Phipps whose enthusiasm and lectures in music theory have inspired my interests in that area.

I thank my family in Taiwan and all my friends; your support has been my biggest motivation and comfort. In the journey of pursuing my dream, I could not have made it this far if not for you.

Finally, I thank my mother and brother for their selfless love and endless support. Because of you, I feel safe and loved. I am proud to be your daughter and sister. Thank you for always being there for me and helping me become who I am today.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF MUSICAL EXAMPLES</td>
<td>vi</td>
</tr>
<tr>
<td>CHAPTER I</td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER II</td>
<td></td>
</tr>
<tr>
<td>MAKI ISHII’S AND IANNIS XENAKIS’S</td>
<td>3</td>
</tr>
<tr>
<td>MUSIC AND CONCEPTS OF MUSICAL TIME</td>
<td></td>
</tr>
<tr>
<td>CHAPTER III</td>
<td></td>
</tr>
<tr>
<td>THE PERCEPTION OF MUSICAL TIME AND IMPORTANCE OF RHYTHM STRUCTURE TO</td>
<td>14</td>
</tr>
<tr>
<td>AESTHETIC EXPERIENCE</td>
<td></td>
</tr>
<tr>
<td>CHAPTER IV</td>
<td></td>
</tr>
<tr>
<td>THE CHARACTERISTICS OF RHYTHMIC STRUCTURE TO THE AESTHETIC EXPERIENCE</td>
<td>28</td>
</tr>
<tr>
<td>IN <em>THIRTEEN DRUMS</em> AND <em>REBOND A</em></td>
<td></td>
</tr>
<tr>
<td>CHAPTER V</td>
<td></td>
</tr>
<tr>
<td>ANALYSIS OF TEMPORALITY IN THE RHYTHMIC STRUCTURE OF</td>
<td>44</td>
</tr>
<tr>
<td><em>THIRTEEN DRUMS</em></td>
<td></td>
</tr>
<tr>
<td>CHAPTER VI</td>
<td></td>
</tr>
<tr>
<td>ANALYSIS OF TEMPORALITY IN THE RHYTHMIC STRUCTURE OF</td>
<td>70</td>
</tr>
<tr>
<td><em>REBOND A</em></td>
<td></td>
</tr>
<tr>
<td>CHAPTER VII</td>
<td></td>
</tr>
<tr>
<td>CONCLUSION</td>
<td>92</td>
</tr>
<tr>
<td>APPENDIX</td>
<td></td>
</tr>
<tr>
<td>ERRATA IN THE SCORE OF <em>THIRTEEN DRUMS</em> PUBLISHED IN 1986</td>
<td>95</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>97</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Page</th>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>5-1</td>
<td>Thirteen Drums, formal structure</td>
</tr>
<tr>
<td>5-2</td>
<td>5-2</td>
<td>Thirteen Drums, sectional structure from [page 6, line 2] to [page 9, line 2]</td>
</tr>
<tr>
<td>6-1</td>
<td>6-1</td>
<td>Rebond A, formal structure</td>
</tr>
</tbody>
</table>
LIST OF MUSICAL EXAMPLES

All musical examples are reproduced with permission from the Hal Leonard MGB Srl.

<table>
<thead>
<tr>
<th>Page</th>
<th>Example</th>
<th>Details</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1a</td>
<td>Thirteen Drums, instrumentation</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>4-1b</td>
<td>Rebond A, instrumentation</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>4-2</td>
<td>Psappha, 1430-1470</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>4-3a</td>
<td>Rebond A, mm. 15-18</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>4-3b</td>
<td>Rebond A, mm. 21-22</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>4-4</td>
<td>Thirteen Drums, the rhythmic scheme</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>4-5</td>
<td>Thirteen Drums, page 3, line 2</td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>4-6</td>
<td>Thirteen Drums, page 4, from line 2 to line 3</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>4-7a</td>
<td>Rebonds A, mm. 1-6</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>4-7b</td>
<td>Rebonds A, mm. 51-60</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>4-8</td>
<td>Thirteen Drums, page 7</td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>4-9a</td>
<td>Rebond A, mm.1-3</td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>4-9b</td>
<td>Rebond A, mm. 34-38</td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>4-9c</td>
<td>Rebond A, mm. 48-50</td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>4-10a</td>
<td>Rebond A, ratios of subdivisions</td>
<td></td>
<td>42</td>
</tr>
<tr>
<td>4-10b</td>
<td>Rebond A, ratios of polyrhythms</td>
<td></td>
<td>42</td>
</tr>
<tr>
<td>5-1</td>
<td>Thirteen Drums, the rhythmic scheme</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>5-2</td>
<td>Thirteen Drums, [L1 P1] ~ [4/4 L11 P4]</td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>5-4</td>
<td>Thirteen Drums, [3/4 L12 P4] ~ [1/4 L13 P5]</td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>5-5</td>
<td>Thirteen Drums, [1/4 L14 P5] ~ [1/4 La5 P5]</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>5-7</td>
<td>Thirteen Drums, [4/4 L26 P9] ~ [2/4 L30 P10]</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>5-8</td>
<td>Thirteen Drums, [2/4 L30 P10] ~ [L37 P13]</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>Thirteen Drums, formation of the variation technique</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>6-1</td>
<td>Rebond A, beats 1-3 in m.1</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>6-2</td>
<td>Rebond A, mm. 1-6</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>6-3</td>
<td>Rebond A, mm. 4-16</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>6-4</td>
<td>Rebond A, mm. 15-19</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>6-5</td>
<td>Rebond A, mm. 19-25</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>6-6</td>
<td>Rebond A, mm. 25-28</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>6-7</td>
<td>Rebond A, mm. 29-36</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>6-8</td>
<td>Rebond A, m. 41</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>6-9</td>
<td>Rebond A, mm. 36-43</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>6-10</td>
<td>Rebond A, mm. 43-49</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>6-11</td>
<td>Rebond A, mm. 49-52</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>6-12</td>
<td>Rebond A, mm. 51-60</td>
<td>87</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

Maki Ishii (1936-2003) and Iannis Xenakis (1922-2001) were important composers of contemporary music in the twentieth century and had significant influence over percussion literature. Both composers had distinct musical styles that were primarily identified by their use of innovative compositional techniques. In order to appreciate and perform their compositions, it is necessary to examine their concepts of musical time as it relates to structure and aesthetic perception. This dissertation focuses on two solo multiple-percussion compositions, *Thirteen Drums* (1985) by Maki Ishii and *Rebond A* (1987-1989) by Iannis Xenakis.

When learning the repertoire of contemporary music, especially the ones considered as avant-garde or modern works, often performers encounter problems of interpretation due to the musical complexity in these works. If performers do not understand a composer’s intention (or meaning) and the compositional concept of the work, it is likely that the performance will be doubtful, inauthentic, or misleading. For listeners, contemporary music is already difficult to comprehend. If the performance is misinterpreted, listeners will be confused and have the inaccurate impression of the work as well as the composer.

Percussionists have more opportunities to be in this situation since much percussion music is contemporary and modern. Performers have to understand the concepts and methods of construction of musical time in order to understand contemporary percussion music. This is important and helpful to professional artists and students interpreting composer’s works. The performances will be more convincing and closer to the composer’s concept. At the same time, listeners will know the composer better and will have an authentic concept of the work; therefore,
they will have a better appreciation of contemporary percussion music.

This dissertation starts with biographical information of Ishii and Xenakis. A brief introduction to their music styles and concept of musical time is also provided. Following that is the discussion on the perception of musical time and its importance to the aesthetic experience of music by using the model of cognitive process in neuroscience of music and the information processing theory from cognitive psychology. The rhythmic structure, which is essential in temporal structure to the perception of musical time, is examined in depth to show its significant influence on the aesthetic experience. Detailed temporal discussion on *Thirteen Drums* and *Rebond A* is represented respectively in separate chapters.

*Thirteen Drums* and *Rebonds* are performed regularly in the modern classical percussion repertoire. These two works provide a great opportunity to present concepts relating to the perception of musical time from each composer. By presenting this dissertation, I hope to give insightful information to performers and listeners alike in order to help them appreciate the value of these works and their contributions to the world. I also hope to encourage additional research on musical time in contemporary percussion music.
Maki Ishii and Iannis Xenakis are important composers of contemporary music and have significant influence on percussion music. Both composers’ compositions for percussion are also representative and influential especially to the genre of multiple-percussion. Although Ishii and Xenakis received western musical education, including the twelve-tone technique, they were not satisfied with the music of their age, so both turned to seek their ideal music within their respective cultural backgrounds. Their ethnic heritages (Ishii was a native of Japan and Xenaxis was Greek), played an essential part in their music.

Biographies and Music Styles

Maki Ishii

Maki Ishii (1936-2003) is an important Japanese composer of avant-garde music. Born in Tokyo in 1936, Ishii started his music training with conducting and composition, and also on the violin and piano in 1948. In 1958, Ishii went to Berlin, Germany and studied music at the Hochschule für Musik under Josef Rufer (twelve-tone technique), Boris Blacher (free composition), Ernst Pepping (counterpoint), and Heinz Friedrich Harting (harmony). In 1962, he returned to Japan and had his debut concert in Tokyo. Invited by the Deutscher Akademischer Austauschdienst (German Academic Exchange Service, DAAD), Ishii went back

---

3 Ibid..
4 Ibid..
to Germany in 1969 and participated in the Artists in Residence Program (Berliner Künstlerprogramm). Since then, Ishii became an active conductor and composer in Japan and Germany as well as an organizer for various festivals. His works have been performed in many countries.

Upon his return to Japan when he completed his studies, Ishii devoted his time to finding a way to combine the sounds of the East and the West together and finally generated his own voice, which he called a “third image.” In the process, Ishii preserved the individual essence of Western and Japanese music instead of fusing both styles together that could have marred each style’s identity.

Ishii’s father, Bac Ishii, was a famous Japanese dance teacher and introduced modern dance to Japan. Through his father, Maki was enculturated in traditional Japanese music since his childhood. Japanese traditional music such as gagaku, heike-biwa, shakubachi and the chant (shōmyō) from Japanese Buddhist ceremonies also had a significant influence in Ishii’s works. He used the compositional techniques from Western music and incorporated the elements of Japanese music to create works such as Kyō-Sō (1968-1969). Ishii was also fond of traditional Japanese instruments. He composed works that utilized both Japanese instruments, such as shakuhachi and koto, and Western instruments. Representative works are Sō-Gu I for shakuhachi and piano (1970), Sō-Gu II for gagaku and orchestra (1971), and Mono-Prism for Japanese drums and orchestra (1976).

---

5 Ibid., 244.
Iannis Xenakis

Iannis Xenakis was a composer of avant-garde music and also an architect. Born in 1922 in Romania to Greek parents, Xenakis was sent to a boarding school on the Greek island of Spetza at the age of ten and became interested in Greek tragedy and poetry. He returned to Athens when he was seventeen years old and fought as a soldier against Nazi Germany and the Axis forces in World War II from 1939-1947. Immediately after the war in 1947, he attended Athens Polytechnic and earned an engineering degree. That same year, he went to Paris and continued his music education that he missed during the war. He studied with Arthur Honnegger, Darius Milhaud and Oliver Messian who had a significant impact on him as a composer. While at Paris, he began his research in electro-acoustic music.

In order to earn a living, Xenakis worked as an architect with Le Corbusier from 1947 to 1960. He participated in several projects with Le Corbusier including the design of the Philips Pavilion for the 1958 Brussels Exposition Universelle. Many of the construction’s designs for architecture can be seen in some of Xenakis’s works.

During his lifetime, Xenakis focused on the synthesis of sound. He was interested in the timbre and structure of ancient music (Greek) and Byzantine music (in the domain of ancient Greece) as well as ancient Greek philosophy, all of which had a great influence in his construction of music. Moreover, with his engineering background, Xenakis utilized mathematical theories such as the Golden Mean (Golden Ratio, Golden Section), Fibonacci series, and sieve theory to construct the formal structure in compositions. He also developed a new approach called “stochastic,” a theory of probability to control the sound masses and to

---

7 The information of Iannis Xenakis’s biography is from several sources: entry of “Iannis Xenakis” on Grove Music Online; James Harley, Xenakis: His Life in Music; Mario Bois, Iannis Xenakis: the Man and His Music; Nouritza Matossian, Iannis Xenakis.

8 Interestingly, many of his compositions are in Greek titles.

**Concepts of Musical Time**

Music is defined as a chronological art form. Jonathan Kramer stated in his book *The Time of Music*, “Music becomes meaningful in and through time.” Time in music (musical time) is perceived through the construction of musical elements such as pitch, rhythm, melody, harmony, etc..., in a temporal arrangement that is the structure of music. The manipulation of structure creates the perception of musical time in a piece. Composers in the twentieth century tried to move away from established forms in Western music and looked for new ways to construct the formal structure. As unique composers, Ishii and Xenakis both developed distinct languages to express their ideal of musical time.

Scholars often refer to Ishii’s presentation of musical time in his works as multi-layers of temporal structure in which different layers of temporal structures, dynamic and static, are simultaneously presented. This time-space concept of Ishii was inspired by the chant of *shōmyō* and *gagaku* performed at the same time and place in a Buddhist temple. The characteristic of static temporal layer is the static sound that is continuous, repetitive, accumulated, less ordered and without directionality. In contrast, dynamic temporal layer is the layer of dynamic sounds

---


11 The trilingual book, *Sounds of West – Sounds of East: Maki Ishii’s Music*, is a collection of essays from seven experts on Ishii’s music from Japan and Germany. In this collection, an article written by Ishii himself talked about his thoughts and techniques, his awakening as a Japanese composer and his philosophy toward music. In all the articles, an emphasis is especially made on the sounds of Ishii’s music and the aspects of musical time and space influenced by Japanese traditional music.
that offer diversity and directionality. The static sounds/layers are the foundation of Ishii’s musical structure.

The main concept of Ishii’s music is a “temporal space” existing between multi-temporal layers. Therefore, the concept of “time-space” becomes the core of his compositions. The sectional development of Ishii’s music is the process of integrating different temporal layers into a unified space. This structural idea is also inspired by the principle of “jo-ha-kyū (preparation-breaking-rushing)” from the dance of Nō (as performed in Japanese traditional theater).

The idea of dynamic temporal layer or static temporal layer can be used extensively in a section as a horizontal development of musical form. If the characteristics of the dynamic temporal layers are perceived strongly, the form of the section is “dramatic form.” In dramatic form, the music is “less stratified or becomes uniformed, the whole moving uni-directionally.” In the static section, it is Japanese static time that no sense of meter or pulse is perceived and it may be thought as “a timeless, spatial concept.” Ishii’s formal structure is based on the alternation of sections in different temporalities. Moreover, at the end of the piece, a section of united temporalities with high intensity concludes Ishii’s music. This stylistic structural closure is also inspired by his experience at a Buddhist temple where he heard different types of music taking place at the same time. The stylistic structural closure was also inspired by the

---

14 Sano, 89.
15 Ibid., 91.
16 Ibid.
17 Ibid.
increasing acoustic density caused by both shōmyō and gagaku.\textsuperscript{18}

In Xenakis’s opinion, aesthetics of music is closely linked to philosophy and humanity. He was more concerned about the “abstract nature” of music itself.\textsuperscript{19} Xenakis had claimed that “To make music means to express human intelligence by sonic means.”\textsuperscript{20} The techniques used in the construction of music had to be able to express humanity (logical or illogical). Therefore, Xenakis was against traditionally established systems such as functional harmony, twelve-tone technique and all forms of structure. He used his knowledge of mathematics and science, subjects he thought were closely related to the philosophy of ancient Greece and to the universe, to construct his music.

Xenakis approached musical time in a different way than that in psychological comprehension and the aural perception of in-time and out-of-time.\textsuperscript{21} He proclaimed the construction of music is based on three aspects. The first part is the decision of the sonic events based on the pitch, intensity and duration. The sonic events in this stage are independent of the procession of time. They are of “structure outside-time.” The second aspect is the “temporal structure.” Any temporal scheme that has a sense of ordering, including structural designs and the mathematical formulas, is still considered as outside-time. The third aspect is that the sonic events of the first aspect are arranged in a “one-on-one” correspondent to the temporal structure (the second aspect). This is called the “structure in-time.”\textsuperscript{22}

He also related the concept of time to that of space and thought of time as a spatial


\textsuperscript{20} Xenakis, \textit{Formalized Music}, 178.


\textsuperscript{22} Xenakis, \textit{Formalized Music}, 160-161.
concept that musical space was equal to “the area of a sheet of paper of a blackboard.”\textsuperscript{23} He did not think time as being only one-dimensional (i.e., linear), but neither did he think of it as three-dimensional. For him, musical space was “multi-dimensional.”\textsuperscript{24} Thus Xenakis spatialized musical time. Once the decision of the outside-time entities were made and arranged according to a temporal structure, time was then “countable” (i.e., with integers). Therefore, time could be visualized as “points of a line and could be notated.\textsuperscript{25}

Works for Percussion

Ishii thought that the potential of percussion instruments in Western music during his time was not fully developed. To that effect, Ishii explored the novelty of sound quality in percussion like his contemporaries and also focused on "control over rhythm." The construction of rhythmic structure became essential for percussion in such a way that made it possible for a performer to play and for the listener to perceive.\textsuperscript{26}

Ishii used percussion instruments, including non-western instruments, in his works of chamber, orchestra, percussion ensemble and solo.\textsuperscript{27} He was especially fond of Japanese traditional drumming and had invented new techniques for it. Ishii wrote several works for famous Japanese Taiko-drum groups: \textit{Monochrome} (1976), \textit{Mono-Prism} (1976), \textit{Dyu-Ha} (1981), \textit{Mono-Prism II} (1985).


\begin{footnotesize}
\begin{enumerate}
\item\textsuperscript{23} Ibid., 173.
\item\textsuperscript{24} Bois, 13.
\item\textsuperscript{25} Iannis Xenakis and Roberta Brown, “Concerning Time,” \textit{Perspectives of New Music} 27, no. 1 (Winter, 1989), 89.
\item\textsuperscript{26} Ishii, 55.
\item\textsuperscript{27} Here percussion instruments refer to non-melodic (non-define pitched) instruments.
\item\textsuperscript{28} \textit{For Lily} is an arrangement from \textit{Thirteen Drums} for percussion solo and percussion ensemble with marimba.
\end{enumerate}
\end{footnotesize}
Xenakis, like Ishii, was fond of percussion and wrote many works for percussion instruments, including non-western instruments, alone or with other instruments in different genres such as chamber, orchestra and percussion ensemble. He composed five works using percussion instruments only. *Persephassa* (1969) and *Pléïades* (1979) are for percussion sextet and were commissioned and premiered by the famous French percussion group, Les Percussions de Strasbourg. *Okho* (1989) is a djembe\textsuperscript{29} trio for Trio Le Cercle (a French percussion group). *Psappha* (1975) and *Rebonds* (1987-1989) are solos for multiple-percussion; these were premiered by Sylvio Gualda, a renowned French percussionist.\textsuperscript{30}

**Thirteen Drums and Rebonds**

*Thirteen Drums* by Ishii and *Rebonds* by Xenakis, are two of the most performed classic multiple-percussion solos. Both works were composed within years of each other and only drums with skin heads were used. Most composers in the twentieth century were attracted to the colorful sounds generated from various percussion instruments, and the music was more complex in structure and form. However, in *Thirteen Drums* and *Rebonds*, Ishii and Xenakis demonstrated different techniques to enrich texture through rhythmic structure to make up for the deficiency of tone color.

Both *Thirteen Drums* and *Rebonds* are considered challenging difficult works for percussionists in the collegiate and professional level. There is no doubt that both pieces are worth performing and studying. An introduction to the historical background of each piece below better explains the detailed discussion of each work’s temporality presented in the coming chapters.

\textsuperscript{29}A djembe is a kind of African hand drum.

Thirteen Drums by Maki Ishii

Thirteen Drums for percussion solo, op. 66 was written in 1985. This piece was commissioned and premiered by Atsushi Sugahara. When he commissioned this work, Sugahara told Ishii that he wanted only a simple piece which would be like music for the Japanese taiko drum. Thus Thirteen Drums was born. However, this piece was beyond the “simple” that Sugahara had pictured with some impossible passages for performance. The work was revised several times resulting with the current version being very different from the one original.

The number “thirteen” in the title came from the chromatic scale in one octave. It was an avant-garde attempt to express musical elements such as melody, harmony and beat and all are expressed through the tuned-indefinite pitches of drums. Ishii explained his intention of using drums only in the program note of the premier of Thirteen Drums:

…In Thirteen Drums I have flown in the face of this awareness by using only thirteen membranophones. I make no use here of gongs, cymbals or any other instruments with long sound envelopes, nor of percussion instruments conventionally used for providing tonal coloration. My aim in composing this work was to draw attention again to the dynamic fascination of drums of the membranophone category … This confronts two main challenges, namely the return to the essence of what it means to strike drums and the search for new possibilities for the interaction of determinate and indeterminate rhythms.

In the detailed analysis of Thirteen Drums which will be discussed in Chapter V, the determinate and indeterminate designs in the rhythmic structure create the formal structure. The determinate and indeterminate rhythmic structures create different perception of musical time.

31 In the printed score, Sugahara’s name is misspelled as Sugawara.
32 This is also adopted in the discography with the published recording by Atsushi Sugahara.
Rebonds by Iannis Xenakis

*Rebonds* (1987-1989), like *Psappha*, was written for Sylvio Gualda, a renowned French percussionist. It was premiered in 1988 by Gualda at the Villa Medici in Rome. There are two movements in *Rebonds*, A and B, and if both are performed in a concert, movement A can be played before or after movement B. Compared to Xenakis’s other percussion works such as *Psappha* and *Pléïdes*, *Rebonds* is a smaller scale of work. Fewer numbers of instruments are used, and it is in homogeneous instrumentation (seven membranophones). It is also less complicated in texture and structure.

Xenakis has commented on the homogeneous instrumentation during his interview by Varga:

> Writing percussion is somewhat like writing for piano rather than for orchestra. The piano has a more homogeneous sound and is consequently much more difficult to write for interestingly: it has just one color. It was similarly a challenge to produce a worthwhile percussion work just for skins, for instance.

Because of the homogeneous instrumentation, both movements of *Rebonds* are pure rhythmic. In Varga’s interview with Xenakis in 1989, Xenakis admitted that

> In the past I experimented with music without a rhythmic pulse, that is, having no precise rhythmic sense. In my latest pieces I seem to have come back to very sharp and simple structures that are immediately perceptible.

Compared to his previous works for percussion, the rhythmic structure in *Rebonds* is simpler but still complex to a certain degree. The complexity of rhythms in *Rebonds* is mainly caused by the irregularity in rhythmic figures, accents patterns, registration of drums, and polyrhythms. The evolution of each factor together creates a “multi-layered system” of rhythmic structure. The manipulation of these factors affects the perception of the rhythmic

---

34 Harley, 192.
36 Ibid., 147.
37 Ibid.
structure and makes a work using homogeneous instrumentation interesting. The detailed discussion is provided in Chapter IV and Chapter VI.

From the information regarding both composers, it is clear that rhythm is the most important element in *Thirteen Drums* and *Rebond A*. To understand the musical time in both works, it is necessary to comprehend the rhythmic structure. In *Rebond A*, the rhythms are precisely notated; in *Thirteen Drums*, despite the grace notes and fermatas, all the rhythms are clearly written. However, even though the rhythms are notated explicitly and can be understood intelligently by studying the score, the rhythmic structure cannot be comprehended through aural experience. The following chapter discusses possible reasons why discrepancies exist between the notated scores and the impact of those discrepancies on the actual experience of musical time.
CHAPTER III
THE PERCEPTION OF MUSICAL TIME AND IMPORTANCE OF RHYTHM STRUCTURE TO AESTHETIC EXPERIENCE

The Perception of Musical Time and the Aesthetics of Music

In daily life, people “experience” time through events happening in the flux of time. Similarly, the experience of time in music (musical time) is through different musical elements such as pitch, rhythm, melody, harmony, timbre, and texture. These musical elements together provide information for listeners about musical time. Some information of musical time is audible and some is hard to perceive. The ability of recognizing the audible information is subject to the limitation of perception and cognition of human hearing.\(^\text{38}\) According to scholars, the appreciation of music is tied to the aural experience of musical time. Justin London, in his article “Temporal Complexity in Modern and Post-Modern Music…,”\(^\text{39}\) claimed that:

... I think it is reasonable to presume that musical works involve the organization and presentation of sounds in time—sound being the ‘primary medium’ of music. If the primary medium of music is that of sounds, then a proper experience of a musical work involves hearing those sounds... While we may have experiences of music that involves other senses (we may follow Crumb’s score while we listen, we may watch an opera acted out on stage), it is always our aural experience of it that is key.\(^\text{40}\)

The research of musical time is also found in other fields such as philosophy and psychology. The perception of musical time has been studied in the cognitive psychology and neuroscience of music. The studies of perceptual neuroscience of music explain the basic process from music perception to cognition involving memory systems in the human brain, similar to the

\(^{38}\) Many documents from experts of different fields: music, psychology, philosophy, and physics, discuss these issues. Please see the bibliography entrees: Kramer, Barry, London, Thaut, Parncutt.


\(^{40}\) Ibid., 46-47.
information processing theory of cognitive psychology. These studies claim that the operation of memory systems influences our perception of music as well as musical time.

The Cognitive Processes of Musical Time

The following content explains the process of perception and cognition of musical elements in the human brain and its relations to aesthetic experience. The perception of musical time happens in the same process. This information is based on memory systems from the neuroscience and the processing theory of cognitive psychology. The processing of memory generates different musical experience. In this dissertation, this process is briefly discussed to explain the perception of musical time. The reference books of this section are *Music and Memory* by Bob Snyder,\(^1\) *Brain & Music* by Stefan Koelsch,\(^2\) and *Rhythm, Music, and the Brain* by Michael H. Thaut.\(^3\)

The musical experience can be divided into two different kinds of processing: perceptual processing and cognitive processing. The musical experience starts with the perceptual processing. To decode the information of musical time, the first step is to extract auditory features. The sounds the ears perceive as auditory data enter and are processed in the echoic memory. Auditory features are extracted in this early part of processing; the acoustic variants such as pitches, loudness, interval, and timbre, are detected. Then according to the relations of extracted features (simultaneity and correlation), they are bound into separate, individual events. The sense of *tactus* or pulse is established here.

The individual events in the echoic memory are then processed in the short-term memory and into different *Gestalt* groups according to the similarity, proximity, and continuity of the


stimulus (in correspondence to the auditory “cues” of information processing theory). The melodic and rhythmic groupings all happen in this process and most of the acts are primitive. Some Gestalt groups are examined further to gain more detailed information such as the qualities of chords and interpretation of time relations. In this process, the action may not be primitive because past experience or knowledge stored in the long-term memory may be involved (Snyder calls this “learned grouping”). A sense of meter emerges at this stage. The discrimination of phrases and the next higher level of groupings may take place in this process. The phrase grouping also follows Gestalt principles.

The performance of grouping is very important for information processing because the storage size of short-term memory is limited. If the perceived information is grouped into valuable units according to the Gestalt principles, the brain can increase the speed of processing information thereby stretching the limits of the short-term memory.

The grouping of information is akin to “chunking” in information processing theory. The psychological chunking behavior is to put the interrelated clusters of auditory information stored in the sensory systems (auditory or visual for example) into groups, allowing the groups (chunks) to be processed easier in the short-term/working memory. Therefore, more information can be encoded and then be understood. When the information is understood, it can be stored in the long-term memory and then be recalled for future use.

Grouping or chunking can take place in multiple structural levels where the discrimination of periodicities such as rhythmic figures, motives, fragments, phrases, and

---

44 Koelsch, 91.
45 Snyder, 33.
47 Ibid., 36.
48 Ibid., 53-56.
49 Ibid., 54.
sections can be intelligible. A chunk of shorter periodicity becomes one of the units of longer periodicity, which is a “larger chunk.”\textsuperscript{50} Thus, structural hierarchy is established. Higher levels of chunking and the establishment of structural hierarchy involve short-term memory, long-term memory and working memory. Usable chunks from short-term memory and long-term memory “rehearse” in the working memory. The performance of rehearsal is important for permanent memory and emotional stimulation.\textsuperscript{51} As music goes on in the process of structural building, listeners keep receiving new elements which may cause the established structural model to be reanalyzed and then modified. The whole cognitive process may start over.\textsuperscript{52}

The key to chunking performance is the closure and cues for boundaries. A closure is the act of grouping so the perceived information can be divided into chunks. The cues are for recalling what the next chunk is in an ordered sequence of a long duration. The chunking cues are essential to the establishment of structural hierarchy. When the structural hierarchy is formed, the musical expectancy is born and the sense of entrainment starts to roll. If the information in a piece of music has better chunking ability (when chunking is easier to perform), the structure hierarchy will be established easily, and the formal structure as well as rhythmic structure can be better understood. Only then can musical time be comprehended.

The Perception of Rhythmic Structure

Rhythm is the most important element to the perception of musical time. Most studies of rhythmic structure in music are on components of rhythm: pulse, beat, tempo, accent, meter, and rhythmic figures. Understanding how each component is perceived and functions in relation to the aesthetic experience is important for comprehending the rhythmic structure and musical time.

\textsuperscript{50} Ibid.
\textsuperscript{51} Ibid., 53.
\textsuperscript{52} Koelsch, 93.
In this dissertation, the following discussion of the rhythmic structure’s essence is referred to in several resources: Justin London’s *Hearing in Time* and his several entries about musical time and rhythm on *New Grove Online*, Christopher Hasty’s *Meter as Rhythm*, Bob Snyder’s *Music and Memory*, and Michael H. Thaut’s *Rhythm, Music, and the Brain*.

Pulse and Beat

London explains both terms as “regularly recurring articulations in the flow of musical time.” Pulse and beat are used interchangeably most of the time. A pulse is sometimes referred to as a *tactus* and from it the sense of “motion” is created. However, the meanings of both words sometimes are different. Pulses are durational. Beats are time points which mark off the musical events in equal temporal intervals and are durationless. Pulses are flexible and are generated from the rhythmic events. Beats are functional locations in a temporal continuum often associated with the sense of meter.

Pulse perception is primitive and is perceived through the operation of echoic memory or short-term memory. Many studies show that the shortest/fastest perceivable IOI (interonset interval) is 100 ms (milliseconds) and the longest/slowest IOI is 5 to 6 seconds. However, the sense of pulse only arises in a range from 250-300 ms or 240-200 bpm (beat per measure) to 2

---

54 London, several entrees: “Rhythm,” “Pulse,” “Time” from *Grove Music Online*.
59 Christopher Hasty claimed that “if there is sound, it has always had duration” in his book *Meter as Rhythm* (pp. 69-76). However, this is a conceptual idea and will help the theoretical explanation for rhythmic structure.
60 Thaut, 8. This is also discussed in “Brain and Music” by Stefan Koelsch in pp. 103-104.
62 ms= millisecond.
seconds (30 bpm) apart. London specifies the characteristics of beats/pulse in different ranges with the temporal envelope:

…ranges of very short elements (100-400 ms), intervals that are too fast to be heard as beats but are still countable, giving distinctive shapes to triplets versus quadruplets; medium elements (400-1,200 ms) that strongly give rise to a sense of beat and that best afford sensorimotor synchronization; and long elements (1,200-2,000 ms) with which we can still entrain, though with less accuracy and stability, and tend to induce a subdivision or counting strategy.

The durations in the range of 80-120 bpm (500-700 ms) are judged “neither too long nor too short” and are easily established as pulses. In Richard Parncutt’s research, he points out that 600 ms (100 bpm) is the “maximal pulse salience.”

Pulse is essential to the perception of rhythm and other components. Thaut explains this importance:

Pulse perception, creating interval templates, must then be considered as a fundamental component in rhythm formation. It is a universal characteristic of music, forming the basis for the temporal organization of music in virtually all culture. Pulses serve as isochronous, equidistant time points generated by interval or period durations. Pulses divide the flow of time into regular reference points. They serve as critical frameworks for the essential function of synchronization, which is the fundamental building process of rhythm.

Pulse is the primary rhythmic level. Other components of rhythm (which will be discussed later) could not exist without the perception of pulse. Another important function of pulse is that the sense of entrainment comes from it. The sense of entrainment involves anticipation and predictability and these could not happen without the establishment of pulse.

The foregoing research shows that the sense of entrainment is tied to the aesthetic experience.

---

64 Ibid., 63.
65 Ibid., 31.
67 Thaut, 7.
Tempo

The basic concept of tempo is that “the repetition rate of regularly occurring beats or pulses in a given amount of time defines the pulse speed or frequency.” In the entry “Time” from *Grove Music Online*, London says that tempo is literally “used to describe musical speed or pacing.” He also claims that “a true sense of tempo, then, is a product of more than the successive note-to-note articulations; it involves the perception of motion within rhythmic groups and across entire phrases.”

In Western music, tempo is marked in beats per minute (bpm). The range of pulse is also the range for the sense of tempo. However, the rate of tempo is not necessary equal to the pulse rate. The sense of tempo for listeners is a perceived experience influenced by all the factors in music such as melodies, rhythms, tonal structure, harmonic progressions and so on.

Accent

Another important component which will affect the perception of rhythm is accent. Accents increase the complexity of rhythm and affect rhythmic structure. Theorists distinguish three types of accents: phenomenal accents, structural accents, and metrical accents. Phenomenal accents emphasize a musical event by changes of dynamics, changes of timbre, long notes (agogic accents) regardless of the phrase structure, rhythmic grouping, and metrical structure. Structural accents are at melodic or harmonic points which render the impression of the beginning or ending of a phrase or section. Metrical accents happen when accentuated events

---

68 Thaut, 9.
are “relatively strong in its metrical context.”\textsuperscript{71} The metrical accents are events “marked by consciousness.”\textsuperscript{72} When a sense of meter is established, listeners project metrical accents on events in the felt metrical frame even though there are no indications of dynamic changes or agogic accents.

Meter

London explains meter in a general sense in \textit{Grove Music Online} —it is “the temporal hierarchy of subdivisions, beats and bars that is maintained by performers and inferred by listeners which functions as a dynamic temporal framework for the production and comprehension of musical durations.”\textsuperscript{73} In this sense, meter is a kind of “attentional behavior”\textsuperscript{74} and a sense of pulse is required to be perceived in order to feel a sense of meter. A sense of meter is felt when at least two or more levels of periodicity are isochronized: the pulse level (primary level), the subdivisions of beat/pulse (surface level), and higher levels of combining successive beats into measures.

The sense of meter also involves psychological behaviors: attention, anticipation, synchronization and the process of synchronization also known as entrainment behavior.\textsuperscript{75} In music meter is a regular and cyclical temporal phenomenon and the sense of entrainment arises from it. Once the sense of meter is established, listeners will project this metrical temporality back to the future events. As the music continues, the metrical sense will be maintained because of the temporal entrainment. This is significant for the aesthetic experience of music.

\textsuperscript{71} London, \textit{Hearing in Time}, 18; Thaut, 10.
\textsuperscript{72} London, \textit{Hearing in Time}, 19.
\textsuperscript{74} This is the fundamental concept for London’s book.
\textsuperscript{75} Ibid., 9-13.
The sense of meter is important in Western music while some music from other cultures do not use the metrical idea. However, the temporal organizations of non-Western music may be established on rhythmic modes in which rhythmic patterns are built on pulse structures and combined into extended phrases.\textsuperscript{76}

The temporal envelope of meter is from 200-250 ms to 2 seconds and 600 ms is a preferred periodicity which is the same range for the sense of pulse. This is because of the subdivisible characteristic of a beat in a metrical framework. The shortest perceivable IOI for a human is 100 ms, which serves the subdivision of a perfect duple (1:1) of a beat (200 ms). The changes of tempo in some musical passages will affect all the levels of periodicities (beat, subdivision, measure) and also the metrical sense. The choice of tempo also restricts possibilities of metrical sense.

Rhythmic Figures

At the beginning of the cognitive process, perceived temporal onsets are identified as separate durations in orders. When durations are in the perceivable range from 100 ms to 5 or 6 seconds, they are grouped into patterns according to their similarity, proximity, and continuity. The process of configuration for durations is like the chunking of information processing. When the perceived durations are arranged in a hierarchical structure based on a metric framework, the rhythmic complexity is intelligible.

The extraction of rhythmic figures is affected by the established pulse and chosen tempo. The metric context also influences the grouping of rhythmic figures.\textsuperscript{77} Some research shows that listeners tend to group auditory onsets into patterns that match certain metrical frameworks.

\textsuperscript{76} Thaut, 9.
from their former musical experience and memory (the recall of information/chunking from long-term memory).

Rhythmic figures occur at the surface level of rhythmic structure. A metric framework is established well when the durational onsets are grouped into isochronized figures with a cyclic, hierarchical, temporal organization.\textsuperscript{79} If entrainment to a meter is well-established prior to the ongoing sound, listeners’ sense of meter is not likely affected by contrary patterns. This is because the pulse salience and metrical sense are maintained by human nature for a short amount of time even when they are not presented in a musical context.\textsuperscript{80} That is, for a short time (maybe one or two measures) when the contrary patterns (which carry conflict cues such as phenomenal accents, structural accents, and periodicity) discord with the entrained patterns created by established metric sense, the “contextual mismatches” happen until the conflicting rhythmic patterns disappear, the pulse salience and metrical sense will not be destroyed.\textsuperscript{81} Rhythmic figures of syncopations, hemiolas, and missing “articulation on the down beat of the measure” (London calls it “loud rests”) are likely to cause short-term contextual mismatches.

Nonetheless, a new metric framework may be expected and the refiguring of rhythmic patterns may occur according to the new extracted salience from the contrary rhythmic figures. Some musical passages formed by rhythmic figures of high complexity, including the ones that involve rests, make it difficult to establish a stable pulse resulting in an undetermined or unavailable metric sense. When rhythmic figures are “metrically malleable” and can generate more than one metric context,\textsuperscript{82} the metric framework becomes ambiguous.

Another situation of metric ambiguity happens when two or more rhythmic activities in

\textsuperscript{78} Ibid., 67.
\textsuperscript{79} Ibid., 77.
\textsuperscript{80} Ibid., 70.
\textsuperscript{81} Ibid., 107-108.
\textsuperscript{82} Ibid., 99.
different layers in music play simultaneously and each rhythmic stream reveals conflicting
dynamic cues or temporal cues. The conflicting temporal cues happen in the musical context of
polyrhythms. London defines polyrhythms as “any two or more separate rhythmic streams in the
musical texture whose periodicities are noninteger multiples.” Hemiola is an example of
polyrhythm and its ratio of periodicities is 2:3.

Studies show that listeners can only extract one metric framework from one passage.
When they encounter passages that have ambiguous meters or polyrhythms, listeners will have
two perceptive activities. One is to follow the composite pattern formed by all the rhythmic
streams and match it to the metric framework; the other is to focus on one metric framework
presented by one rhythmic stream.

Rhythmic Structure to the Aesthetic Experience

Scholars from different fields agree that encoding rhythmic structure is essential to the
aesthetic experience of music. Thaut explains why rhythm is the key to grasping meanings in
music. Thaut claims:

Rhythm determines, assigns, and builds time relationships between events in the
perceptual process. Because all efforts in perception must fundamentally include a
multidimensional temporal process, regardless of sense of modality, rhythm assumes a
critical role in the shaping and modulating of meaning in perception.

Thaut continues:

Rhythm organizes time. In music, as a time-based acoustical language, rhythm assumes a
central syntactical role in organizing musical events into coherent and comprehensible
patterns and forms. Thus, the structure of rhythm communicates a great deal of the actual,
comprehensive “musical meaning” of a musical composition. At the other end of the
musical communication process, rhythm also modulates the attention of the listener in
relationship to the perception of musical events. Rhythm guides the ear and brain to make
sense of acoustical patterns and shapes by directing focus to important moments in the

---

83 Ibid., 66.
84 Thaut, 4-6.
unfolding of the music.\textsuperscript{85}

From the point of view of entrainment or attention-attending theory, when the rhythmic structure establishes a sense of periodicity (cyclical or metric), psychological behaviors such as anticipation and entrainment are created for future structural events. When a musical element violates the structural expectation, tension takes place and a search for tension release or a resolution follows. The affective experience of music therefore happens during the process of alternations between “expectation and temporary suspense, tension and release, arousal and de-arousal, arsis and thesis.”\textsuperscript{86}

Bob Snyder talks about the “rhythmic tension.” Rhythmic tension still happens within a rhythmic grouping by “the number of events occurring in a given amount of time” even when a metric frame or pulse is not established. When the amount of events happening in shorter time spans is larger, the generated rhythmic tension is perceived as higher.\textsuperscript{87}

The rhythmic structure shows temporal organizations of musical events and these are revealed in chronological order. The more discernible the events of rhythmic structure, the easier the rhythmic structure can be understood. The intelligibility of rhythmic structure becomes essential for the aesthetics of music. The perception of rhythmic structure is subject to aural experience. The cognitive model from neuroscience and the information processing theory from psychology introduced earlier in this dissertation also provide the cognitive process for the comprehension of rhythmic structure.

Issues of Temporal Structures in Contemporary Music

A lot of contemporary music is considered incomprehensible. Composers in the twentieth

\textsuperscript{85} Ibid., 6.
\textsuperscript{86} Ibid., 6.
\textsuperscript{87} Snyder, 161.
century tried to move away from the classical musical language in tonality, harmony, forms, and structures. They explored new possibilities of organizing music which created issues related to the aesthetic of music. While contemporary composers explored and expanded the horizon of music, a problem arose: because contemporary music is complex and difficult, many structural and formal elements cannot be heard and understood. The comprehension of temporal structure is therefore challenging for listeners and creates challenges to the aesthetic experience of contemporary music.

According to aforementioned studies, the sense of entrainment established by rhythmic structure is key to the aesthetic experience. Rhythmic structure in a musical work that renders a strong sense of entrainment is usually pulse-based and metrical. It also creates the sense of motion and continuity. From the point of view of the information processing theory, when the perceived musical elements are organized into a hierarchical structure, the chunking process makes the performance more approachable; other musical elements and structure is then better comprehended. Music with an established pulse and a metrical temporal structure is therefore easier to understand and remember. This is important to the aesthetic experience.

The temporal characteristic in music described above is often referred to as “in time” and a sense of motion is experienced. In order to explore new experiences of musical time in contemporary music, composers construct such time with innovative methods. They use pre-compositional schemes to build the piece’s form such as the block of sounds of different texture, mathematical formulas and ratios like the golden mean, the twelve-tone technique in pitch or rhythmic element and so on. The music constructed under those methods is complex in structures and creates a temporal experience of “out-of-time.” The sense of motion is missing or weak due to the lack of entrainment. The performance of grouping and structural building is hard for
human brains’ capacity due to a lack of clear cues from the inaudible or unclear auditory information.

Much contemporary percussion music is identified as modern in style and conceptual in nature. Because modern compositions often are not easily comprehended by aural experience, applying theoretical methods such as score studying, analysis or commentaries of program notes will help listeners and even performers understand and appreciate modern works.

In the following chapters, temporal analysis on *Thirteen Drums* and *Rebond A* are examined through their rhythmic structure. Aesthetic experience is discussed through the aural experience of rhythmic structure. The theory introduced in this chapter provides a basis for comprehending the rhythmic structure and perception of musical time.
CHAPTER IV

THE CHARACTERISTICS OF RHYTHMIC STRUCTURE TO THE AESTHETIC EXPERIENCE IN THIRTEEN DRUMS AND REBOND A

There are four important aspects of rhythmic structure in both pieces: instrumentation, compositional scheme/formal structure, absence of notated meter, and rhythmic complexity. These aspects affect the aesthetic experience of musical time. In Chapter III, scholarship in the neuroscience of music and cognitive psychology studies on information processing theory of memory were provided to explain the discrepancies between the written music in the score and the actual perceived temporal information.

The purpose of the next two chapters is to discuss how certain features of rhythmic structure affect the perception and cognition of musical time, which is the first and most important factor in the aesthetic experience. However, these chapters will not identify the emotions evoked by features of the rhythmic structure because emotional responses are more complicated; they can be very different according to the individual’s personal response and because more complex physical reactions are involved.

As discussed in Chapter III rhythmic tension is perceived through rhythmic grouping by the amount of events taking place within a given time period. The aesthetic experience from rhythmic tension occurs whether a pulse or a metric sense is established or not. Therefore, even if the rhythmic structure is not always intelligible in Thirteen Drums or Rebond A, rhythmic tension is still experienced. The experience of rhythmic tension is discussed when more details on rhythmic structure are analyzed in the following chapters.
Instrumentation

In both *Thirteen Drums* and *Rebond A*, only drums are used. In *Thirteen Drums*, Ishii called for 13 drums that had calf skin, such as bongos and Japanese drums. In *Rebond A*, Xenakis asked for 2 bongos, 3 tom-toms, and 2 bass drums (example 4-1). These drums are classified as “indefinite pitch membranophones.”

Example 4-1. Instrumentation in *Thirteen Drums* and *Rebond A*.

a. Instrumentation of *Thirteen Drums* by Maki Ishii

b. Instrumentation of *Rebond A* by Iannis Xenakis

The notation system of Western music, including note values, bar lines, and the staff, has been commonly adopted in works for percussion. It becomes a convenient tool for learning and reading music. *Thirteen Drums* uses a staff of thirteen lines (example 3-1a) and *Rebond A* adopts a five-line staff of Western music (example 3-1b). Like the notation system of Western music, the lines of the staff indicate “high to low” indefinite-pitch as they descend.

---

88 But in performances where 13 drums with calf skin are not available, 13 tom-toms can be used.
89 In *Rebond B*, it needed 2 bongos, 1 tumba, 1 tom-tom, 1 bass drums and a set of 5 wood blocks.
91 This and all musical examples in this dissertation are for analytical purposes only and are not intended for reproduction or performance.
The homogeneous instrumentation in both works conveys a clear rhythmic structure and reduces possible issues caused by the contrasting qualities of sounds such as the balance and blend between the instruments of metal, wood, and skin-heads. The two composers most likely used drums to allow greater focus on the fundamental character of percussion: attacks and rhythms. Using multiple drums also creates a melodic quality in a non-pitched drumming work.

Percussive Characteristics

Unlike woodwinds, brass, or strings, the sound generated by striking percussion instruments primarily creates sharp attacks of sound quality\(^{92}\); if a sustained or “long-note” effect is desired, special techniques such as a “roll”\(^{93}\) technique must be applied. To relate this characteristic of percussion instruments to time, the attacks are the events happened in time points.\(^{94}\) The notated durational values of rhythm therefore can be ignored and the score becomes a reference timing plate. Xenakis’ *Psappha* for multiple-percussion solo is a good example:

Example 4-2. An excerpt from *Psappha* by Iannis Xenakis

---

\(^{92}\) Harvey White and Donald White, *Physics and Music: The Science of Musical Sound* (Philadelphia: Saunders College, 1980), 270. “A percussive note, on the other hand, has a sharp attack, followed immediately by a decay of variable duration.”

\(^{93}\) A roll is a continuous succession of single strokes performed very close together.

\(^{94}\) Hasty, 69. Hasty claimed that “if there is sound, it has always had duration.” However, for many percussion instruments, the notated note values, if no special technique is used, are often indeterminate and not stand for “real” durational indication. The notation system is for “timing” reference.
Melodic Quality

Even though the drums are of indefinite pitch, the tuning is done according to a “relative scale.” The relative-pitch contents in both pieces imply melodic qualities. The implied melodic qualities sometimes form “motives” which are more easily recognized than rhythmic (non-pitched) motives. The recurring motivic materials can serve as a “grouping principle” for chunking information and are important for periodic divisions such as motive, phrase and section. The excerpts from Rebond A is a good example (example 4-3). In Rebond A, membranophones with different heads create distinct timbres. Therefore, bongos, tom-toms, and bass drums render different sound qualities that will enhance some motivic materials.

Example 4-3. Examples of registers in Rebond A by Iannis Xenakis
a. High register

b. Low register

---

95 Sugawara (personal communication) points out that the 13 drums used in Thirteen Drums resemble a complete octave. In Rebond A, seven drums are in relative non-definite pitches.
Compositional Scheme/Formal Plan

Since both *Thirteen Drums* and *Rebond A* lack tonal elements, the study of a pre-composed structural plan helps identify phrases and sections especially in the case of *Thirteen Drums*.

**Thirteen Drums**

In *Thirteen Drums*, the development of the music is based on a rhythmic series: twelve rhythmic figures of four-consecutive-sixteenth notes with different accent patterns (referred to as “accent patterns of the rhythmic scheme”) followed by a grace-note group (“the thirteenth figure”, example 4-4):

Example 4-4. Rhythmic scheme in *Thirteen Drums*

When represented in real content, the accented notes and non-accented notes are distinct because of the dynamic contrast. This rhythmic scheme is modified into various textures by different techniques to create a diverse experience of musical time. It can be broken into segments consisting of two or three accent patterns without changing the order. Segments are flexibly used to expand the periodicity of phrases that becomes the structural feature of form. The new formations of the rhythmic scheme are further discussed later in this current chapter and the following one.

Ishii composed the rhythmic scheme for two different effects of musical time: the determinate rhythms and orders made of the rhythmic scheme’s accent patterns, and the
indeterminate “interruption” of the thirteenth figure. He later gradually added grace notes to the existing accented sixteenth notes (example 4-5). At the same time, he increased the tempo making it impossible for the performer to keep the timing of sixteenth notes due to the large setup of thirteen drums. Therefore, the time of an actual performance is distorted which is the effect that Ishii desired.96

Example 4-5. The temporal distortion, starting in page 3, line 2 in *Thirteen Drums*

---

**Rebond A**

Xenakis did not clarify the pre-composed structure of *Rebond A*. Greg Beyer claims that

---

96 This is described on the last page of the score of *Thirteen Drums*.  

---
Xenakis used the Golden Section (Golden Mean) as a formal scheme. Xenakis used the Golden Section (which he called “the Modular”) as a structural frame in other compositions, for example, *Metastasis* (1953-1954). Xenakis claimed that you can “identify” the proportion of a piece in the Golden Section through rhythmic exercises. However, for most people, it is hard to “hear” the arrival of the division in the golden ratio. In fact, there is no clear discrimination of phrases or sections in *Rebond A* besides the silence caused by longer notated values of notes and rests. The composition is based on changes of density between the two sixteenth notes in the very beginning (example 4-1b). Schick roughly divides this piece into six sections according to the changes of density (“points of articulation” in Schick’s words). These changes of density are achieved through different elements, register of drums, polyrhythms, and various subdivisions of duration. These elements also affect the perception of rhythmic groupings and the perception of duration. The continuous mutation of rhythmic figures oscillating between the drums in polyrhythmic texture obscures the groupings and boundaries for chunking. The formal structure is therefore more difficult to perceive and understand.

Absence of Notated Meter

These works lack notated time signature (see example 4-1) and both have a weak sense of meter. The *sense* of meter (with or without the indication of time signature) is important in understanding the musical time of a piece because it helps the establishment of the sense of entrainment (discussed in Chapter III). Because of the instrumentation and the lack of a clear

---

98 Harley,
metric sense, the notated rhythmic figures and measures are open for interpretation including
durational determinations such as motives, phrases, and sections.

In *Thirteen Drums*, there are no divisions of measure: only dashed lines (single or double)
used for phrases and pauses or solid doubled lines for the indication of large sections (only two
places). The repeated sixteenth notes may give a sense of pulse that normally is felt as the length
of two or four sixteenth notes (a value of eighth note or quarter note). Groups of grace notes
interrupt this sense of pulse. Although these groups cause the distortion of time, some of them
also serve as “closures” or cues of chunking boundaries at the ending of a phrase.

In the score of *Rebond A*, the music is organized/notated in 4/4. Nevertheless, the music
is not felt in 4/4 time. Although the quarter note equals 40 throughout the work, the rhythmic
grouping is not easily perceived and does not help listeners develop a steady pulse and a sense of
meter. The constant changing rhythms do not build the sense of entrainment.

**Rhythmic Complexity**

This section focuses on the surface level of rhythmic structure: rhythmic grouping.
Studies show that the higher the complexity of rhythms becomes, the more ambiguous rhythmic
groupings can be perceived.\(^{101}\) In addition to the previously discussed factors of instrumentation
and compositional plan, other elements also increase the rhythmic complexity in *Thirteen Drums*
and *Rebond A*: use of rests, pervasive accents, and subdivisions of beat/pulse.

**Use of Rests**

Ishii wrote many rests in *Thirteen Drums*, and the impact of the silence created by the
rests is significant. *Thirteen drums* is constructed of a rhythmic scheme and the development of

\(^{101}\) Parncutt, 454.
the piece is primarily variations of the rhythmic scheme. Rests become the tool for Ishii in some of the variations (example 4-6):

Example 4-6. Variation of the original rhythmic scheme, starting in page 4, the end of second line

In the excerpt above, if each grace-note group at the beginning represents a sixteenth note and is combined with sixteenth rests, each grace-note group is in the accented sixteenth note’s timing of each rhythmic figure of four-consecutive-sixteenth notes. The same approach can be applied to the figure of a single sixteenth-note with an ornament and the variations with rolls in which the rests are substituted by rolls. It is clear that the musical excerpt in example 4-6 is a variation from the original rhythmic scheme’s patterns (see example 4-4), in the score, but the aural experience of accent patterns is not as salient.

Moreover, the duration of silence is indicated by successive sixteenth rests instead of rests with other values. The intention is clear: Ishii wanted the performer to keep precise timing of the sixteenth rest. But for the aural experience, listeners can hardly keep track of the timing of these rests. The grace-note groups are heard as random events. For these reasons discussed, this excerpt is difficult to recognize as a variation from its original form and the temporal experience of duration is distorted.
In the score of Rebond A, rests appear in the very beginning (example 4-7a) and at the very end (example 4-7b). Since the development of this piece is a continuous transformation of rhythms, these rests create silence that serves as chunking cues for rhythmic grouping or a break between phrases. In fact, rests are not the only ones that have this function. In the section of instrumentation, the notated note values can be ignored. Note values longer than an eighth note also give the impression of rests. Besides the excerpts in musical examples 4-7a and 4-7b, eighth notes in m.20, m.21, m.22, and m.36 also have the same effect.

Example 4-7a. Rebonds A, mm. 1-6

In example 4-7a, even though the tempo is marked at a quarter note as 40 bpm (beats per minute), the pulse is likely felt as durations of eighth notes or sixteenth notes. In human perception, the periodicities in the 80-120 bpm (500-700 ms\textsuperscript{102}) are judged “neither too long nor too short.”\textsuperscript{103} So the pulse in this range is easily felt and established as the pulse for entrainment.

\textsuperscript{102} ms= millisecond.
Therefore in the beginning three rhythmic figures, the pulse is the duration of the eighth note and the rhythmic grouping is identified as the repeated rhythmic figure of two sixteenth-notes followed by an eighth rest.

However, the pulse of eighth notes is not consistently perceived. Starting in the last beat\textsuperscript{104} in m.1, the pulse as eighth notes is interrupted. The rhythmic grouping is a repeated figure of three sixteenth notes followed by an eighth note rest until the third beat in m. 5. The pulse is now changed to be felt as a sixteenth note or as odd meter as 5/16 (example 4-7a).

Example 4-7b. *Rebonds* A, mm. 51-60

In example 4-7b, silence between each quarter note resembles the silence of rests. The polyrhythms and irregular rhythms reduce the sense of pulse. Like the situation in *Thirteen Drums*, listeners can hardly keep track of the timing of these rests. The musical time here seems out-of-time for the aural experience.

\textsuperscript{104} I use “beat” here to indicate where the rhythmic figure is in score. The “beat” is not involved in any metric frame.
Pervasive Accents

Pervasive use of accents is prominent in both *Thirteen Drums* and *Rebond A* and easily perceived during performance (please refer to the musical examples in the following chapter). According to the information of accents discussed in Chapter III, metric accents are hard to perceive in both pieces because neither have a strong sense of entrainment and lack pitch elements and metric framework.

In *Rebond A*, structural accents are not obvious and are unrecognizable most of the time. This is due to the consistent evolution of rhythms and lack of clear chunking boundaries. Structural accents are represented in *Thirteen Drums* at the use of grace-note groups (see example 4-5) and sustained notes (accomplished by the performance technique of the roll) for phrase discrimination (example 4-8). The dynamic changes (*crescendo* and *decrescendo*) also contribute to the perception of structural accents. Detailed analysis is provided in the next chapter.

Example 4-8. *Thirteen Drums*, page 7
Phenomenal accents are pervasive in both pieces. Some phenomenal accents coincide with the structural accents. In *Thirteen Drums*, the phenomenal accents are marked by sharp changes of dynamic level as in the symbol $>$, which is sometimes paired with other dynamic markings such as *sf*, *sff*, *sfff*, etc… The accents of the first twelve rhythmic figures of the rhythmic scheme’s four-consecutive-sixteenth notes are phenomenal accents.

There are two accent symbols used in *Rebond A*: `˅` (single accent) and `⮠` (double accents). Xenakis did not include an explanation of how to interpret both accents in the score of *Rebonds*. However, in the score of *Psappha*, Xenakis indicated the interpretation of both accent types as follows:¹⁰⁵

1. Louder, greater intensity
2. Abrupt change in timbre
3. Abrupt change of weight
4. Addition of another sound played simultaneously
5. Simultaneous combination of all preceding suggestions

These accents increase the complexity of the non-repetitive rhythmic figures and obscure the identification of phrases. According to Xenakis’s interpretations of the accents, these accents have different functions depending on their placements in the musical context. When the functions of accents are evaluated, the execution of the accents is open to the performer. This breaks the sense of continuity in the mutating rhythmic figures and brings out the periodicities of motives or phrases which serve as the chunks for listeners to process the music. Some examples are listed here (examples 4-9a, 9b, 9c) and a detailed analysis is provided in the next chapter.

In example 4-9a, the first three single accents on the beginning sixteenth-note figures represent the core of the piece. The accents’ function can be interpreted as having greater intensity or greater weight to grasp the listeners’ attention and to balance the sound qualities between the small bongo and large bass drum. The fourth accent on the large bass drum is to introduce the “new timbre” of different drums following the large bass drum.

Example 4-9b. *Rebond* A, mm. 34-38

Example 4-9c. *Rebond* A, mm. 48-50
In example 4-9b, accents are added on the sixteenth notes that conclude the rhythmic sequences of various subdivisions of pulse. These spots break the continuous mutating rhythmic patterns and periodicities of phrase then emerge. In example 4-9c, the frequent accents enhance the intensity of the musical context that is created by the high density of rhythms.

Subdivisions of Beat/Pulse

This section deals with another important factor that increases the rhythmic complexity in Rebond A: subdivisions of beat/pulse. Note that Rebond A’s main effect and compositional design is in changes of density. The various durations caused by subdivisions of beat/pulse mostly contribute to this effect. If the beat/pulse is based on the rate of a sixteenth note, the subdivisions of beat/pulse are in the ratios of 1:2, 1:3, 1:4, 1:5, 2:3, and 2:5 in the monophonic musical context (example 4-10a). In the context of polyrhythms, the density increases especially when the sixteenth note is divided into a thirteen-second note or a sixty-fourth note in the ratios of 2:3, 4:3, and 6:5 (example 4-10b).

Example 4-10a. Ratios of subdivisions in Rebond A

Example 4-10b. Ratios of polyrhythms in Rebond A

The continuous mutation of rhythmic figures obscures the groupings and boundaries for chunking. Because of irregular rhythms and the lack of reference to a metric framework, the
information in the formal structure is therefore more difficult to perceive and understand. However, the subdivisions of duration dominate the density and intensity that they create rhythmic tension in the aural experience of the piece (Chapter III). The tension building and release in *Rebond* A depends on various subdivisions of a pulse.
CHAPTER V
ANALYSIS OF TEMPORALITY IN THE RHYTHMIC STRUCTURE OF
THIRTEEN DRUMS

In this chapter and the next, a temporal analysis of *Thirteen Drums* and *Rebond A* will be presented respectively. The primary focus of each respective chapter examines the effects of perception and cognition of rhythmic structure and the resulting aesthetic experience. According to the characteristics of rhythmic structure discussed in the previous chapter, detailed discussion on musical time is offered. The analysis reveals a framework for a formal structure. Each work is divided into parts according to different levels of tension created by texture and intensity, and in the case of *Rebond A*, density. Each part conveys musical time and rhythmic tension in a different way.

Rhythmic Scheme and Formal Structure

There are a total of thirteen pages (37 lines) in the score of *Thirteen Drums*. It was said earlier that no discrimination of measures are used for organization, so every line is numbered for reference (like measure numbers). When a specific passage is referred to, the fraction, number of line and page number will be used to indicate the location in the score\(^\text{106}\): [2/4 L11 P4], for example, means the spot approximately on two fourths of line 11 in page four. *Thirteen Drums* is divided into 8 parts (Table 5-1).

The rhythmic scheme (example 5-1) introduced in the previous chapter is presented in different ways, just like theme and variations. Since the metric framework is not established in

\(^{106}\) The referenced score in this dissertation is the version published by Moeck Verlag und Musikinstrumentenwerk in 1986. According to the rhythmic scheme and musical content, there are several errors in the score published by Moeck Verlag und Musikinstrumentenwerk in 1986. A list of errata is provided in Appendix.
this piece, it is the rhythmic scheme that sets up the formal structure and ties all the parts
together into a large-scale composition. The rhythmic structure of each variation therefore builds
the tension and decides the perception and cognition of musical time in each section. The
aesthetic experience is subject to the different characteristic temporalities created by the
rhythmic structure in each section.

Example 5-1. The rhythmic scheme of *Thirteen Drums*

According to the musical example, the rhythmic scheme is composed of twelve rhythmic
figures of four-consecutive-sixteenth notes with different accent patterns (only four possibilities);
the seventh to twelfth figures are the retrograde of the first to sixth figures. The twelve sets of
duae consecutive sixteenth notes end with the grace note group as the “thirteenth figure.” This
“thirteenth figure” in Ishii’s design concept is an “indeterminate” event. By indeterminate, this
means the figure reveals its openness in the musical content and its contrast to the figures of
determined temporal values.

<table>
<thead>
<tr>
<th>Part#</th>
<th>Location in the score</th>
<th>Correspondent sectional marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beginning ~ [3/4 L11 P4]</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>[1/4 L14 P5] ~ [1/4 L15 P5]</td>
<td>Transition I</td>
</tr>
<tr>
<td>4</td>
<td>[1/4 L15 P5] ~ [1/4 L17 P6]</td>
<td>C</td>
</tr>
<tr>
<td>7</td>
<td>[3/4 L29 P10] ~ [1/4 L30 P10]</td>
<td>Transition II</td>
</tr>
<tr>
<td>8</td>
<td>[2/4 L30 P10] ~ Ending</td>
<td>C'</td>
</tr>
</tbody>
</table>
The rhythmic scheme is enriched by phenomenal accents and the “melodic quality” of the instrumentation: The non-accented sixteenth notes are kept on one drum in a lower level of dynamics when the accented notes are played on different drums with abrupt emphasis in dynamics.

Before providing a detailed analysis of each section, it is helpful to understand how *Thirteen Drums* is divided. The letters used for sectional marking distinguish between different “core elements” in the sections. The core elements are basically features that change the formation of the rhythmic scheme. The core elements are discussed later in this chapter.

The main feature in Sections A and A’ is characterized by clearly notated sixteenth notes denoting the rhythmic scheme. In Sections B and B’, only accented sixteenth notes are preserved; other sixteenth notes are substituted by rests and some are combined into notes of longer values with rolls. Transitions are located between Sections B and C (or B’ and C’). The elements of rhythmic scheme are either absent or ambiguous.

In Sections C and C’, the design has moved away from the rhythmic scheme of earlier sections. Like the alternation done in Section B, only the notes with rolls substituting the rests are extended into longer values in Section C. The total duration of the rhythmic scheme is then prolonged. In Section C’, fragments from accent patterns of the rhythmic scheme are formulated in special arrangements to create new musical context and conclude the piece.

**Analysis of Rhythmic Structure of Sections**

**Section A**

Sections A and A’ feature clearly-notated sixteenth notes. Section A into three
subsections based on changes in melodic quality and rhythmic structure: A1, A2, and A3 (example 5-2). The phrase discrimination is based on the basic formation of the rhythmic scheme: rhythmic figures of four-consecutive-sixteenth notes followed by a group of grace notes. The group of grace notes serves as a cue for boundaries of chunking and break up the long passage into several phrases. There are six phrases in A1 (A1-1 to A1-3), four phrases in A2 (A2-1 to A2-4), and seven phrases in A3 (A3-1 to A3-7).

The music of *Thirteen Drums* starts with twelve rhythmic figures of four-consecutive-sixteenth notes without accents (referred to as ‘sixteenth-note group’) followed by a group of five grace-notes (A1). The continuous sixteenth notes repeat on the same drum starting in *fortissimo* followed by a *decrescendo*, and are interrupted by the loud grace-note group (marked as *sff*). The same design happens five times on different drums. Between some of the repeated passages, each accent pattern of the rhythmic scheme from material A2 is gradually revealed when the music unfolds in time. The group of grace-notes in passages of A1 and A2 is the same figure.

The fragments of accent patterns from the rhythmic scheme characterize the material in A2. The accented notes are assigned on drums in the order of 5-3-11-1-9-7-5-7-9-1-11-3 in which, after the seventh drum (drum 5), the order of drums is in retrograde. Ishii inserted a variety of sixteenth-note groups between accent patterns. All twelve accent patterns are introduced completely at [L7 P3] (A2-4). During the time when Phrase A2-4 is introduced, all the drums except the bass drum have been assigned for the non-accented notes.

107 There is a mistake in the score: at the second four-sixteenth note figure, the accent should be on the third sixteenth note instead of the fourth one.
An explicit appearance of the rhythmic scheme is first introduced at [1/4 L8 P3] in Section A (example 5-2, A3-1) and the passage of A3 starts here. There is no insertion of any sixteenth-note group between each accent pattern. The non-accented notes are kept on drum 5; the accented notes are played on drums 7-4-2-10-9-6-7-4-2-10-9-6, but are gradually changed every time when the rhythmic scheme is reintroduced. The groups of grace notes are different from those in passages of A1 and A2.

The rhythmic scheme appears to evolve with the shifting of musical materials from A1 to A3. The process starts in its simplest form: sixteenth notes, dying away, played on a single drum followed by an abrupt group of five grace-notes. Accent patterns of the rhythmic scheme are gradually revealed. As the music unfolds, material from A1 disappears and the formation of the rhythmic scheme reaches completion. When accent patterns are all represented, the dynamic intensity also increases (via a crescendo) until the material of A3 is reached at [L8 P3].

In the representations of material of A3 from [L8 P3] to [3/4 L11 P4], Ishii gradually added one to two grace-notes on the accents; at the same time, the tempo and intensity increases (please refer to the musical example 4-5). The addition of grace-notes and the acceleration of speed interrupt the timing of sixteenth note. The rhythmic figures of accent patterns are therefore enriched and distorted.

Based on the features of the rhythmic structure discussed above, different materials of A1, A2, and A3 affect the perception of musical time and create different levels of tension as to aesthetic tension.

At the beginning, the material of A1 sets up the pulse perception as the duration of an eighth note or quarter note (two-or four- sixteenth notes) according to the possible adopted tempo. The most commonly chosen tempo is from 80 to 100 bpm of a quarter note, which is in
the temporal range for better pulse perception. The sense of pulse is interrupted by the occurrence of the group of grace notes.

Possible metric frameworks are identified in section A2. The insertions of partial segments at [3/4 L2 P1], [4/4 L3 P1] and [1/4 L5 P2] can be perceived by the meter as 4/4 if the quarter note gets the beat. Metric cognitions of 3/4 and 2/4 happen in later passage of A2 (example 5-2). The motion of the music is discernible.

Characteristics of the passage in A3 have been discussed in Chapter III. The pulse is carried on in this passage, but the sense of meter is ambiguous. As the music goes on, the addition of grace-notes and acceleration of speed cause temporal distortion, because the pulse cannot be preserved under that condition (please refer to example 3-5). At the end of Section A, the sense of pulse and motion is destroyed.

The musical intensity and tension increases along with the process discussed. The evolution of the rhythmic scheme starts in a plain form, with gradually-revealed accent patterns added to its explicit presentation. Then the rhythmic scheme evolves until its formation is not recognizable. At the end of Section A, the level of musical tension reaches its first climax of *Thirteen Drums*.

Section B

Section B contains within it two subsections (B1 and B2). Similar to the periodic formation of phrases in Section A, three phrases are recognized: B1, B2-1 and B2-2 (example 5-3). The formation of phrase B1 has been analyzed in Chapter III. The group of grace-notes, on drums 1-3-6-9-12-13, is inherited from A3’s material. However, the function of this group is different. In the A3 passage, this group serves as the closure of phrases for boundaries of
chunking. Here in first half of Phrase B1, it substitutes the spot of accented sixteenth note in each accent pattern. This group later concludes Phrases B1 and B2-1.


In the second half of Phrase B1, the group of grace-notes is replaced by flams. There are six flams played on different drums: $51-113-76-49-1012-2-813$ (smaller numbers on the top left are grace notes). All thirteen drums are used. This formation of flams is repeated in the first half of Phrase B2-1, so the drums used on the figures of flams in Phrase B2-1 are $51-113-76-49-1012-2-813-1112-108-79-104-612-211$. This formation is again used in Phrase B2-2, but the drums on the grace-note and primary note in each figure of the flam are switched.

It was mentioned earlier that non-accented sixteenth notes are substituted with rests in Phrase B1, and in Phrases B2-1 and B2-2, they are turned into rolls of different durations. In

---

108 A flam is a percussion technique by which a single grace note precedes the primary note (stroke).
these passages, a new formation of the rhythmic scheme is introduced: if the number of sixteenth rest between two consecutive accented notes is four or above, the durations of sixteenth rests are combined into longer temporal intervals which are executed by rolls on drums (example 5-4).

Example 5-4. Comparison of Phrase B1 and the original rhythmic scheme, from [3/4 L12 P4] to [1/4 L13 P5], *Thirteen Drums*

In Chapter IV, the issues of the rhythmic structure in Section B were discussed. It is clear that phrases in Section B are variations of the rhythmic scheme at the opening of the work. For performers, it is possible to keep precise timing of the sixteenth notes while playing rolls. Listeners, on the other hand, are likely unable to keep track of such timing. The grace-note groups are heard as random events, and so are the accented figures of flams.

There are several reasons for causing this discrepancy. The musical passages of A3 before Section B end with temporal distortion in which the sense of pulse is destroyed. Therefore, the music in Section B starts without a sense of pulse. In Section B, successive rests and rolls on the longer note values do not provide a solid temporal salience for pulse perception. At Phrase B2-1, the speed starts to slow down (*rit.*). Because of these reasons, this excerpt is difficult to recognize as a variation from its original form and the temporal experience of duration of this excerpt is distorted.
Ishii, based on the same rhythmic scheme, creates different musical textures by altering the articulations. In comparing the aural perception of sixteenth notes, sixteenth rests, and rolls, consecutive sixteenth notes are the “articulated time points,” and in the preferred range of tempo, they serve as the “motor” driving music to different directions. Rests and rolls here cause temporal indeterminacy due to the absence of a sense of pulse. Therefore, in the passages of Section B, the driving force is taken away, and the music loses its momentum.

The musical tension achieves a climax in the block of massive sound that occurs at the end of Section A. In Section B, the intense energy is not lost completely. However, the level of tension drops a little if compared to the end of Section A because of the rhythmic structure and tempo slowing down. The texture starting in the second half of B1 creates the sound color reminiscent of Klangfarbenmelodie of the Second Viennese School. Ishii was trained in serial methods so it is not surprising that he adopted the technique in Thirteen Drums.

Another important element Ishii introduced in Section B is rolls. It was said that the primary characteristic of percussion instruments is attack. The technique of rolls on most percussion instruments is to sustain a sound. The contrast of sound is then created (imagine a string player performing a pizzicato and arco on his/her instrument). The sound quality produced by rolls becomes the main feature in the transitions and other later sections.

Transition I

Transition I (example 5-5) starts at [L14 P5]. There are four phrases in Transition I (TI-1 to TI-4). Section B concludes with the crescendo of rolls on a dotted-half note followed by a group of grace notes in dynamic of sfff. Phrase TI-1 is the two figures reversed and the rolls are in decrescendo. A fermata is inserted between the end of Section B and Transition I.
Example 5-5. Transition I from [1/4 L14 P5] to [1/1 L15 P5], *Thirteen Drums*

There are several features in Transition I: use of rolls, use of fingers, use of small and medium sizes of drums, and fermata. Ishii uses three kinds of fermata in *Thirteen Drums*: \( \wedge \) (short fermata), \( \bigcirc \) (medium fermata), and \( \bullet \) (long fermata). A fermata not only provides the pause of silence (notated above with dashed barlines) but also serves as a cue for the boundary of the phrase. Fermatas of \( \wedge \) are used to separate Phrases TI-1, TI-2 and TI-3.

\[109\] Maki Ishii, *Zone for Piano-Percussion* (Japan: Ongaku No Tomo Sha Corp., 1968). Ishii did not include an explanation of them in *Thirteen Drums* but in the score of *Zone* for Piano-Percussion.
The use of rolls is more legato compared to the articulated attacks of the sixteenth note in previous sections. In Phrase TI-2, rolls are applied on mid-register drums: 7-6-8-5-7-6. High-register drums are used in Phrase TI-3: 3-2-4-1-3-2. Phrase TI-4 are repeated half-note rolls on drum 5. The starting points of the rolls (in general, it is called the attack of the roll) are accentuated. This is the first appearance of this sonority.

At the end of Section B, the tempo has a marked quarter note of 60bpm. At this tempo, a performer will have a smooth movement between drums to avoid the accented attack of the roll, especially in soft dynamics. The dashed slurs confirm the “legato” effect wanted by the composer.

The dynamics range from \textit{pp} to \textit{sf} and \textit{ff}. However, in the passages of \textit{ff}, smaller drums are chosen and are played with fingers. Using fingers on these drums produces softer attacks and a mellower sonority of rolls compared to using sticks or mallets. Moreover, the chosen drums are smaller so the volumes in passages of \textit{ff} actually sound like they are in the dynamics of \textit{mf} or \textit{f}. Consequently, the whole Transition I has a much less intense dynamic.

Although the pulse of the quarter note may be perceived and kept in Phrases TI-2, TI-3, and TI-4, it feels as if it is lacking forward motion in Transition I. The main reason is because the shortest notated duration of the rhythmic figure is a quarter note with a rate of about 60 bpm. This is considered slower in the tempo envelope as the sense of entrainment is very weak. The musical time seems suspended.

From the features discussed above, the music in Transition I is perceived as less intense, less active, and legato. Therefore, when compared to previous sections, the experience of this whole section is smooth and tranquil.
Section C

The music of Section C starts at [L15 P5]. This section includes two variations of the rhythmic scheme: C1 and C2 (example 5-5). The structural scheme is similar to the alterations that occurred in the passages of B2. The use of rolls happens at the temporal intervals of six consecutive sixteenth notes between accented figures of flams, in which intervals occur during the accent patterns of ③&④, ⑥&⑦, and ⑨&⑩. Originally, the duration of six sixteenth notes combined is a dotted quarter-note. Ishii doubles the durations so a dotted half-note is represented. The thirteenth figure of Phrase C1 is a larger group of nine grace-notes.

The feature of the rolls’ extension is carried through Phrase C2 but in a more complicated manner. In the musical example 5-5, it shows the comparison between Phrase C2 to the original rhythmic scheme. Combined durations of sixteenth notes happen during the accent patterns of ①&②, ③&④, ⑥&⑦, and ⑨&⑩ and like in Phrase C1, the durations are extended. However, the presentation of each extended-duration is different: rolls on one or two or multiple drums. Notations of large groups of grace-notes can be interpreted as rolls on multiple drums.

Another important feature of Phrase C2 is that accented sixteenth notes of the rhythmic scheme are played on the bass drum (the thirteenth drum in the score). The remaining non-accented notes of the rhythmic scheme that are not combined together are replaced by different figures such as a sixteenth note, a sixteenth rest, a flame, single sixteenth-note ornamented with two to four grace-notes, and rolls on sixteenth notes (please refer to example 5-5).

Variations of Phrases C1 and C2 create contrasting textures. Phrase C1 contains rests and most of this passage is played with fingers until the last figure of flams and the group of grace-notes. Most of the drums range from small to medium in size. In Phrase C1, every spot of a sixteenth note is filled with a figure except in one place (marked with * in the score). The
accented notes in the original rhythmic scheme are placed on the only bass drum, which produced a heavy and weighted quality of sound that makes it stand out in the passage. The whole passage is played with mallets or sticks. The various segments of rolls in Phrase C2 produce much more volume than that produced by the rolls on the single drum. The dynamic in Phrase C2 is raised by a level (sff to sfff).

Phrase C1 is the return of the rhythmic scheme. It breaks up the smooth atmosphere in Transition I by reintroducing the articulation of staccato and the isolation between events. In Phrase C2, activities filled up the silence in Phrase C. Along with the other features discussed above, the impact is very powerful and intense. The musical tension is again pushed to a high level.

Section A'

A pervasive feature of Section A, characterized by consecutive sixteenth notes, returns after the forceful ten-second rolls at the end of Section C. The segments marked earlier as A1, A2, and A3 appear again but in different order (please refer to examples 5-2 and 5-6). Section A' is divided into 5 parts. Each section is marked by the shifts of texture and tension which will soon be discussed. The shift of texture and tension in each part is achieved mainly through the shapes of dynamics, the manipulation of tempo (accelerando and ritardando), and the thirteenth figure of the original rhythmic scheme. The chart (Table 5-2) shows the formation of each part. It indicates the segments corresponding to materials taken from Section A.

According to Table 5-2, the basic formation of each part is \{(A1) + A2 + A3 +thirteenth figure\} and each part is separated by the new “thirteenth figure.” The thirteenth figure of the original rhythmic scheme is a group of grace-notes. In Section A', it is replaced by
rolls on drums lasting in various length of seconds. The new design of the thirteenth figure is longer in length and serves as a cue of boundary for chunking like the old one.

Table 5-2. Structure of parts in Section A’

<table>
<thead>
<tr>
<th>Part</th>
<th>Formation</th>
<th>New 13th Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A' 1</td>
<td>A1 + A2 + A2 + A3-2</td>
<td>√ (8&quot;)</td>
</tr>
<tr>
<td>A' 2</td>
<td>A2 + A3-4</td>
<td>√ (7&quot;)</td>
</tr>
<tr>
<td>A' 3</td>
<td>A2 + A3-5</td>
<td>√ (5&quot;)</td>
</tr>
<tr>
<td>A' 4</td>
<td>A2 + A3-6</td>
<td>√ (2&quot;)</td>
</tr>
<tr>
<td>A’ 5</td>
<td>A3-7 + A3-7 (broken)</td>
<td>--------</td>
</tr>
</tbody>
</table>

The clear representation of material of A1 is only in the first part. However, during the end of the last roll of the thirteenth figure, Ishii gives an indication to slow down the speed of roll, slowing down the rate of the hand-to-hand motion for performers. When the rate of hand-to-hand motion slows down, the strokes happening in a temporal interval reduce. According to the range of temporal perception which is discussed in Chapter III, the event that is above 100 ms is heard as an individual sound. At this point, the rolls actually lose the quality of sustaining sound, and the timing of sixteenth notes (by what’s notated in the score) is set. Toward the end of the thirteenth figure, it resembles the material of A1 and the actual material of A1 is then replaced.

The variation of the rhythmic scheme of A2 introduces some new design. A new performance technique of dead strokes, notated with a cross on a note head, is employed in the passages of A2 on the timing of the accented sixteenth-note in the original rhythmic scheme. To perform a dead stroke, a performer lets the stick stay on the drum head after striking to stop the resonance from the drum head. This produces a sound that is shorter and dryer than that played by a normal stroke. This particular technique creates a different timbre from the drum. Ishii only uses this technique in softer dynamics in Sections A’ and B’.
Example 5-6. Section A' from [2/4 L16 P6] to [3/4 L26 P9], *Thirteen Drums*
Another feature is in the melodic design. In the material of A2 of the first and second parts, drums used on the timing of the accented sixteenth-note in the original rhythmic scheme are 11-2-9-7-4-1-12-6-3-8-10-13. But in the third and fourth parts, those notes are played on drums 2-11-4-6-9-12-1-7-10-5-3-13. The later melody is the “inversion” of the previous melody:

\[
\begin{array}{cccccccccccc}
11 & 2 & 9 & 7 & 4 & 1 & 12 & 6 & 3 & 8 & 10 & 13 \\
+ & 2 & 11 & 4 & 6 & 9 & 12 & 1 & 7 & 10 & 5 & 3 & 13 \\
13 & 13 & 13 & 13 & 13 & 13 & 13 & 13 & 13 & 13 & 13 & 13 & --- \\
\end{array}
\]

The design of dynamics and tempo in Section A’ is also in a specific plan. Each part starts slower and in a lower dynamic level. As the passage develops, the dynamics and the speed gradually increase (indicated as \textit{poco a poco accel. e cresc} in the score) until the material of A3 is presented. During the thirteenth figure after A3, the volume and speed both drop to a slower and lower level.

The building up of dynamics and tempo does not only happen during each part but also during the whole section of A’. Each part starts and ends in a faster tempo compared to the previous part and dynamically, each part starts and ends stronger. When the tempo and dynamics increase, the materials of A3 are more complicated (comparing A3-2 to A3-7) and the periodicities of the thirteenth figure are reduced.

Toward the end of part 5, the material of A3-7 is repeated but is broken into segments and separated by quarter rests. The segments consist of different amounts of accent patterns of A3. It starts with three patterns and then reduces to one. The number of rests between the segments goes from one, then increases to four, and finally reduces to two. The reducing numbers of activities and separation of rests create a “liquidation” effect that makes a smooth transition into the texture of Section B’.
The perception of the materials’ musical time has been discussed in Section A. Materials of A1 and A2 establish a sense of pulse but the material of A3 destroys it because of the added ornamentations (grace notes) and increasing tempo. According to the discussion above, in Section A’, the stretch of tempo also elevates the rhythmic complexity, which affects the aesthetic experience of time.

The buildup of tension and intensity in Section A is a long process, with the climax reached at the end. The overall effect in Section A’ follows the diagram. Nonetheless, each part in Section A’ proceeds as an organism in which the tension and intensity on each part builds up and then resolves itself.

Section B’

Following the liquidation of ornamented accent patterns, the music in Section B’ unfolds in the technique of variation from materials of B1. The tempo is marked as a quarter note that equals about 66 bpm, a much slower tempo than that of the music in Section B. By doing so, Ishii makes the transition between Sections A’ and B’ much smoother than the transition between Sections A and B. Because the temporal rate of sixteenth notes for the material of A3-7, for Ishii’s preference, is very fast during the liquidation of A3-7, accent patterns and quarter rests are set up for the texture of Section B’.

The musical example 5-7 shows the formation of variation of the rhythmic scheme in Section B’. Non-accented sixteenth notes are replaced by rests and a quarter rest is inserted between each accent pattern (in the middle of [L28 P10], there are two quarter rests). There is no thirteenth figure, but two drums played in the last accent pattern are 6 and 7 (13!). This formation of the varied rhythmic scheme is repeated again from [4/4 L27 P9] to [3/4 L28 P10]. A
new cycle of the rhythmic scheme begins at [4/4 L28 P10], and is interrupted by the rolls entering at [1/4 L29 L10]. This shift of texture is the beginning of Transition II.

Example 5-7. Section B' and Transition II, [4/4 L26 P9] to [2/4 L30 P10], *Thirteen Drums*
Dynamically, Section B' starts in dynamics \textit{sfff} and then gradually gets soft as the music unfolds. Dead strokes are used on some attacks in the repeat of the variation. The speed in this section starts at quarter note as 66 bpm and slows down with the dynamic level dropping.

The effect in Section B' is similar to that in Section B. All the articulated sixteenth notes in the original rhythmic scheme are replaced by rests with only the accented notes left. The tracking on the timing of sixteenth rests is impossible for listeners, especially when the tempo is already slow and then slows down more. Unlike Section B, there is no use of the roll to fill up the silenced time span. Thus, in Section B', the silence between articulated notes is much longer than in Section B. The energy level decreases significantly and no sense of motion is perceived. The perception of time seems lost.

Transition II

The materials in Transition II are very different from what is in Transition I. Based on the texture, Transition II consists of two parts. The first part starts with a roll that leads to accent patterns. The accent patterns are the continued figures of the cycle of the rhythmic scheme that started at the end of Section B': patterns, ⑤, ⑥, ⑦, ⑧, ⑨ (please refer to example 5-7). The accent patterns are broken up by dotted half-notes with \textit{crescendo}. The accented notes are played on drums 1 and 2 together.

The second part begins in the middle of [L29 P10]. The materials are the remaining accent patterns of the rhythmic scheme's cycle but in mixed order: ⑦, ⑧, ⑨, ⑩, ⑪, ⑫. These accent patterns are in new forms: the non-accented sixteenth notes, which were replaced by rests, are now \textit{all} changed to rolls (marked with ⚫ in example 5-7). These new forms of accented patterns are kept and become the feature in the following section.
The new forms of accent patterns are played on drums 1 and 2 (one drum is for the rolls and the other is for the accented note). Ishii introduces them in loud dynamics (ff, sff). After the accented patterns, the thirteenth figure comes in two figures of eight-note triplets followed by a dotted half-note roll. Similar material is repeated but in different levels of dynamics and speed. A prolonged roll marked by long fermata concludes this section.

From the discussed information, Transition II is another variation of the original rhythmic scheme. In this variation, two techniques are used: the old technique from B and the new technique that is dominant in Section C. Unlike the characteristics in Transition I, smooth, less intense, and lacking movements, music in Transition II is more energetic, intense, and contains various textures.

Section C'

According to the formation of the rhythmic scheme’s variations, Section C' can be divided in three parts (C'1, C'2, and C'3, example 5-8). Each part can be separated into segments. The cues of boundaries for chunking are groups of grace-notes. In parts of C'1 and C'2, each represents a complete variation of the rhythmic scheme.

The new variation technique of accent patterns is discussed in the previous section. The formation of each segment in C'1 is repeated in accent patterns (three times or two times) and followed by a group of grace-notes. There are total 11 segments. Every three consecutive segments can be grouped together as a phrase because of the special arrangement of dynamics and group of grace-notes.
Example 5-8. Section C' from [2/4 L30 P10] to [L37 P13], *Thirteen Drums*
In the excerpt of example 5-8, the accent patterns are repeated: segments 1, 2 and 3 are the same; 4, 5 and 6 are the same, so are 10 and 11. Each segment contains three continuous accent-patterns from the original rhythmic scheme. In comparing the accent patterns grouped in each segment, a new formation then arises.

Accent patterns ②, ③, ④ have the same rhythmic patterns as patterns ⑤, ⑥, ⑦; accent patterns, ⑥, ⑦, ⑧ are the same as patterns ⑨, ⑩, ⑪. The relation of this formation to the original rhythmic scheme is in the following example (example 5-9):

Example 5-9. Formation of the variation technique in Section C'

Segments 1, 2, 4, 5, 8 are the rolls and accented notes staying on one drum and followed by a group of grace-notes on drums: 2-3-4-1-5-6. This combination of drums was already used on the figures of eighth-note triplets in the second part of Transition II (example 5-7, at [4/4 L29 P10]). Accent patterns of segments of 3, 6, 7, and 9 are played on two drums (rolls on one drum and accents on the other). The group of grace notes followed these segments are 1-2-1-3-2-3-4-3, which was seen on the figures of eighth-note triplets at the end of Transition II (example 5-8, at [1/4 L30 P10]).

In segments 10 and 11, more drums are involved in the accent patterns that are only

---

110 Circled numbers are correspondent to the accent patterns in the original rhythmic scheme.
played two times and the dynamics increase gradually. The groups of grace notes are in a new combination. The second part of C'2 enters after the eleventh segment of C'1. The variation technique of materials used in the part of C'2 is the same as C'1 with a few adjustments. There are five segments in C'2. The musical example 5-8 shows the structure and formation corresponding to the original rhythmic scheme.

The melodic shape created in C'2 is moving up-and-down in a step-wise motion. This shape is represented in the small portions (C'2-1 for example) at the beginning of each segment and then is used between portions (C'2-4 for example) and the whole segment (C'2-5). In the segment of C'2-5, it starts in the second-lowest drum, then gradually moves up. The pedaled bass drum concludes the step-wise motion. A large group of grace-notes played on top-nine drums follows in a random order and this group lasts for seven seconds. After that, another group of grace-notes comes in sfff and with tremendous crescendo. This group is the last appearance of grace notes and leads to the powerful final statement (C’3) in Thirteen Drums. In this final statement, rolls and accented notes are played on drum 5 and quarter-notes are consistently repeated on drum 13. The repeated figures on drum 5 are the first and second accent patterns of the original rhythmic scheme.

In the new variation technique, rolls replacing the articulated sixteenth-notes or rests become the new “background” of the accented notes in the original rhythmic scheme. Although rolls are heard and are the opposite of rests (silence), they do not project a clear sense of pulse as articulated sixteenth notes do. However, the attack of rolls does give a cue of down beats, especially during drum changing. Thus a sense of pulse may be perceived in some passages such as segments of C'2. Nevertheless, most of the time, the accents, and, sometimes, fast-moving ‘melody’ obscures the sense of pulse even during drum changing.
Based on the information in parts 1 and 2 of Section C’, the rhythmic structure in the score is not easily recognizable by aural experience. The perception of musical time is obscured until the final statement. In the final statement, a strong pulse of a quarter note is repeated in the bass drum. Another consistent rhythmic pattern is played against it. Together, both active rhythmic streams establish a solid metric frame of 2/4. The times of repetitions of this material are open to the performer’s decision.

From Ishii’s compositional concept, the core of Thirteen Drums evolves two opposite ideas: determinacy and indeterminacy. Ishii again confirms this concept with the final statement: determinacy in rhythmic design but indeterminacy in duration.

The Multi-Characteristic Rhythmic Scheme and Aesthetic Experience

The analysis of the rhythmic structure above provides detailed information about how the aesthetic experience is influenced by the texture, intensity, and rhythmic tension in Thirteen Drums. The various effects are based on the different variation techniques of the rhythmic scheme. Although not all the variations of the rhythmic scheme are recognizable and the rhythmic structure is obscured most of the time, it is the design of the rhythmic scheme that is fundamental to the formal structure and connects each section as a whole.

As discussed in the first chapter, the feature of Ishii’s music is the co-existence of multi-temporal layers—the dynamic and static layers. The structure of Thirteen Drums’s rhythmic scheme contains both characteristics of temporal layers. The repeated sixteenth notes are the static layer, and the accents represent the dynamic layer, as does the thirteenth figure. Solid evidence of the temporal space between both temporal layers is shown in Section A3. Ishii demonstrates this temporal space by adding grace-notes to the accented note. The number of
grace-notes existing in the temporal space increases gradually, as does the speed and dynamics. The dynamic temporal layer becomes obscured and loses its characteristic to static effect. At the end of Section A, both the dynamic layer and static layer are unified as oneness (this is also an important feature of Ishii’s musical structure). The same structural design occurs in other sections. The variations of the rhythmic scheme preserve the characteristics of dynamic and static temporal layers. The static sound is substituted by silence and sustained sound (rolls).

The formal structure in *Thirteen Drums* also represents the feature of Ishii’s formal design. Music in Sections A and A’ is of the dramatic form and is strongly directional. In Sections B, B’, and C, the characteristics of static form dominate. In Section C’, the characteristics from dramatic form and static form begin to unify. The repetition of segments represents the dynamic accented patterns taken from the original scheme mixed with the characteristic of static form, the repetition. The quick change on the segments’ different drums adds melodic diversity to the static nature of rolling on a single drum. Characteristics of the dramatic form and static form are blended. The increasing dynamics and speed intensify the aggregation of the different forms. The total synchronization of both dramatic and static forms concludes *Thirteen Drums* with indeterminate repetitions.
CHAPTER VI
ANALYSIS OF TEMPORALITY IN THE RHYTHMIC STRUCTURE OF REBOND A

Unlike Thirteen Drums, a pre-composed structure is not verified in Rebond A. Nevertheless, many scholars have agreed that the development of this composition lies in the changes of density between the two sixteenth notes introduced at the very beginning (example 4-1b). The opening statement, a simple rhythmic figure of two consecutive sixteenth notes assigned individually to the highest bongo and the large bass drum, is the core of the composition. The development of Rebond A evolves through the density of the time span (temporal interval) between those notes. The amount and complexity of rhythms occurring in this time span determines the temporal density.

James Harley described Rebonds: “This is less utopian than Psappha in its demands, but is, like the earlier work, a study in regularity and irregularity—of pulse, pattern, and form.”

Just as Harley stated, the regularity and irregularity of the drums’ register, polyrhythm, and various subdivisions of duration affect the pulse, rhythmic figures, and formal structure. The continuously-mutating and irregular rhythms oscillating between drums obscure the boundaries for chunking and also affect the perception of rhythmic groupings and the perception of periodicities. Therefore, the formal structure is more difficult to perceive and understand.

Compared to Thirteen Drums, the timing of rhythms in Rebond A is precisely written but the irregularity influences the perception of time. The rhythmic irregularities are caused by phenomenal accents, complex subdivisions, and polyrhythms. The aesthetic experience of Rebond A is especially tied to the “rhythmic tension” created by the change of density and irregularity of rhythms.

111 Harley, 192.
Formal Structures

The changes of density, already discussed in Chapter IV, are achieved through the features of rhythmic structure: the register of drums, polyrhythms, accents, and various subdivisions of duration. According to the change of density and the features of rhythmic structure, Schick roughly divides *Rebond A* into six sections.\(^{112}\) In this dissertation, the formal analysis is based on Schick’s identification of structure. Details in each section are examined through the features of rhythmic structure discussed earlier in Chapter IV and rhythmic groupings according to the proximity, similarity, and continuity, which are discussed in Chapter III. Table 6-1 demonstrates the adjusted formal structure for *Rebond A*:\(^{113}\)

Table 6-1. Formal structure of *Rebond A*

<table>
<thead>
<tr>
<th>Section#</th>
<th>Location in the score</th>
<th>Length (Approximate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measure 1, Beats 1-3</td>
<td>12 sixteenth-notes</td>
</tr>
<tr>
<td>2</td>
<td>Measure 1, Beat 4 ~ Measure 6, Beat2</td>
<td>76</td>
</tr>
<tr>
<td>3</td>
<td>Measure 6, Beat 3 ~ Measure 28</td>
<td>360</td>
</tr>
<tr>
<td>4</td>
<td>Measure 29 ~ Measure 36, Beat1</td>
<td>115</td>
</tr>
<tr>
<td>5</td>
<td>Measure 36, Beat1 ~ Measure 51</td>
<td>255.5</td>
</tr>
<tr>
<td>6</td>
<td>Measure 52 ~ The End</td>
<td>141.5</td>
</tr>
</tbody>
</table>

This formal structure only provides an approximate boundary between each section. Note that bar-lines and notated rhythmic groupings are for learning purposes discussed in Chapter IV. The numbering system for measures and beats used in this analysis are for convenience of communication.

---

\(^{112}\) Schick, 211-212.

\(^{113}\) Schick, 211.
Density Analysis of Rhythmic Structure

Section 1: Measure 1, Beats 1-3

Example 6-1. Section 1, beats 1-3 in m.1, Rebond A

Schick calls this section the “declamation.” The beginning two sixteenth notes (two-note grouping), one on high bongo and the other on the large bass drum, are the core of the entire piece (example 6-1). The repeated rhythmic figures are separated by eighth rests and set up the pulse of the eighth note or the sixteenth note and a sense of entrainment is established.

The tempo marked in the score shows that the quarter note equals 40 bpm and is kept all the way to the end. If a performance starts in this tempo in the beginning, the pulse of the eighth note will be 80 bpm and will fall into the range of 80~120 bpm (in which the pulse is easier to establish). However, in cases of practice, due to the increasing rhythmic complex, some performers play this piece at a slower tempo between 30 bpm and 40 bpm. In this temporal envelope, an eighth note is between 60 bpm and 80 bpm and a sixteenth note is between 120 bpm and 160 bpm. The sense of pulse may then move toward the duration of the sixteenth note and will affect the discrimination of phrases and sections.

In this dissertation, the analysis is based on the tempo of the 40 bpm quarter note as marked. Therefore, a pulse of an eighth note is set at the beginning but not for long. In the following section, the pulse is adjusted to the duration of the sixteenth note and is likely to be maintained throughout Rebond A. Reasons will be revealed in the discussion of each section.
Section 2: Measure 1, Beat 4 ~ Measure 6, Beat 2

Example 6-2: Beat 1 in m. 1 ~ Beat 2 in m. 6, Section 2, *Rebond A*

New drums are gradually introduced from low to high register after each core figure (example 6-2). The rhythmic figure that was in two-note grouping becomes three-note grouping. On beat 2 in m. 3 when the high bongo is reached, the drums’ register decreases until the last three-note figure on the upbeat of beat 4 in the next measure. In three-note groups of decreasing drum size, the core is moved to the second and third spots of the figure and the large bass drum is played before the high bongo.

The figure of a four-note grouping starts in the last sixteenth note on beat 1 in m. 5. Unlike chunking cues for groupings of two notes or three notes, each figure is separated by the silence of an eighth note’s time interval. The cue of chunking boundaries is the rest; its cue for the four-note grouping is the ‘melodic’ element. The figure of a four-note grouping has drums of ascending and descending indefinite-pitches (example 6-2) inserted between the lowest and highest drums. The large bass drum gives the impression of the grouping’s beginning.

The pulse of an eighth note or a sixteenth note was established in the first appearance of the core (example 6-1). However, starting in three-note groups, the pulse as eighth notes is interrupted. In the discussion earlier in Chapter IV, the pulse is now changed to be felt as an
sixteenth note or as odd meter as 5/16 (example 4-7a).

During the first appearance of a four-note grouping, the metric sense of 5/16 is kept. But starting at the second four-note figure, the 5/16 metric frame is hindered, and the metric frame of 4/16 is perceived because of the melodic quality and the pulse of sixteenth note. The phenomenal accents in this section do not disturb the perception of the proposed metric frame but increase the complexity of rhythmic structure.

Section 3: Measure 6, Beat 3 ~ Measure 28

The complexity of rhythmic figures and the rhythmic structure’s density start to increase in this section. According to the texture and the motivic materials in the rhythmic structure, there are four parts in Section 3. Part 1 starts from the beginning of this section. Part 2 enters on beat 3 in m. 15 when a motivic material is played on bongos. Another piece of motivic material played on beat 4 in m. 19 begins Part 3. Part 4 starts at the first large bass drum with a single accent in m. 25.

In Part 1 (example 6-3), new rhythmic figures of different durations, sixteenth-note triplets, and thirty-second notes are introduced, and the first appearance of polyrhythm occurs on beat 3 in m. 6. Each new rhythmic figure represents the evidence of increasing density: the former is achieved horizontally through subdivisions of beat and the latter is done vertically through polyrhythm. The ratio of the only polyrhythm in Part 1 is 2:3 (two sixteenth-notes against a sixteenth-note triplet).

The pulse is possibly perceived as the eighth note and sixteenth note in Part 1. Nonetheless, the rhythms seem random and incoherent. Mutations of rhythms are irregular and there are no perceived patterns. Most of the time, the single accents appear every four or five
sixteenth-notes, so a metric sense of 4/16 (2/8) or 5/16 may be perceived.\textsuperscript{114} This metric sense is not as evident as that in previous sections because the melodic quality does not support it and due to the interruption created by polyrhythm. Therefore, the cues for rhythmic grouping are ambiguous and the chunking ability of rhythmic figures and phrases are low. The rhythmic structure is not as intelligible as previous sections.

Example 6-3. Section 3, Part 1 in \textit{Rebond A}

\textsuperscript{114} In the marked tempo of quarter note as 40 bpm (1500 ms), a thirty-second note is 188 ms, which is too fast to be perceived as pulse.
In Part 2, the rhythmic structure is organized around a motivic material. Although this motivic material is not represented in the same rhythmic pattern every time, it still stands out because of its melodic quality and rhythmic formation. The example 6-4 shows the construction of this part.

Example 6-4. Section 3, Part 2 in *Rebond A*

The motivic material occurs nine times and oscillates between bongos, producing a high and penetrating sound quality. Following this motivic material is the large bass drum (the lowest drum) that creates a distinctive contrasting sound from the bongos. Thus, this motivic material stands out in the aural experience even when it is in the texture of polyrhythms. The new ratios of polyrhythms are represented: 2:3 (two thirty-second notes against a thirty-second-note triplet) and 4:3 (four thirty-second notes against a sixteenth-note triplet). Sixty-fourth notes, a new subdivision of the beat, are introduced on beat 1 m. 17.

Rhythmic figures used in the motivic material are mostly in total duration of three
sixteenth-notes but arranged in different formations containing various subdivisions of the beat. The beat here is referred to as the duration of the sixteenth note. Between each appearance of the motivic material are various figures of sixteenth notes. The density achieved in the motivic material is higher than single sixteenth notes because of the more complex subdivisions that are mixed with duple or triple ratios and the polyphonic texture.

Example 6-5. Section 3, Part 3 in *Rebond A*

In Part 3 of Section 3, the motivic material of total duration of three sixteenth-notes continues. However, it is not placed on the bongos (which represent the high register of drums in *Rebond A*); instead, it occurs in the middle register (tom-toms) and mostly in the low register.
(lowest tom and two bass drums). Each piece of motivic material is separated by the three-note grouping with a few exceptions (please refer to example 6-5). The drums used for the three-note grouping create a melodic shape, high (descending to middle range) to low-high, which is distinct for an aural experience.

The three-note grouping breaks the continuity of the motivic material. According to its diverse formation, it may affect the discrimination of periodicities. The formation of the three-note grouping is one eighth note and two sixteenth notes at the end of m.19 and then the eighth note is replaced by a sixteenth-note triplet. Starting in the second half of m. 21, the eighth note is replaced by a sixteenth-note and this formation is kept until m. 24. The figure of an eighth note (or other rhythms) creates a pause or extension of duration compared to a single sixteenth note. Therefore, part of the three-note figure may be interpreted as the continuation of the motivic material or a beginning of a phrase with the motivic figure concluding it. Similar functions are the addition of single accents.

Starting in the middle of m. 24, the formation of the three-note grouping is unstable. On beat 1 in m. 25, an accented sixteenth-note is introduced on the large bass drum and begins Part 4 of Section 3. This single sixteenth-note on the large bass drum breaks the continuously mutating rhythms just like the three-note grouping in Part 3 and later is extended into a three-note group played between two bass drums. In Part 4, the total duration of the motivic material is expanded into multiple beats: it is seven and five sixteenth notes; later it is consistently six sixteenth notes which is the original duration’s double of the motivic figure (example 6-6).

In Part 4, the extended motivic material is mostly played on tom-toms (mid-register). In passages of polyrhythm, opposing rhythms played on bongos and two bass drums where the melodic quality is in contrast to mutating rhythms of the motivic material. The motivic material
of the six-sixteenth-note period can also be divided into 3+3 according to the melodic quality.

Example 6-6. Section 3, Part 4 in *Rebond A*

In Section 3, according to the texture and motivic materials in the rhythmic structure discussed above, the complexity of rhythmic figures and the density of rhythmic structure increase gradually. The discrimination of periodicities is possibly perceived but is also obscured by the irregularly mutating rhythms, the melodic quality, accents and the polyrhythm. A sense of pulse is perceived but metric sense is unstable or absent. Therefore, the sense of entrainment is weak. The rhythmic structure is not intelligible for aural experience.

Section 4: Measure 29 ~ Measure 36, Beat1

The characteristic of continuously-mutating rhythms from the previous section is preserved and becomes the main feature of Section 4 (example 6-7). Schick called this section
“linear” since the density of texture is achieved through the linear transformation of rhythms by subdivisions of the beat. From beat 1 in m. 29, the noted values are thirty-second notes or shorter until beat 1 in m. 34 where a double-accented sixteenth note on the high bongo appears. This passage is mostly played on drums in the high and mainly middle registers, avoiding the lower bass drum which only appears once in m. 32 during the polyrhythm. The polyrhythm only appears three times in this passage.

Example 6-7. Section 4 in *Rebond A*
The single sixteenth note with a double accent concludes the linear passage. Starting in beat 1 in m. 34, the linear mutating rhythms are interrupted by one or more sixteenth notes, a situation that is similar to one in Section 3. Accents (single or double) are added to the first single sixteenth note(s) when they occur. In the passage between the sixteenth notes, the total duration of the mutating rhythms is in the order of short (3 sixteenth notes)-long (5 sixteenth notes)-short (3)-long (6)-short (4). During the short passages, drums in the high register are used, and in the long passages, drums of middle and low registers are chosen. The contrast of melodic quality between linear passages becomes the main characteristic of the next section.

Two subdivisions of quintuplets are introduced in Section 4: thirty-second-note quintuplet and sixty-fourth-note quintuplet. The sixty-fourth-note quintuplet provides the shortest time interval (75 ms) in Rebond A. The sixty-fourth-note quintuplet happens at the end of m. 35 and it enhances the ‘long’ duration of the eighth note occurring in the beginning of the next measure. This eighth note is important because it is in contrast to the continuous mutating rhythms of sixteenth-note subdivisions. It is also perceived as a ‘long’ break since the last appearance at the end of m. 22.

In Section 4, the pulse is based on the sixteenth note. However, it is sometimes obscured by the constantly changing rhythms from subdivisions of different ratios (especially during the passage without a single sixteenth-note). The phenomenal accents and melodic quality do not synchronize to give cues of boundaries for chunking. The first recognizable cue is not represented until the upbeat on beat 1 in m. 34. Due to the high complexity of rhythmic grouping and low chunking ability, the discrimination of periodicities is harder to perform and thus the rhythmic structure is difficult to understand.
Section 5: Measure 36, Beat 1 ~ Measure 51

The density and intensity gradually increases and reaches the climax toward the end of this section through several aspects: subdivisions, melodic quality, polyrhythm and accents. The music in Section 5 can be divided into three parts according to the rhythms and melodic quality.

There are two main contours of the melodic quality: rhythmic figures repeating on single drums and rhythmic figures oscillating between drums. The rhythmic figures repeating on single drums are single sixteenth notes, or duple subdivisions (type 1); the subdivisions used in the rhythmic figures oscillating between drums will include triple divisions (type 2). The second type of rhythmic figures is inherited from the linear mutating rhythms. The musical example 6-8 shows the materials of type 1 and type 2. The development in all three parts is based on the alternation of these distinct types of rhythmic figures.

Example 6-8. Two featured rhythmic figures in Section 5, Type 1 and Type 2

In Part 1 (example 6-9), the rhythmic figures of type 2 are played in the higher register of drums and then moved down to the lower register of drums. The periodicity of the linear mutating rhythms is in different lengths but is regulated in the total duration of three sixteenth-notes on the last beat in m. 39. The polyrhythm of ratio 4:3 sometimes occurs in the linear mutating rhythms.

The rhythmic figures of type 1 consist of various numbers of sixteenth-note duration. The grouping of type 1 starts with a single or double accent on drum 4 or 5 (the high bongo is counted as drum 1 and counted down to the large bass drum as drum 7). Other accents are
considered as phenomenal accents and they add to the complexity of rhythmic structure.

Example 6-9. Section 5, Part 1 in *Rebond A*

The choice of drums for the rhythmic figures of type 1 is in a special order that gives a structural cue for chunking. Starting with the first accented note, the order of drums is [513], [413], [4132], [51324], [5142], [51424], [51325], [41325], [4124], and the last one [41243] is before the entrance of the lower bass drum with a double accent. The similar melodic quality of each combination and the duple rhythmic quality stand out for the aural perception in comparison with the rhythmic figures of type 2.
The transformation in both types of rhythmic figures in Part 2 is similar to that in Part 1. However, there are two important features in Part 2 that set it apart from Part 1: the large bass drum with a double accent and increasing use of accents (example 6-10). The large bass drum with a double accent is repeated twelve times and serves as a chunking cue for the discrimination of periodicity. Before the appearance of the seventh double accented bass drum, the passages between each double accent contain the duration of a total of eight sixteenth-notes. In these passages, the rhythmic figures of type 1 remain the length of three sixteenth-notes. The drums
used in the type-1-rhythmic figures, including the double accented bass drum, are in similar orders of \([741253], [751362], [751312], [751413], \) and \([751624]\). The fourth drum in each order descends to 7 after the seventh double accent.

After the seventh double accent, the passages are in various lengths and then are set to the periodicity of a total of seven sixteenth-notes. The accents reach their most dense form from the seventh double accent to the eighth one (example 6-10). The drums used in this segment are \([7517]\), which become the melodic cue for chunking boundaries. In the passage between the tenth and eleventh double accents, the rhythmic figures of type 2 disappear. In each rhythmic figure, the subdivisions of each single sixteenth-note are played on a single drum. In the same passage, the order of the drum, \([75174152]\), is later changed to \([75174162]\). The order of \([75174162]\) and the discussed rhythmic feature in this passage become the “skeleton” for Part 3.

Example 6-11. Section 5, P3 in Rebound A

In mm. 49-50 in Part 3, the music reaches its climax through the aggregation of high densities of different elements: subdivisions, melodic quality, polyrhythm, and accents. There are four passages of the same design in mm. 49-50: the skeleton from Part 3 and is ornamented with
polyrhythm in ratio of 4:3 oscillating between drums (example 6-11). In m. 51, the two-note figure from the core introduced in the very beginning is reconfirmed. The interval between the high bongo and the lower bass drum is gradually stretched in this measure. This creates an impression of *rallentando* that commonly appears as a structural closure at the end of a phrase or a piece.

**Section 6: Measure 52 – the End**

As discussed in the previous section, the end of m. 51 feels like the ending of *Rebond A*. The music afterwards is the recollection, as Schick calls it, of the core in this piece. So Section 6 is the coda in the formal structure (example 6-12).

Continuing the low density and the entrainment to the core from the end of the previous section, a note on the large bass drum followed by long silence is expected after the dotted sixteenth note on the high bongo (example 6-8). The sixteenth note on the large drum occurs as expected but a passage of high density intrudes the silence. The expected silence is then filled up with subdivisions of beat and polyrhythms. The temporal density and the time interval between the two notes of the core are increased by the mutating rhythms as well as the register of drums.

The figure played on the large bass drum is followed by a long silence exactly as expected; it actually occurs in m. 54 where a single quarter note is. On beat 4 in m. 54, the figure of the flam between the large bass drum and the high bongo represents the shortest time interval of the core (the timing on the high bongo and the large bass drum is never together). The figure of the flam is repeated five times straight and each is in every three sixteenth-note apart. Dynamically, it starts in **fff** on the second flam and gradually gets softer (dim.) till it reaches the dynamics of **p**.
Following is a long silence until repeated figures occur on the large bass drum. The figure of a flam reappears twice in dynamics of $f$ with a single accent, and between each appearance, a long silence with a few notes is played on the large bass drum in dynamics of $pp$. After the last occurrence of a flam is another long silence. A note placed on the large bass drum concludes Rebond A.

The passage from m. 55 to the end is reminiscent of the core material. The decreasing dynamics and increasing silence signify the resolving of high intensity and tension created by the high density of the rhythmic structure. Furthermore, as discussed in Chapter IV, the sense of pulse is lost during the long silence; so too is the perception of musical time. The impression of rallentando is better established than that in m. 51. This is the actual ending of Rebond A.
Rhythmic Tension and Xenakis’s Rhythmic Scheme

As discussed above, features in the rhythmic structure, pervasive use of irregular accents, melodic quality from oscillating on different drums, irregular mutation of rhythmic figures, and polyrhythm all contribute to the building up and releasing of rhythmic tension. The aesthetic experience of Rebound A is especially tied to the rhythmic tension created by the change of density and irregularity of rhythms. For Xenakis, the manipulation between simple and complex passages creates the aesthetic experience of tension buildup and release. 115

“Simple and complex” can be interpreted as “regular and irregular” in Rebound A. Although the components of rhythmic structures, rhythmic figures, accents, and choices of drums are in random designs, some forms of regularity are also found. For example, the core figures in m.1, recurring total periodicities of accent patterns and motivic passages, types of rhythmic figures, contrasting timbre in registers of drums, and melodic choices of drums that was discussed in the analysis of each section carry some ‘identities’ that are recognizable. Nonetheless, the original form of each identity is not preserved but changed by irregular patterns of accents, melodic quality, and subdivisions of beat. The regularity is therefore obscured by the irregularities.

“Change” is an important concept of Xenakis’s rhythmic scheme. 116 People entrain to regularities and when changes happen, the aural experience is shaken. When irregularities of several rhythmic components aggregate or accumulate, the regularity of the pattern from any component is then hard to follow, and at times, is lost. Xenakis understood that in order to spot changes formed by the irregularities a sense of pulse (metronomic beat or underbeat as he

---
115 Xenakis, “Concerning Time,” 90.
116 Ibid., 92.
described it) is required. Once a sense of pulse is established by a rhythmic pattern, he altered one or more of the rhythmic components to ‘shake’ the entrainment as well as the sense of musical time. So in *Rebond A*, a sense of pulse is perceived most of the time, and some metric senses could be experienced, but the rhythms seem distributed randomly because of the constant changes in the rhythmic structure. Therefore, the rhythmic structure is mostly unintelligible in *Rebond A*.

**Performance Interpretation and Musical Time**

Xenakis did not organize *Rebond A* in a metric framework. It is rhythmic but the structure is often unintelligible because of the irregularities that affect the perception of musical time. From the analysis provided, there are materials that serve as chunking cues for the formation of motives, phrases, and sections. Based on the information process theory provided in Chapter III, these materials are essential to the comprehension of the rhythmic structure as well as musical time.

The experience of listening to *Rebond A* is challenging as to the aspect of primitive rhythmic grouping. People may regard *Rebond A* as a piece of “free rhythms” because of its lack of tonal elements, a metrical frame and the irregularity of complex rhythms. For performers, it is important to help listeners grasp a composer’s intention and ideas in the work. Therefore, the performers’ interpretations are essential to the aesthetic experience and will influence the perception of musical time.

Here, the performers’ interpretations can add some expressive nuance that helps listeners capture the motivic materials and understand the formal structure especially the discrimination of periodicity. The expressive nuance happens through adding dynamic contours, adjusting the

---

117 Varga, 147.
intensity of accents, and creating layers of foreground/background. The nuance of interpretation needs to be made based on the rhythmic design discussed earlier in this chapter.

Materials in Part 3 of Section 3 are good examples (musical example 6-5). Two contrasting materials, figures of three-note grouping and linear mutating rhythms, are represented one after another. The three-note figure has various functions. If the figure itself is interpreted as an intrusive rhythm breaking the continuation of the mutating rhythms, a little dynamic adjustment of the different materials can be made. One of them could be emphasized more than the other without a significant dynamic change. Thus the discrimination of periodicity is perceived as three-beat units most of the time (sometimes four-beats). Another situation is that if the first note in the group is interpreted as the last note concluding the continuation from the mutating rhythmic figure, the perception of periodicity will be changed. The accents in this section are interpreted differently according to the situation a performer chooses.

The interpretation of polyrhythm also influences the aesthetic experience. Xenakis used polyrhythm to enrich sound and especially triplets against other note values (2:3, 4:3 for example).\footnote{118 Varga, 150.} His intention was also to enhance the perception of a particular pattern by introducing an opposing rhythm so the listener would “hold on” to the established pattern.

The discussion of polyrhythm in Chapter III stated that listeners could perceive polyrhythms as a composite rhythm or would grasp toward one of the coexisting rhythms. So when playing polyrhythms, a performer can choose to keep one voice stronger than the other or keep both voices at the same volume. Each interpretation has a different impact on aural experience. The polyrhythm first appears in Section 3 of \textit{Rebond} A and it is a sixteenth-note triplet imposed against two sixteenth-notes. This polyrhythm sometimes obscures boundaries the rhythmic groupings of four or five sixteenth notes which are based on accent patterns. The accent
patterns may form metric senses. If the triple is played under the duple sixteenth-note, the metric senses will be better preserved, allowing listeners to better follow the music.

It is not the purpose of this dissertation to judge what kind of interpretation is right or wrong but to point out the fact that performance interpretation will affect the perception of musical time and the aesthetic experience. Unlike the design of rhythmic structure in *Thirteen Drums*, the discrimination of periodicity of formal structure is not as transparent in *Rebond A*. Therefore, the performance interpretation of materials becomes crucial to the aesthetic experience of musical time.
CHAPTER VII
CONCLUSION

_Thirteen Drums_ and _Rebonds_ are classic representative works in solo repertoire for multiple-percussion. Each work demonstrates the composer’s concept of musical time. Ishii’s “multi-layered” temporal structure is presented in the rhythmic scheme in _Thirteen Drums_ that contains two different temporal layers: the static and dynamic layers. The variations of rhythmic scheme show the “time-space” concept of Ishii’s musical time. In _Rebond A_, the irregularly mutating rhythms dominate the density in the “space” between the two notes of the core at the beginning statement. The various densities are achieved vertically and horizontally through several elements of rhythmic structure: the register of drums, the accents, subdivisions of beat, and the polyrhythms. These elements represent musical time as the “multi-dimensional” musical space.

In the detailed temporal analysis discussed in this dissertation, the characteristics of rhythmic structure (instrumentation, compositional scheme/formal structure, free of meter, and rhythmic complexity) determine the perception of musical time of both works. The homogeneous instrumentation of using drums with skin heads becomes the significant feature of both pieces. Multiple drums resemble a relative scale of indefinite pitches that produce a melodic quality. In _Thirteen Drums_ distinctive rhythmic structures of different parts are based on the compositional rhythmic scheme that connect these parts cohesively; the core material and the change of density in _Rebond A_’s rhythmic structure roughly defines the sections. The absence of meter and the high rhythmic complexity challenge listeners’ aural experience. The high rhythmic complexity is primarily caused by use of rests, pervasive accents, and subdivisions of beat/pulse.
Combined with other characteristics in rhythmic structure, the resulting rhythmic complexity dominates rhythmic grouping.

Rhythmic grouping is a subjective behavior and is the rhythmic structure’s surface level. The cognition of temporal structure and the discrimination of periodicities start with this subjective behavior. This behavior is limited to perception and cognition of human hearing. Studies of neuroscience and cognitive psychology have provided information processing theories that are associated with memory systems of the human brain. Listeners encode the perceivable auditory information through different levels of memory systems: echoic memory, short-term memory, working memory, and long-term memory. Melodic and rhythmic elements in the temporal structure are examined through the encoding process. Therefore, musical time is experienced and understood.

The aesthetic experience of music is also strongly tied to this information processing model of memory systems. If a piece renders a stable sense of pulse and a strong metric sense, a sense of entrainment and anticipation to structures are then established. The entrainment and anticipation are essential to the aesthetic experience: when structural expectation is violated by upcoming events, the tension takes place and the search for tension release or a resolution follows. This tension-and-release phenomenon stimulates the affective aesthetic experience.

Another type of aesthetic experience is influenced by rhythmic tension. The formation of rhythmic tension does not require the establishment of pulse or metric sense and it is determined by the density of events happening in a given amount of time. The more events happen in a shorter time span, the higher rhythmic tension will be perceived. *Thirteen Drums* and *Rebond A* are perceived as modern and conceptual to aesthetic experience. In both works the rhythmic structures are not intelligible. A sense of pulse is sometimes perceived but not stable; the metric
sense and entrainment are weak or absent. Nevertheless, the rhythmic tension is still experienced in aural experience.

In contemporary music, the complexity of temporal structure is challenging for listeners to grasp and musical time is not easily understood. One of the most significant challenges for performers is to transmit the conceptual ideas created by composers in modern works into comprehensive interpretations. It is a performer’s responsibility to transmit the composer’s conceptual work to the audience. To achieve this goal effectively, a performer should study the temporal structure in order to convey the aesthetic intentions of the composer.

The purpose of this dissertation is not to argue the values of contemporary music. The purpose is to offer alternative listening strategies that may bring out different aesthetic experiences toward contemporary music. Since the aesthetic experience is closely related to the information processing of memory systems in which the function of long-term memory involves learnt experience and past memories, a comparison of aesthetic experience can be made from the first-time and after-score-studying listening experiences of *Thirteen Drums* and *Rebond A*. A valuable project for future research would be to conduct a study that measures how informed listening and score studying improve an individual’s comprehension of musical time in *Thirteen Drums* and *Rebond A*. 
APPENDIX

ERRATA IN THE SCORE OF *THIRTEEN DRUMS* PUBLISHED IN 1986
<table>
<thead>
<tr>
<th>Location</th>
<th>Description of Errata</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dedication above the title The last name should be spelt as Sugahara, not Sugawara.</td>
</tr>
<tr>
<td>2 [1/4, L6, P2]</td>
<td>Drum #1 should be located on the 4\textsuperscript{th} sixteenth note of the sixteenth-note pattern.</td>
</tr>
<tr>
<td>3 [2/4, L6, P2]</td>
<td>After the first group of grace-notes, drum #5 should be located on the 4\textsuperscript{th} sixteenth note of the sixteenth-note pattern.</td>
</tr>
<tr>
<td>4 [1/4, L8, P3]</td>
<td>Drum #4 should be located on the 3\textsuperscript{rd} sixteenth note of the sixteenth-note pattern.</td>
</tr>
<tr>
<td>5 [4/4, L9, P3]</td>
<td>The grace-note before drum #2 should be placed on drum #11 instead of #12.</td>
</tr>
<tr>
<td>6 [1/4, L10, P4] and when it is represented later</td>
<td>The grace-note before drum #6 should be placed on drum #12 instead of #13.</td>
</tr>
<tr>
<td>7 [4/4, L10, P4] and when it is represented later</td>
<td>The primary stroke after two-grace notes on drums #6 and #9 should be placed on drum #12, instead of #11.</td>
</tr>
<tr>
<td>8 [3/4, L11, P4] and when it is represented later</td>
<td>The primary stroke after two-grace notes on drums #7 and #6 should be placed on drum #3, instead of #4.</td>
</tr>
<tr>
<td>9 [4/4, L12, P4]</td>
<td>The second-grace note between the grace-note on drum #2 and the primary stroke on drum #13 should be placed on drum #8, instead of #7.</td>
</tr>
<tr>
<td>10 [3/4, L13, P5]</td>
<td>The grace-note before the primary stroke on drum #6 should be placed on drum #12, instead of #13.</td>
</tr>
<tr>
<td>11 [2/4, L19, P7]</td>
<td>The note on drum #2 should be played on drum #3.</td>
</tr>
<tr>
<td>12 [4/4, L23, P8]</td>
<td>Drum #4 should be located on the 1\textsuperscript{st} sixteenth note of the sixteenth-note pattern.</td>
</tr>
<tr>
<td>13 [4/4, L23, P8]</td>
<td>Drum #6 should be located on the 4\textsuperscript{th} sixteenth note of the sixteenth-note pattern.</td>
</tr>
<tr>
<td>15 [4/4, L30, P10]</td>
<td>In the grace-note group at the very end, drum #4 should be used instead of drum #5.</td>
</tr>
<tr>
<td>16 [4/4, L32, P11]</td>
<td>Drum #6 should be located on the 3\textsuperscript{rd} sixteenth note of the sixteen-note pattern.</td>
</tr>
<tr>
<td>17 [1/4, L34, P12]</td>
<td>The accented note on drum #10 should be located on the 1\textsuperscript{st} sixteenth note of the sixteenth-note pattern.</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY

Information of Musical Time and Percussion


Information of Maki Ishii

Articles


Web site

Scores


Recording

Information of Iannis Xenakis

Books


Articles and Dissertations


Web site

http://www.duocontour.org/main_menu.htm

Scores
