ALTERNATIVE INSTRUMENTATION:

A STUDY OF SELECTED INSTRUMENTS

A DISSERTATION

SUBMITTED TO THE GRADUATE SCHOOL

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE

DOCTOR OF ARTS

BY

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JULY 2003

ABSTRACT

This study includes information on nonstandard instruments. The purpose of this document is to benefit composers who may wish to write for instruments not found in the standard orchestra. Since composers are constantly seeking new sounds, they often turn to exotic or less frequently used instruments. These nonstandard instruments can provide fresh timbres in addition to those of standard Western instrumentation, or aid the composer in alluding to the characteristic sounds of a particular culture. A study such as this is needed because most nonstandard instruments do not appear regularly in orchestration texts.

The instruments included in this study are: accordion, carillon, didgeridoo, erhu, glass harmonica, hammered dulcimer, cimbalom, hardanger fiddle, harmonica, highland bagpipes, Irish flute, tin whistle, koto, shakuhachi, sitar, theremin, and uillean pipes. Entries contain information about each instrument's timbre, dynamics, physical description, history and origins, and limitations. Photographs and musical examples from well-known composers are included with each entry. A significant portion of information was collected from personal interviews with expert performers and composers.

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CHAPTER 1

INTRODUCTION

The purpose of this document is to benefit composers who may wish to write for instruments not found in the standard Western orchestra. Since composers are constantly seeking new sounds, they often turn to exotic or less frequently used instruments. These nonstandard instruments can provide fresh timbres in addition to those of standard Western instrumentation, or aid the composer in alluding to the characteristic sounds of a particular culture. A study such as this is needed because most nonstandard instruments do not appear regularly in orchestration texts.

When composers wish to write for nonstandard instruments, they must look to alternative sources because modern orchestration books have largely neglected these instruments. These alternative sources include consulting experts or finding specialty texts, both of which may not be readily available. Therefore, there is a distinct need for a study to encompass such concerns and serve as an important reference for the composer.

The instruments included in this study are: accordion, carillon, didgeridoo, erhu, glass harmonica, hammered dulcimer, cimbalom, hardanger fiddle, harmonica, Highland

bagpipes, Irish flute, tin whistle, koto, shakuhachi, sitar, theremin, and uillean pipes. Entries contain information regarding range, timbre, dynamics, physical description, history and origins, and limitations. Photographs and musical examples from well-known composers are included with each entry. A significant portion of the information was collected from personal interviews with expert performers and composers.

Choosing the Instruments

The selection of instruments to include was influenced by two factors: 1) available resources, and 2) cultural diversity. A primary criterion was the availability of musical examples by known composers. In order to produce a text capable of aiding a composer in writing for these instruments, I wanted to be able to provide examples of how composers had already successfully written for them. While there are other instruments certainly worthy of inclusion, I chose to omit them due to the lack of available musical examples. A second criterion was the inclusion of instruments from a wide variety of cultures. A study of this type could easily be made exclusively for Indian, Japanese, Chinese, Native American, or African instruments. This study is designed so there are instruments representative of Australia (didgeridoo), Japan (koto and shakuhachi), China (erhu), Ireland (uillean pipes, Irish flute, and tin whistle), Scotland (Highland pipes), Germany (glass harmonica), Norway (hardanger fiddle), India (sitar), Belgium (carillon), Russia (theremin), and Hungary (hammered dulcimer and cimbalom). The remaining two, accordion and harmonica, have their roots in Russia and Germany respectively, but since they have been assimilated into many different cultures, they no longer have a singular cultural identity.

Literature Review

While several texts on orchestration are available, few go beyond the standard instrumentation of the basic symphony orchestra. This statement is not necessarily a criticism, as nonstandard instruments often exceed the scope of these texts. At this time, some of the main orchestration books in use are Samuel Adler's *The Study of Orchestration,* Kent Kennan's *The Technique of Orchestration,* and Alfred Blatter's *Instrumentation / Orchestration.* Other texts include Stephen Douglass Burton's *Orchestration,* Andrew Stiller's *Handbook of Instrumentation,* Cecil Forsyth's *Orchestration*, and Owen Reed's *Scoring for Percussion*.[1]

The third edition of Samuel Adler's *The Study of Orchestration* is over 800 pages long but does not make mention of nonstandard instruments such as the didgeridoo, shakuhachi, accordion, bagpipe, or sitar. This text is intended for standard orchestral writing and/or classroom teaching using traditional Western instruments. Another example of a standard orchestration text would be Kent Kennan's *The Technique of Orchestration,* which features projects and activities at the conclusion of each chapter but neglects to venture beyond standard scoring.

Alfred Blatter's *Instrumentation/Orchestration* includes various nontraditional Western instruments such as the ocarina, guitar, mandolin, accordion, and harmonica.

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[1] Samuel Adler, *The Study of Orchestration,* 3rd ed. (New York: W. W. Norton and Co., 2002); Kent Wheeler Kennan and Donald Grantham, *The Technique of Orchestration,* 4th ed. (Englewood Cliffs, N.J.: Prentice Hall, 1990); Alfred Blatter, *Instrumentation/Orchestration* (New York: Schirmer Books, 1980); Stephen Douglass Burton, *Orchestration* (Englewood Cliffs, N.J.: Prentice Hall, 1982); Andrew Stiller, *Handbook of Instrumentation* (Los Angeles: University of California Press, 1985); Cecil Forsyth, *Orchestration*, 2nd ed. (New York: Macmillan Company, 1937); H. Owen Reed and Joel Leach, *Scoring for Percussion* (Englewood Cliffs, N.J.: Prentice Hall, 1969).

While Blatter does include ranges and some explanation of how the sound is produced, he does not provide historical data, musical examples, photographs, or repertoire. Stephen Douglass Burton's *Orchestration* deals mainly with orchestra and band instruments and includes a section entitled "Instruments Found in Twentieth-Century Orchestral Scores." This chapter lists many instruments yet supplies only a brief explanation for each; therefore, the reader who wishes to learn more must seek an alternative text.

Like Blatter's text, Andrew Stiller's *Handbook of Instrumentation* does include some nonstandard instruments. Although all traditional orchestral instruments are addressed and discussed, a great deal of this text deals with ancient and older instruments such as the crumhorn, cornetto, and shawm. Additionally, Stiller mentions some other instruments such as the bagpipe, steel drum, and ocarina. Unfortunately, because of the book's broad scope, the author's discussions do not go into great depth. No musical examples are present and historical information is sparse. Stiller does, however, address the sound production for many of the instruments. *Orchestration*, by Cecil Forsyth, also discusses some older instruments such as the cornetto and serpent. While Forsyth's text provides some historical background, it still confines itself exclusively to Western European instruments.

Owen Reed's *Scoring for Percussion* is a text devoted entirely to the percussion family. This focus allows the author to spend more time discussing each instrument. However, the book's scope is limited; it focuses solely on standard percussion used in orchestra and ensemble playing.

Other more general sources, such as encyclopedias, often have some valuable information. These sources include *The New Grove Encyclopedia of Music and Musicians* (Sadie, ed.), *The Oxford Companion to Musical Instruments* (Baines), and *Musical Instruments: An Illustrated History* (Remnant).[2] A physical description of instruments is almost always present, sometimes accompanied by a photograph or a diagram. Because of the scope of these texts, little attention can be devoted to nonstandard instruments. More important, the discussions do not come from a composer's point of view, nor are they addressed specifically to composers or arrangers. They offer no musical examples or writing tips and have little to say regarding special notations.

Because many of the instruments that are not covered by standard orchestration books are non-Western, some of the best source materials are music books of other cultures. These include *The Music of India* (Massey), *Japanese Music* (Malm*), The Music of Japan* (Shigeo), *Music of the Whole Earth* (Reck), *A History of Norwegian Music* (Grinde), *Music of the Billion: An Introduction to Chinese Musical Culture* (Liang), *Music in India: The Classical Traditions* (Wade), *Musical Creativity in Twentieth-Century China* (Stock), and *The Rags of North Indian Music* (Jairazbhoy).[3]

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[2] Stanley Sadie, ed., *The New Grove Dictionary of Music and Musicians*, 2nd ed. (London: Macmillan Publishers Ltd., 2001); Anthony Baines, *The Oxford Companion to Musical Instruments* (New York: Oxford University Press, 1992); Mary Remnant, *Musical Instruments: An Illustrated History* (Portland, Oregon: Amadeus Press, 1989).

[3] Reginald Massey and Jamila Massey, *The Music of India* (New York: Crescendo Publishing, 1976); William P. Malm, *Japanese Music and Musical Instruments* (Rutland, Vermont: Charles E. Tuttle Company, 1959); Kishibe Shigeo, *The Traditional Music of Japan* (Tokyo: Ongaku No Tomo Sha Corp., 1984); David Reck, *Music of the Whole Earth* (New York: Charles Scribner's Sons, 1977); Nils Grinde, *A History of Norwegian Music* (Lincoln, Nebraska: University of Nebraska Press, 1991); Mingyue Liang, *Music of the Billion: An Introduction to Chinese Musical Culture* (New York: Heinrichshofen, 1985); Bonnie C. Wade, *Music in India: The Classical Traditions* (Walpole, Massachusetts: The Riverdale Company, 1991); Jonathan P. J. Stock, *Musical Creativity in Twentieth-Century China* (Rochester, New

While these texts concentrate on the traditional purpose and uses of the instruments within their cultures, they often include some musical examples, photographs, and diagrams. Additionally, to understand some of the instruments, one must have a certain grasp of the value music plays in these cultures. Frequently, rich detailed histories and theoretical musical principles can be gleaned from the pages of these texts.

Perhaps the best literary sources of information on nonstandard instruments are texts devoted entirely to specific instruments. Such texts include *The Highland Bagpipe and Its Music* (Cannon), *The Bagpipe* (Collinson), *The Sitar: The Instrument and Its Technique* (Junius), *Theremin: Ether Music and Espionage* (Glinsky), *The Hammered Dulcimer: A History* (Giffird), *The Kumiuta and Danmono: Traditions of Japanese Koto Music* (Adriaansz), *The Sitar Manual* (Alford), *The Hammered Dulcimer in America* (Groce), *Tegotomono: Music for the Japanese Koto* (Wade), *My Music, My Life* (Shankar), *Didgeridoo: Ritual Origins and Playing Techniques* (Schellberg), and *The Carillon* (Price)[4]. These texts often provide pitch ranges, notational data, notes on technique, and effects the instruments are capable of performing. However, these

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York: University of Rochester Press, 1996); N. A. Jairazbhoy, *The Rags of North Indian Music* (Middletown, Connecticut: Wesleyan University Press, 1971).

[4] Roderick D. Cannon, *The Highland Bagpipe and Its Music* (Edinburgh: John Donald Publishers Ltd, 1988); Francis Collinson, *The Bagpipe* (Boston: Routledge and Kegan Paul, 1975); Manfred M. Junius, *The Sitar: The Instrument and Its Technique* (Wilhelmshave, Germany: Heinrichshofen Press, 1974); Albert Glinsky, *Theremin: Ether Music and Espionage*. (Chicago and Urbana: University of Illinois Press, 2000); Paul M. Giffird, *The Hammered Dulcimer: A History* (Lanham, Maryland: Scarecrow Press, 2001); Willem Adraansz, *The Kumiuta and Danmono: Traditions of Japanese Koto Music* (Los Angeles: University of California Press, 1973); Clem Alford, *The Sitar Manual* (London: Keith Prowse Music Publishing Co. Ltd., 1973); Nancy Groce, *The Hammered Dulcimer in America* (Washington D.C.: Smithsonian Institution Press, 1983); Bonnie C. Wade, *Tegotomono: Music for the Japanese Koto* (Westport, Connecticut: Greenwood Press, 1976); Ravi Shankar, *My Music, My Life* (New York: Simon and Schuster, 1968); Dirk Schellberg, *Didgeridoo: Ritual Origins and Playing Techniques* (Diever, Holland: Binkey Kok, 1997); Frank Percival Price, *The Carillon* (London: Oxford University Press, 1933).

comments often come from the performer's perspective, and while the books do include information relevant to composition, one must sift through a large amount of extra material to discover it.

Significance of the Study

While many fine resources for composers exist, there continues to be a need for information about nonstandard musical instruments. A significant amount of information about nonstandard instruments remains with the performers. Therefore, the interviews in this study constitute important original research that will not be found in any other source. While a significant amount of data relevant to this study is published in other sources, it has not been organized into a single useable reference. Additional information is scattered amongst specialty instrument and cultural history texts. This study is significant because it combines original research with musical examples and information from written sources into a reference that is readily available to composers and others wishing to study or write for nonstandard musical instruments.

CHAPTER 2

METHODOLOGY

This chapter will explain the process and decisions that were involved in this dissertation. The main points addressed include interviews, chapter format, pitch identification system, musical examples, and photographs.

Interviews

I completed a substantial portion of the research via personal correspondence with experts. Due to the rarity of written information on these instruments, I felt the best way to learn about them was to communicate with experts. These experts included virtuoso performers on their instruments and composers who employ these special instruments. I conducted interviews in several ways: personal interviews in the field, telephone, e-mail, and postal mail. Table 1 on the following page shows all the names of those interviewed, their instruments, the medium through which the interview was conducted, and the date. Biographical information on all of the interviewees can be found in Appendix A.

Interviews and Correspondents

Table 1

Name	Instrument	Medium	Date
Anupalma Bhagwat	Sitar	Personal interview	Sept. 22, 2002
Henry Doktorski	Accordion	Telephone and mail	Sept. 2002
Michael Gould	Shakuhachi	Personal interview	Sept. 22, 2002
John Gouwens	Carillon	Personal interview	Oct. 30, 2002
David Hudson	Didgeridoo	Telephone, mail, and email	Oct. 2002
James Jones	Didgeridoo	Personal interview	Aug. 2002
William Jones	Highland Bagpipes	Personal interview	Aug. 2002
Kirby Koriath	Carillon	Personal interview	Oct. 21, 2002
Lydia Kavina	Theremin	Mail and email	Sept.-Oct. 2002
Russ Landau	Didgeridoo	Telephone and mail	Sept. 2002
Grey Larsen	Irish Flute and Tin Whistle	Personal interview	Nov. 22, 2002
Anthony Maiello	Accordion	Telephone and email	Oct. 2002
Reiko Obata	Koto	Email	Jan. 15, 2003
Kyoko Okomoto	Koto	Telephone	Feb. 3, 2003
Jim Smith	Uillean Pipes	Personal interview	Nov. 25, 2002
Jonathan Stock	Erhu	Email	Dec. 16, 2002
Peter Van Gelder	Sitar	Telephone	Nov. 26, 2002

Through the use of the internet and email, I was able communicate with these people more efficiently and receive a swift response. In fact, I was able to make contacts on multiple continents. Lydia Kavina was very helpful in answering countless questions over email, and sent a package of scores to me via postal mail from Moscow. David Hudson from Australia and Jonathan Stock from England also were able to communicate with me and answer specific questions.

Chapter Format

The chapters are in alphabetical order by instrument name. Every instrument chapter is organized into several categories or subheadings. Each chapter starts with a photograph of the instrument. The headings "Physical Description," "Range," and "History and Origins" appear in every chapter. "Literature" or "Modern Works" appear in all but two chapters. Irish flute and tin whistle lack repertoire outside of folk music, and the majority of sitar music is improvised. Other headings include: "Timbre," "Dynamics," "Pitch," "Tuning," "Tone Production," "Technique" or "Extended Techniques," "Limitations," and "Notation." Because every instrument in this study is unique and has its own special qualities, different headings appear in each chapter. Sometimes these headings appear in combination (e.g. "Pitch and Timbre").

Pitch Identification System

Throughout the document, middle C is identified as C^4. This system of pitch identification was selected because it is a standard system used by composers and

theorists and I believe that they will be the primary audience for this work. This system is commonly used in major theory textbooks, Samuel Adler's *The Study of Orchestration*, and the journal *Perspectives of New Music.*

Musical Examples

It was vital to obtain musical examples and scores for this project. They provide the reader with models and clarify the instruments' capabilities in the hands of virtuoso performers. Some instruments, such as the sitar and didgeridoo, do not traditionally employ notation; therefore musical examples were more difficult to locate. One of the examples for the sitar is a transcription of Indian classical music, which is completely improvised. Russ Landau was kind enough to supply me with his original manuscript from the television show "Survivor II: the Australian Outback," which includes a didgeridoo.

Many of the instruments included in this dissertation have a distinct repertoire. Both the harmonica and the accordion have a repertoire that spans from solo to orchestral, while the carillon tends to remain a solo instrument. When possible, I tried to give musical examples that were indicative of the highest level of art music. Other examples were selected to be representative of folk music, as many of these instruments have a strong cultural bearing. I contacted the publishers or copyright holders to obtain permission to use the musical examples. In most cases permission was granted. Sometimes, however, the copyright holder could not be contacted. In such cases, I have only used examples as allowed under the copyright law's fair use clause.

Although the uillean pipes have been used in several films, it is often difficult to obtain the original film scores. The chapter on uillean pipes contains a musical example by James Horner. This example is a copy of the original manuscript for the soundtrack to the Paramount Pictures film *Braveheart*. Ridge Walker at Paramount Pictures was instrumental in securing both the excerpt and the rights for publication in this dissertation.

Photographs

I obtained photographs from many different sources: photos I took myself, photos digitally scanned from other texts, pictures on the web, and pictures taken for me. When scanning pictures or accessing them on the web, I contacted the publisher, photographer, webmaster, or copyright holder and obtained their permission to use the photographs. I am grateful for the excellent hardanger fiddle photographs that Bevan Wulfenstein took for me.

I used a digital camera for taking original photographs. This technology made importing pictures into a document easier, and also gave me editing control over the size, brightness, cropping, and contrast. Microsoft Photoshop and Microsoft Photo Editor were used for the editing process.

Perhaps the most enjoyable experience I had researching this dissertation was my carillon interview with Dr. Kirby Koriath. We climbed up 101 steps to the top of the Schaffer Tower, the bell tower at Ball State University. Not only was I allowed to play the carillon, (which can be heard across the entire campus!) but I was permitted to ascend

to the roof and photograph the bells. Dr. Koriath photographed me while I took pictures of the bells as a documentation of my efforts.

Fig. 1. The author photographing the Schaffer Tower at Ball State University

Fig. 2. The author performing on the carillon

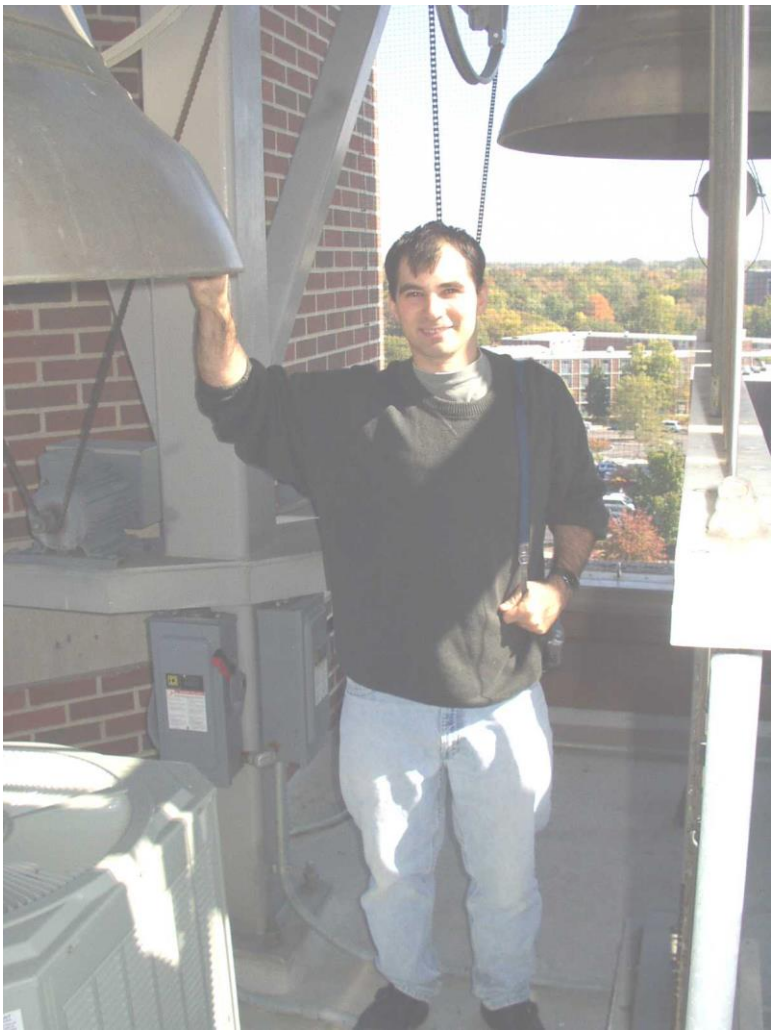

Fig. 3. The author on the top of Schaffer Tower, Ball State University

CHAPTER 3

ACCORDION

Fig. 4

Physical Description

Although there are several types of accordions, the most common is the piano accordion pictured above. The piano accordion is distinguished by the piano keyboard on one side, unlike the concertina and other types, which have no keyboard. The accordion is a free-reed instrument. It has a piano keyboard that is played with the right hand and a system of buttons on the other side controlled by the left hand. These two sides of the accordion are connected by a bellows, which blows air across the reeds and enables

them to vibrate. It can be played from either the seated position or standing with the aid of a shoulder strap. The number of different sizes of accordions assures that ranges will vary, and the keyboard will typically have between 25 and 41 keys.

Range

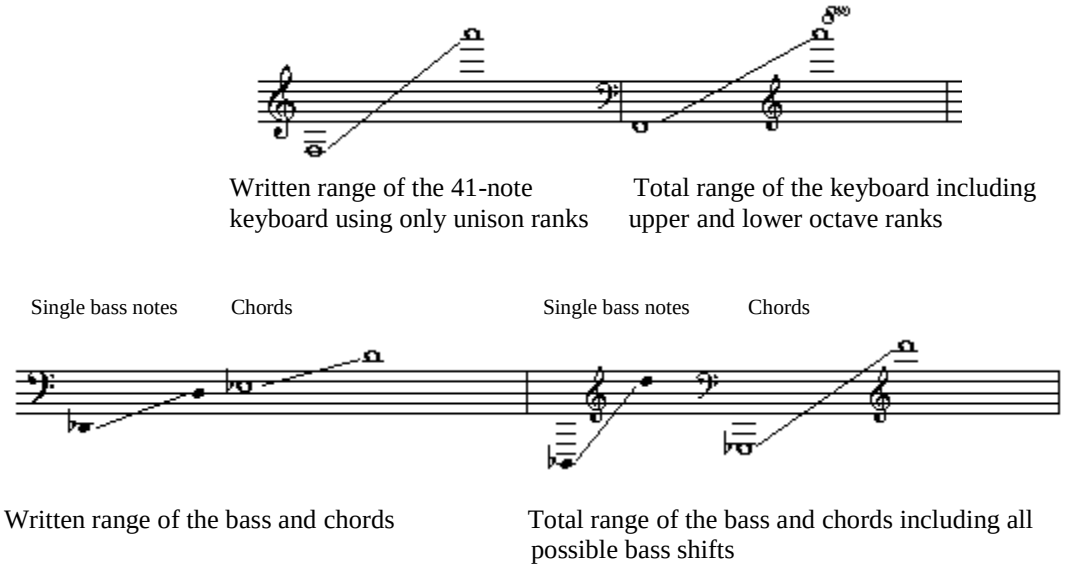

Fig. 5. Accordion Range

Tone Production

The accordion operates on a free-reed system. This means that, unlike on a clarinet, oboe, bagpipe, or bassoon, pitch is not influenced by a column of air. Instead, the reed's size and length are the determining factors. Air is blown across the reeds by means of a bellows, which enables the performer to vibrate the reeds while closing or opening the bellows. When writing for the instrument, it must be taken into consideration that a note must be rearticulated when the bellows changes direction. The amount of time a tone can be sustained depends on the speed at which the bellows is being opened or closed and the number of reeds vibrating. Although usually assumed by

the player, written arrows can be used to designate the direction of the bellows. Traditional upbow and downbow symbols, as applied to strings, can also be used.

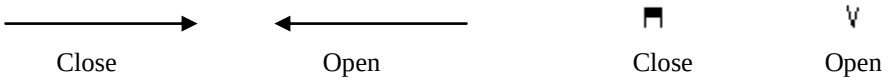

Fig. 6. Accordion symbols

The accordion can produce an effect called a bellows shake, whereby the performer rapidly changes direction of the bellows. The abbreviation B. N. is used for bellows normal. The notation appears as follows:

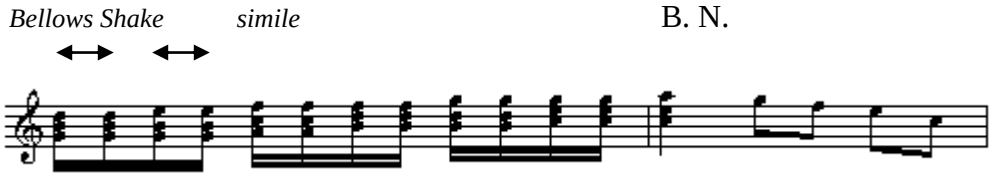

Fig. 7. Bellows Shake and Bellows Normal

Timbre and Dynamics

The timbre of the accordion is determined when sets of reeds, often called ranks or registers, are activated. A full concert accordion contains four ranks. The first rank is tuned in unison. The second is tuned an octave higher, and the third rank is tuned an octave lower. The fourth rank is known as the tremulant; it is tuned slightly sharper than the unison reeds to give a chorus effect. Much like the stops of an organ, these reed settings may be combined in various ways to create additional timbres. These combinations are sometimes referred to as treble shifts.[5]

[5] Alfred Blatter, *Instrumentation/Orchestration* (New York: Schirmer Books, 1980), 259-262.

Table 2. Accordion Settings

Reeds Used	Name	Notation
All	Master	
Unison	Clarinet or Oboe	
Lower Octave	Tuba, Saxophone, or Bassoon	
Higher Octave	Piccolo	
Lower Octave + Higher Octave	Organ	
Unison + Lower Octave	Bandonium, Saxophone, or Tuba	
Unison + Higher Octave	Violin or Oboe	
Unison + Tremulant	Violin	
Unison + Lower + Higher Octave	Harmonium	
Unison + Higher Octave + Tremulant	Musette	
Unison + Octave Lower + Tremulant	Celeste or Accordion	

In addition to treble shifts there are bass shifts, which engage different combinations of reeds for the bass. These can include unison, one octave lower, one octave higher, and two octaves higher. The bass shifts may also cause pitch adjustments in the chord buttons. The left hand is responsible for the bass notes. On the standard Stradella concert piano accordion there are six rows of buttons, 120 in all, plus buttons for bass shifts. The two that are furthest from the left hand are called the counterbass and the fundamental bass. The other four rows consist of chords including major, minor, dominant seventh, and diminished. In accordion notation, single bass notes are

Fig. 8

performed with the fundamental bass when written below E^3. But if a line, similar to a legato symbol, is written under the note, the counterbass is to be used. Anything that is E^3 or above in the bass is a chord and must be accompanied by a chord symbol: M, m, 7, or dim. If notes above E^3 are repeated in a bar, the chord symbol may be omitted.[6]

The Stradella system enables one-button chords. The free-bass accordion does not have this feature. It can, however, produce any left-hand chord including suspended chords, quartal harmonies, and clusters (see fig. 12 for a fingering chart comparison between Stradella and free-bass systems). When writing for accordion it is vital to know if the instrument will be a free-bass or Stradella-style instrument.[7]

The dynamics are influenced by both the number of reeds vibrating and the rate at which the air is being blown across them. The faster the bellows are opened or closed, the louder the dynamic. This can be obtained by notating a bellows accent, which looks like a normal accent (>). Additionally, the instrument will be at its loudest when the master rank is activated; that is, with all reeds sounding.

[6] Ibid., 263.

[7] Anthony Maiello, interview by the author, e-mail survey, October 2002.

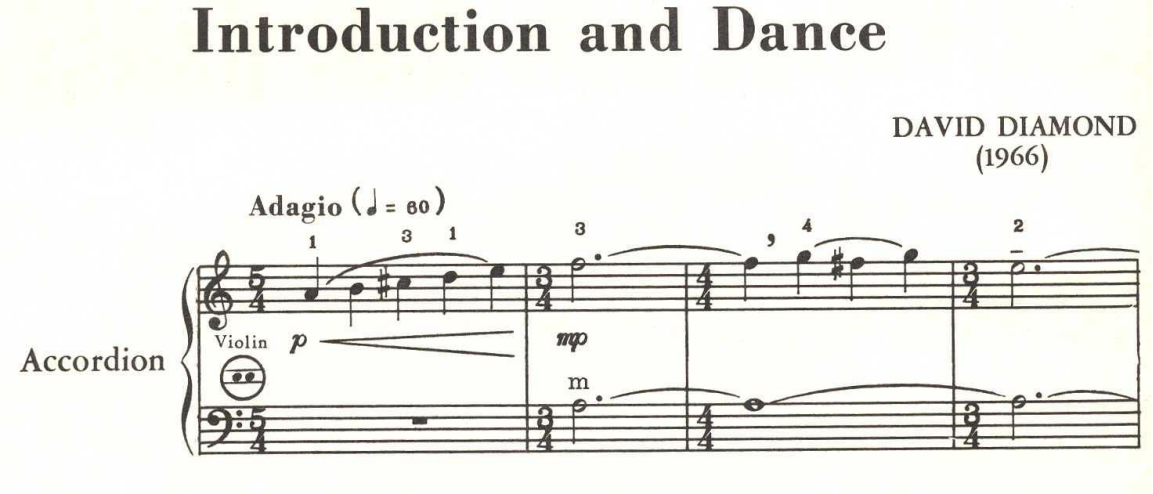

Fig. 9. Note the symbol used to specify timbre and the small "m" for minor chord.
David Diamond, *Introduction and Dance* (New York: Southern Music Publishing Co. Inc., 1967).
Used by permission.

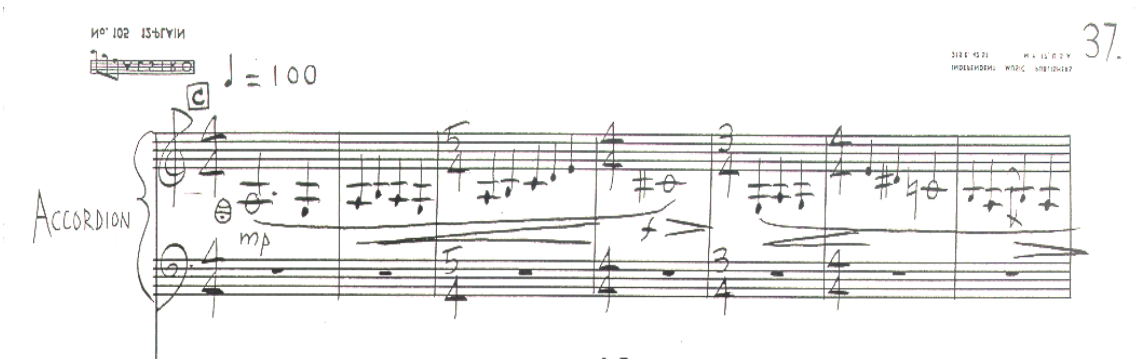

Fig. 10. From the Alan Hovhaness *Accordion Concerto* © 1960 by C.F. Peters Corporation.
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Pitch

The pitch on the standard concert accordion is controlled by the use of the piano keyboard and the bass buttons. While the unison pitch is outlined in the range section, actual pitch may be determined by the ranks activated. Therefore, the right hand can extend the range by an octave in either direction and the left can extend one octave down and two octaves up. Making a change, however, requires a break in the music.

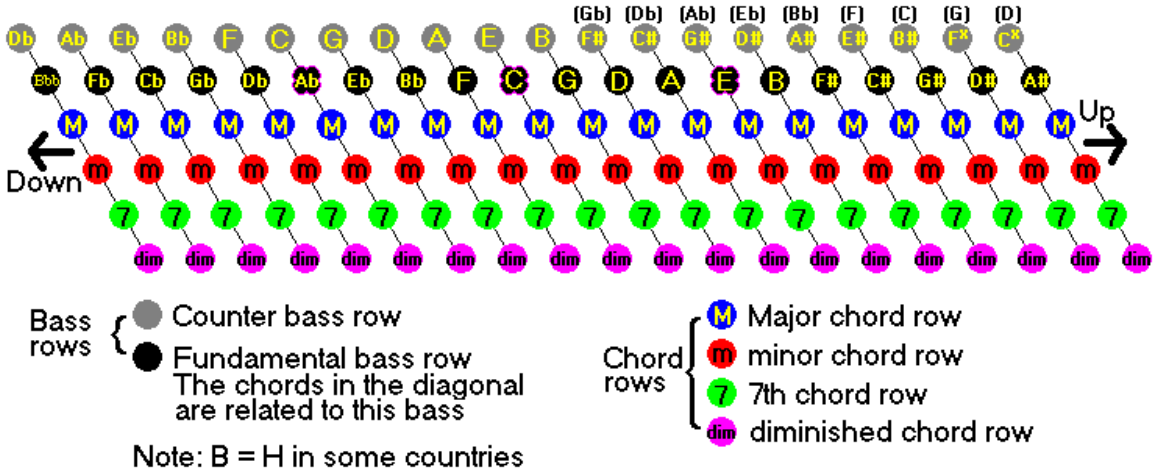

Fig. 11. Fingering chart for a Stradella system accordion - Chart courtesy of Hans Palm

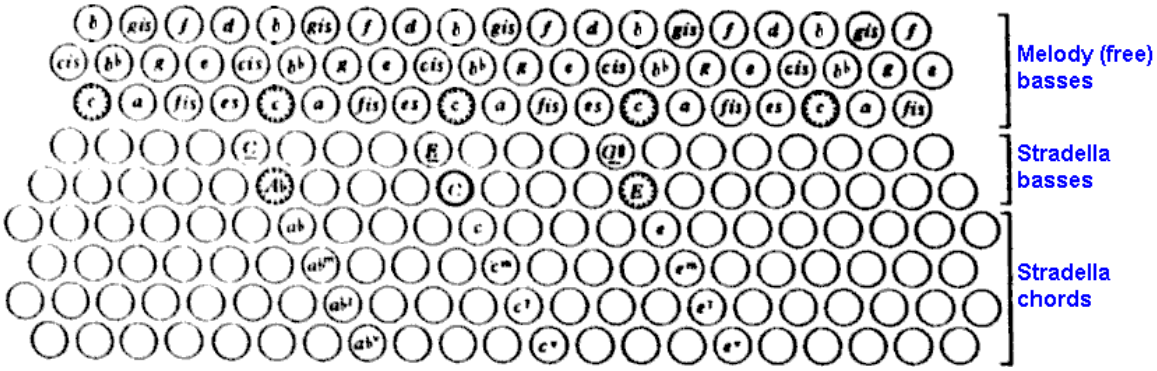

Fig. 12. Fingering chart for a free bass accordion - Chart courtesy of Hans Palm

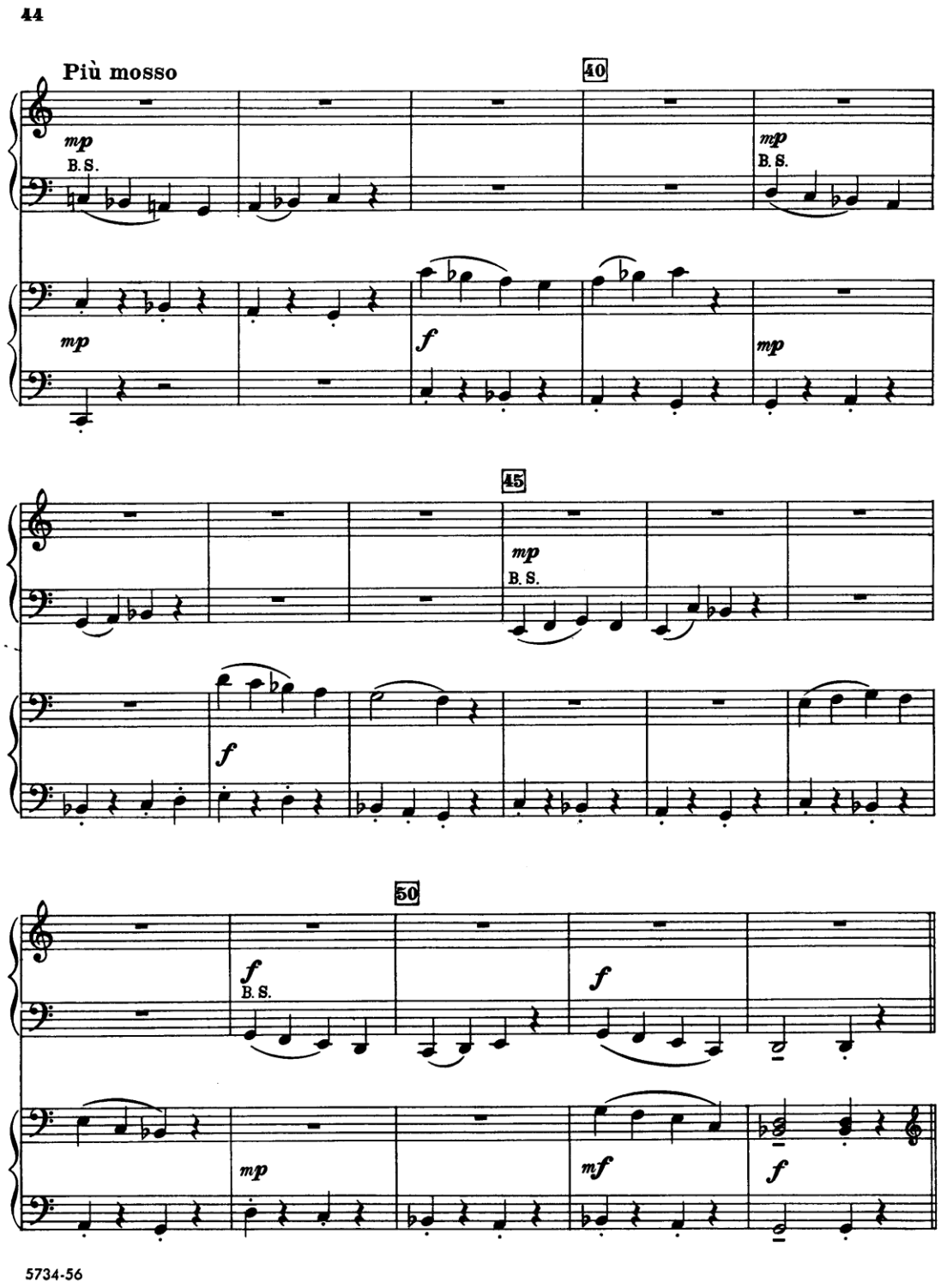

Fig. 13. *Concerto Brevis* by Henry Cowell. Note the Symbol B.S. for Bass Solo.
Henry Cowell, *Concerto Brevis* (New York: Momac Music Co., 1962).

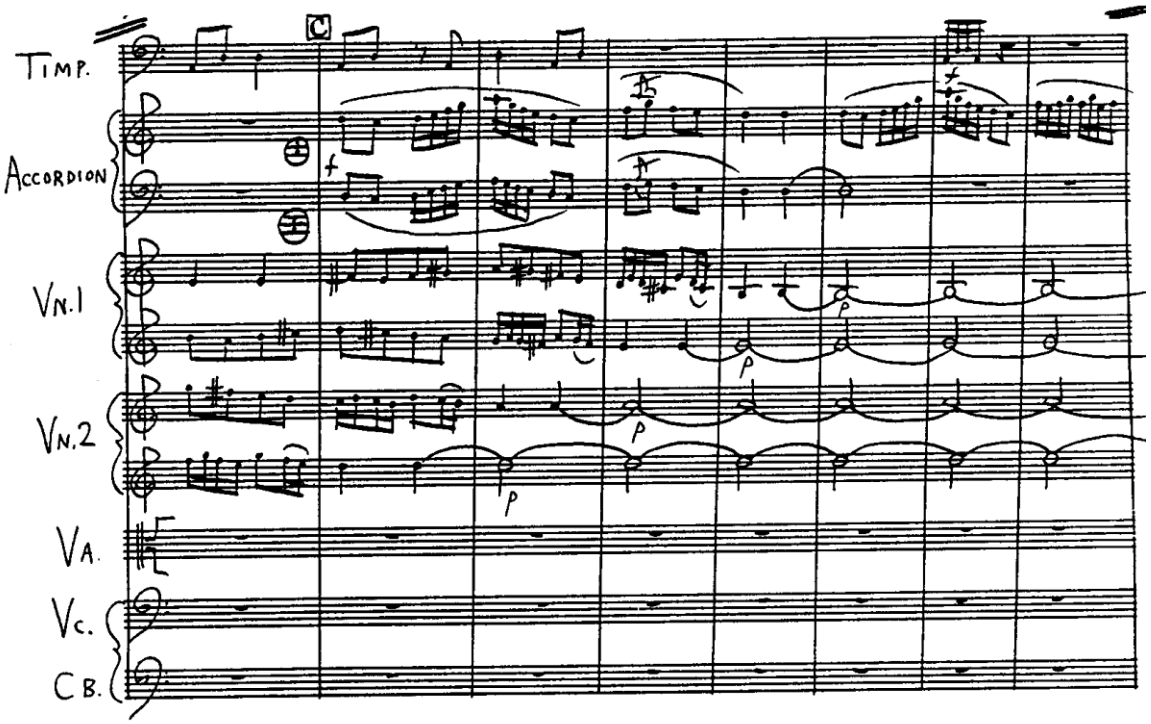

Fig. 14. *Accordion Concerto* by Alan Hovhaness © 1960 by C.F. Peters Corporation. Used by permission. All Rights Reserved.

History and Origins

The first accordions were single-action instruments. The first double-action accordions originated in Russia during the 1840s. The first patent of an accordion with a piano keyboard was made by M. Bouton of Paris in 1852, but the piano-accordion did not come into popular use until the beginning of the twentieth century. Credit for much of the growth of the classical accordion must go to the Hohner company, which began manufacturing accordions shortly after the turn of the century. Hohner decided to improve the accordion's public image by helping it evolve from a folk instrument played

by ear to a respectable instrument played from sheet music. Hohner also began to publish sheet music of classical pieces and established a college for accordion teachers.[8]

Christoph Wagner writes,

> When the Nazis came to power, the growth of the accordion slowed down. The propagandists claimed that the accordion was a "nigger jazz instrument" for its close connection with modern American dance music. The Nazis tried to stop accordion bands from playing classical music which for them was an "abuse of the music of our great masters." The president of the Reichsmusikkammer -- the highest institution controlling music in the Third Reich -- declared that "now is the time to build a dam against the flooding of our musical life by the accordion."[9]

The decision to eliminate the accordion from Germany was never enforced, however, because the Hohner company made a convincing appeal to the government. Hohner argued that the accordion was a genuine, legitimate instrument and had a large repertoire of authentic German folk music. In addition, they claimed, if the accordion were banned, hundreds and thousands of German music teachers and workers in Hohner factories would lose their livelihoods.[10]

Literature

While many composers have written for the accordion, the instrument still seems to fit into a general category of folk instruments in various cultures. But, despite its strong grounding in folk literature, the classical accordion does have a place in concert

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[8] Henry Doktorski, "The Classical Accordion, part 2" 1998 [On-line article]; Available from http://trfn.clpgh.org/free-reed/history/classic2.html; Internet; accessed September 2002.

[9] Ibid.

[10] Ibid.

repertoire. Because of the significant contribution to the literature by Pauline Oliveros, the majority of her works for or including accordion are listed separately.

P. I. Tchaikovsky	(1883) *Orchestral Suite No. 2 in C Major*, Op. 53 (3rd mvt.)
Alban Berg	(1922) *Wozzeck* (Act II, scene 4)
Paul Hindemith	(1922) *Kammermusik* No. 1
Darius Milhaud	(1946) *Prelude et Postlude pour "Lidoire"* (Clarinet, bassoon, trumpet, accordion, harp and contrabass)
Roy Harris	(1947) *Theme and Variations* (Accordion and orchestra)
George Antheil	(1951) *Accordion Dance*
Luciano Berio	(1952) *El Mar la Mar* (Mezzo soprano and ensemble)
	(1995) *Sequenza No. 13* (Accordion)
	(1996) *Outis* (Opera with accordion part in the score)
Alan Hovhaness	(1975) *The Rubaiyat* (Narrator, accordion, and orchestra)
Henry Cowell	(1961) *Concerto Brevis* (Accordion and orchestra)
David Diamond	(1962) *Night Music for Accordion and String Quartet*
	(1966) *Introduction and Dance* (Accordion)
Otto Luening	(1967) *Rondo* (Accordion)
Lukas Foss	(1975) *Curriculum Vitae* (Accordion)
	(1980) *Curriculum Vitae with Time Bomb* (Accordion, percussion and cap gun)
Lorin Maazel	(1995) *Music for Violoncello and Orchestra* (Accordion part in the orchestra)

Works by Pauline Oliveros

(1961) *Trio* (Trumpet, accordion, and double bass)

(1964) *Duo* (Accordion, bandoneon, and optional mynah bird)

(1969) *Events* (Film music)

(1975) *Horse Sings From Cloud* (Harmonium, accordion, bandoneon, and concertina; also a 1977 version with voice and accordion)

(1982) *Three Meditations* (Accordion)

(1982) *...Jam* (Accordion and ensemble)

(1982) *Songs and Dance* (Accordions)

(1982) *The Wanderer* (Accordions)

(1983) *The Seventh Mansion: From the Interior Castle* (Amplified accordion)

(1983) *A Secret Relationship* (Accordion)

(1983) *Go* (Accordion and violin)

(1984) *Letting Go* (Accordion ensemble or solo)

(1984) *Syracuse Meditations* (Accordion)

(1984) *Earth's Ears* (Accordion, vibraphone, violin)

(1984) *A Love Song* (Voice and accordion)

(1983) *The Well: Preponderance of the Great and Gentle Race* (Mixed ensemble)

(1985) *Tasting the Blaze* (Mixed ensemble with four accordions)

(1985) *Rain Music* (Voice and accordion)

(1985) *Legend* (Chorus, amplified accordion, percussion, effects)

(1988) *Roots of the Moment* (Accordion in just intonation and electronics)

CHAPTER 4

CARILLON

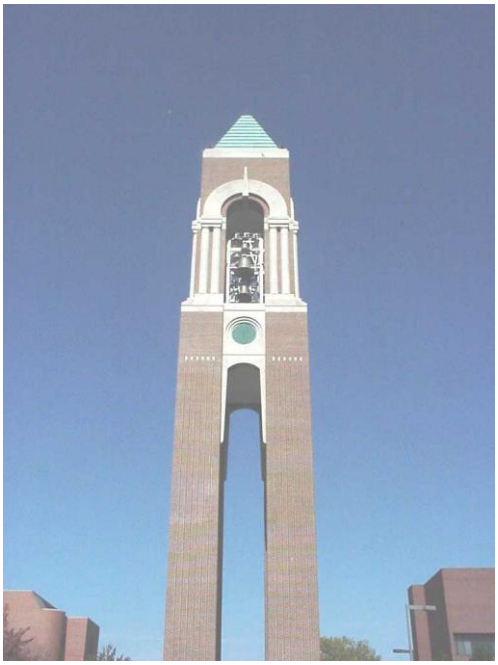

Fig. 15

Physical Description

The carillon contains a minimum of twenty-three bells (anything less is classified as a chime) and has three main components: the console and its mechanics, the bells, and the housing. The large cast bells, which can weigh in excess of twenty tons, are made of bronze (78% copper and 22% tin) and the clappers are made of iron. The carillon is

usually housed in a tower, often part of a church, a clock tower, or a bell tower specifically designed for the instrument.[11]

The console resembles an organ console with long wooden dowels instead of keys. The levers are arranged in a standard piano keyboard sequence and include a set of pedals. Several strong wires are connected to the console's levers and the clappers on the bells. The standard carillon works on mechanical action; however, modern carillons can add additional control such as electronic time controls and MIDI.

Range and Tuning

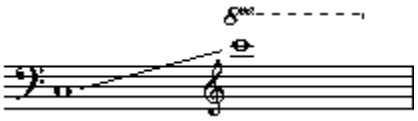

Fig. 16

Although the carillon commands a full chromatic range, sometimes the bottom C# bell is not present because it is not often used and the large bell can be expensive. Older carillons were tuned in mean-tone temperament but modern bells conform to the equal-tempered system. The carillon is also a transposing instrument, as many older models were not built in concert pitch.[12] Therefore, if a carillon is pitched in A, written notes will sound a minor third lower.

[11] Norman Bliss, webmaster, "The Guild of Carilloners in North America" [Web Page] http://www.gcna.org/index.html; Internet; accessed October 2002.

[12] John Gouwens, interview by the author, Muncie, Indiana, October 2002.

Fig. 17. One of the large bronze bells

Fig. 18. The console with levers for hands and feet

Technique

Carilloners use a downward striking motion with the bottom of a half closed hand on the protruding levers (see fig 2.8). Performers can also use their feet to depress the pedals that will also ring the bells. Sometimes players wear small pads on their hands for comfort. Passages with scales are often accomplished with a hand-over-hand motion. The mechanism is not designed to be as agile as the piano, however, some modern carillons are equipped with MIDI controllers in the form of piano keyboards, which can increase agility and enable the performance of many piano transcriptions.

Levers are never held down; the bells cannot be dampened, and the tone will sustain even after the levers return to the upright position. Multiple-note chords can be accomplished by a combination of pedals and hands, splitting the fingers apart so that two levers are depressed with each hand, or chords can be rolled in the manner of a

harpsichord or harp. When splitting the hand to sound a chord, the largest distance between the fingers is a fourth. Trills and tremolos are also possible. Because the keys are much further apart than on a piano, wide leaps and quick extreme register changes can be awkward.[13]

Carillon music is written on a grand staff. The top staff is dedicated to the manuals and the bass staff is reserved for the pedals. Although the pedal notes can be achieved via the manuals as well, it is often easier to play with the feet because of the weight required to sound the lower notes. The heaviness of the lever action on the lower bells does not allow them to be struck repeatedly at a rapid tempo.[14] The excerpt below by Roy Hamlin Johnson features six-note chords. When players encounter chords with this number of notes, the left hand plays the top note in the bass staff and the bottom note in the treble staff.

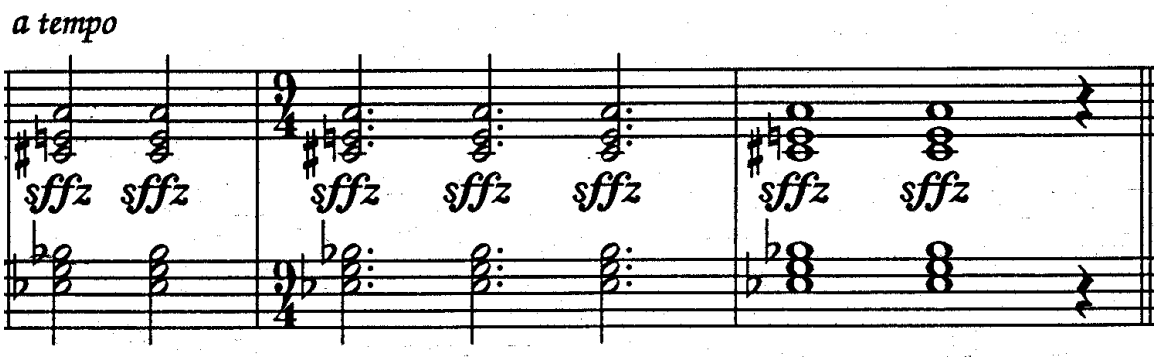

Fig. 19. Roy Hamlin Johnson, *Summer Fanfares* (The Guild of Carillonneurs in North America, 1997).

The carillon is capable of six-note chords: two notes in each hand and one per foot.

[13] Ibid.

[14] Ibid.

Dynamics

The carillon can be one of the loudest instruments. Its sound can be heard for long distances without the aid of electronic amplification. The carillon is also capable of producing sound at a soft dynamic level. Because the instrument is controlled via mechanical action, the harder the levers are struck, the louder the resulting sound will be. One will note that there is a considerable amount of difference in the action of the high and low bells. The levers of the lower pitched bells are heavier to depress because they connect to larger clappers which strike the larger bells. Many times a carilloner will use the pedals to control the lower pitches because of the heavier action. The pedals are merely an alternative control and control the same pitches as the upper part of the console.[15]

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[15] Ibid.

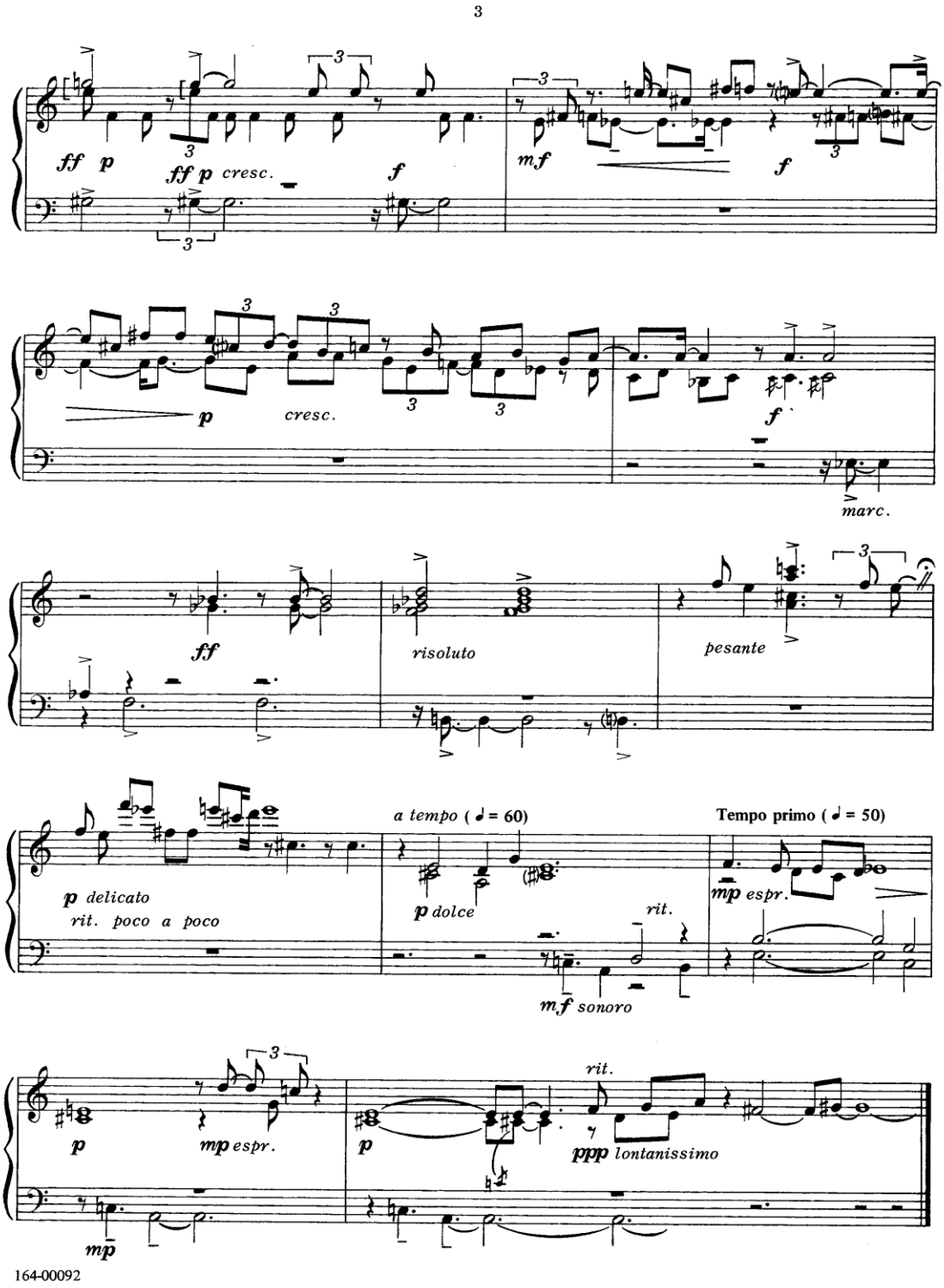
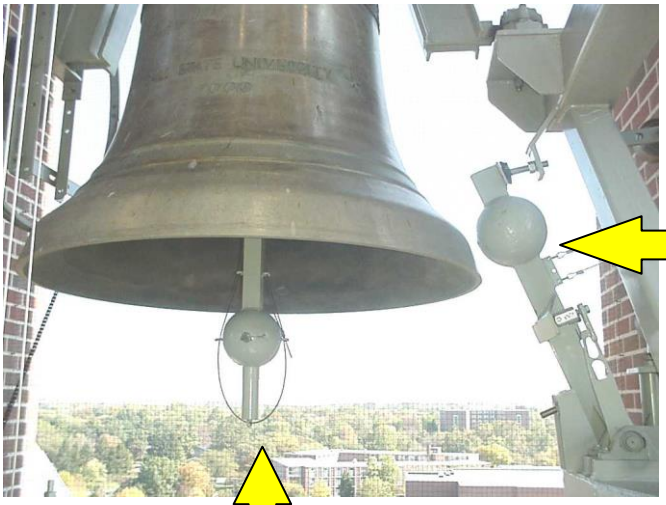


Fig. 20. *Parable for Carillon* by Vincent Persichetti. Note the ability to play at ppp lontanissimo.

How the Bells Are Rung

Ringing the bells can be accomplished using two different approaches: by 1) moving the clapper to strike the bell, or 2) swinging the bell itself to hit the clapper inside the bell. The first approach can be controlled by the console, MIDI, or an electronic time clock. The second approach usually involves only the heaviest bells, which are attached to swings. Once a heavy bell is set swinging, it may take several minutes to stop. Obviously, swinging the bells gives the performer literally no control and is reserved for signal or symbolic purposes.[16] When the bells are struck with the clapper, they can be hit on either the inside or outside of the bell, but are always struck on the lower portion of the rim.

[16] Ibid.



The outside clapper

Fig. 21

The inside clapper

The chain-driven swing

Fig. 22

Fig. 23. Dr. Kirby Koriath performing on the carillon

Fig. 24. The console

Fig. 25. A close-up view of the console

Note the performer's half-closed hands used to strike down the levers.

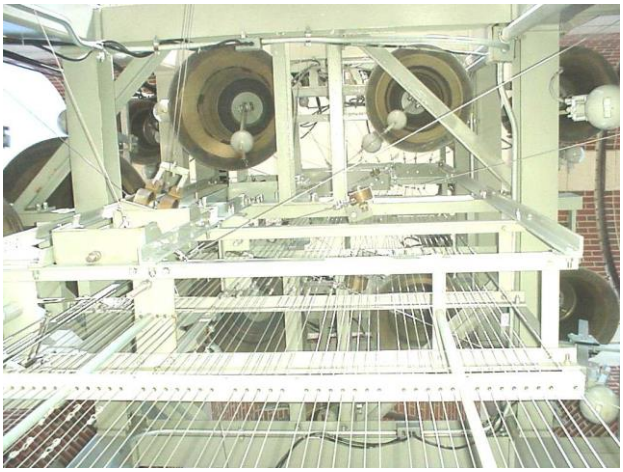


Fig. 26. Wires from the console connect to the bell crank or tumbler.

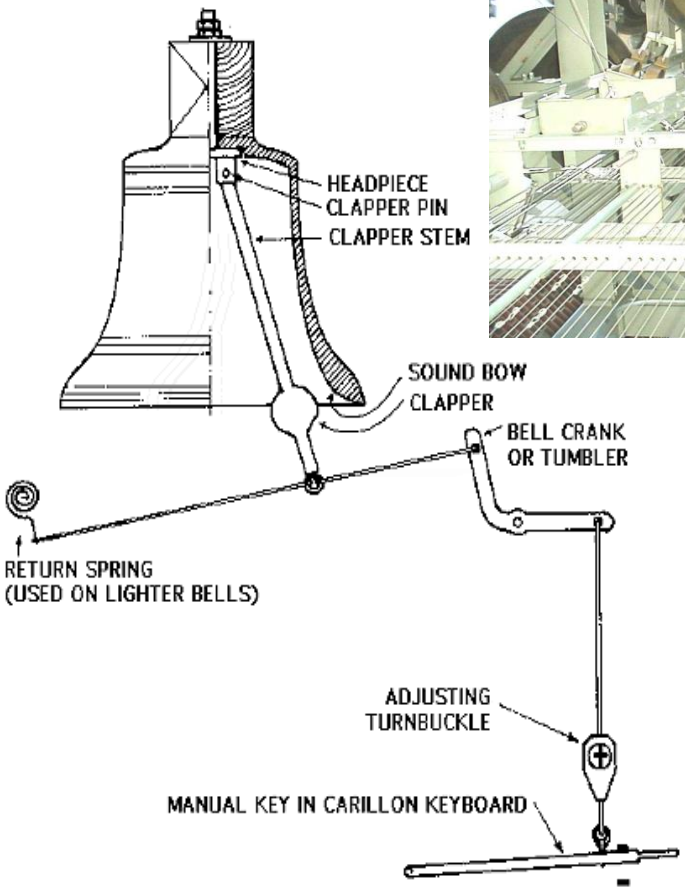


Fig. 27. Illustration courtesy of The Guild of Carilloners in North America.

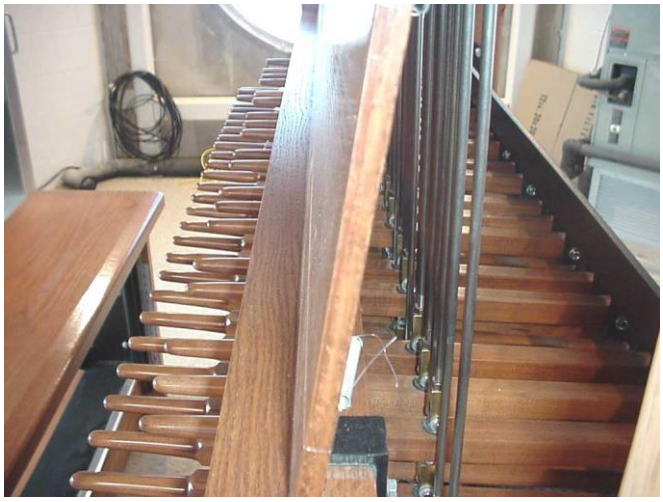


Fig. 28. A cross section of the console

On the left side are the levers. On the right side are the wires that connect to the bell crank.

Bell Tones

Fig. 29. A bell from the Schaffer Tower at Ball State University

Bells have a large number of overtones. Bell makers take special care in tuning important overtones. There are five tones that are of specific importance. The hum tone is the lowest and is the vibration of the entire bell. The prime or striking tone is the most prominent tone; it is one octave above the hum tone. The tierce is a minor third up from the prime. This gives the bell its unique timbre as it does not follow the overtone series directly. The quint is a fifth above the prime and the nominal is an octave above the prime.[17]

[17]Frank Percival Price, *The Carillon* (London: Oxford University Press, 1933), 86-95.

An example:

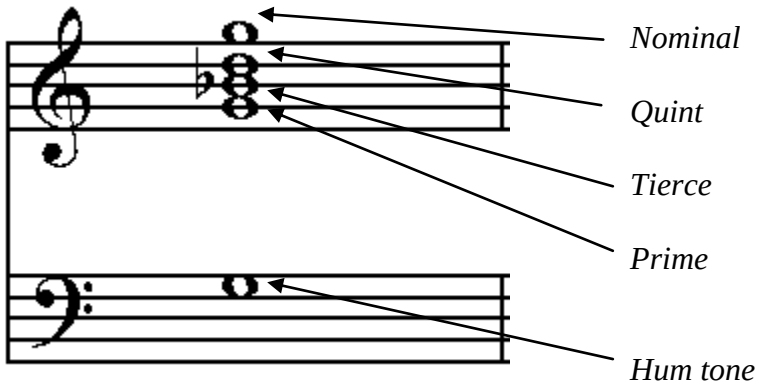


Fig. 30. Overtones of the bells

Because of the prominence of the minor third, the octatonic scale, which is rich in minor thirds, is considered idiomatic to carillon writing (see fig. 31). Voicings should be given special attention; the ring of the minor third may cause a simple triad C^2-E^2-G^2-C^3 to sound muddled. Revoicing the chord to C^2-G^2-E^3-C^4 will spread the pitches out and allow for a full sound without conflicting overtones.

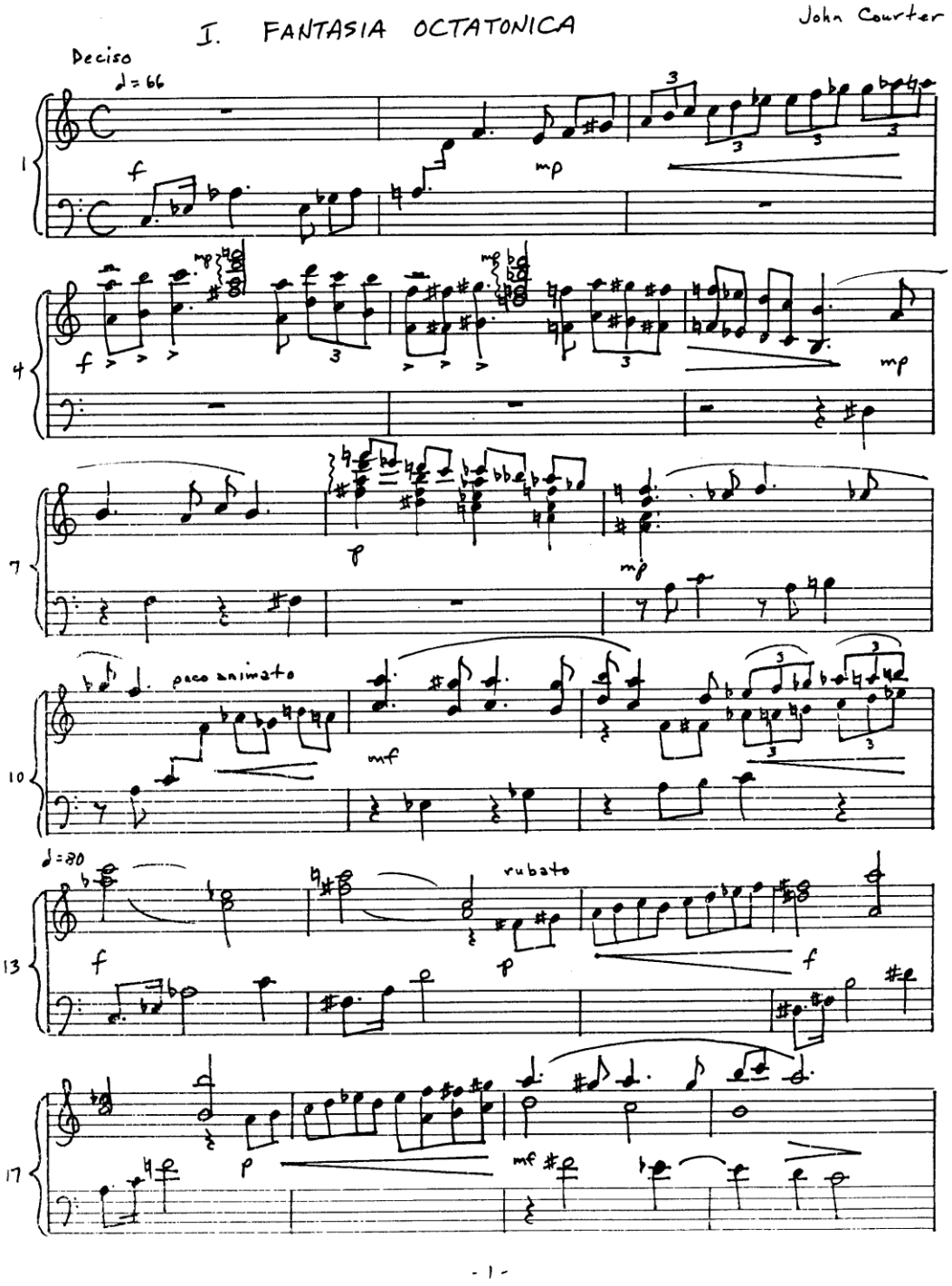


Fig. 31. *Suite No. 1 for Carillon* by John Courter

Note the title of the movement and use of the octatonic scale.

Literature

Many compositions performed on carillon are arrangements or transcriptions. The carillon's repertoire of original music is not as rich as that of other instruments for three reasons: early carillons were automated and the console did not come into play until later; the instrument has many limitations; and early carilloners developed the ability to improvise like an organist. In the twentieth century, new music has been written for carillon. Although combinations including Highland pipes, brass, and amplified instruments have been attempted, most of the successful literature written has been for solo carillon. On occasion, carillon will be used as sound effects for an outdoor performance of Tchaikovsky's *1812 Overture*.[18]

Samuel Barber	(1931)	*Suite for Carillon*
Easley Blackwood	(1961)	*Chaconne*
Henk Badings	(1952)	*Suite No. 2*
John Cage	(1954)	*Music for Carillon*
John Courter	(1988)	*Georgorian Triptych*
	(2001)	*Suite No. 1 for Carillon*
George Crumb	(1992)	*Easter Dawning*
John Gouwens	(1978)	*Cortege*
Alan Hovhaness	(1951)	*Gamelan and Jhala*

[18] John Gouwens, interview by the author, Muncie, Indiana, October 2002.

Roy Hamlin Johnson	(1956)	*Summer Fanfares*
	(1986)	*Victimae Paschali*
Gian-Carlo Menotti	(1934)	*Six Compositions*
Vincent Persichetti	(1971)	*Parable for Carillon*
Flor Peters	(1976)	*Sonatina II*, Op. 46
Daniel Pinkham	(1962)	*A Song for Bells*
John Pozdro	(1989)	*Triptych*
	(1981)	*Rustic Landscape*
Nino Rota	(1931)	*Novena di Natale*
Leo Sowerby	(1962)	*Passacaglia for Carillon*
Gary White	(1964)	*Etude*
	(1973)	*Changes*
	(1983)	*Figments*
	(1991)	*Asteroids*

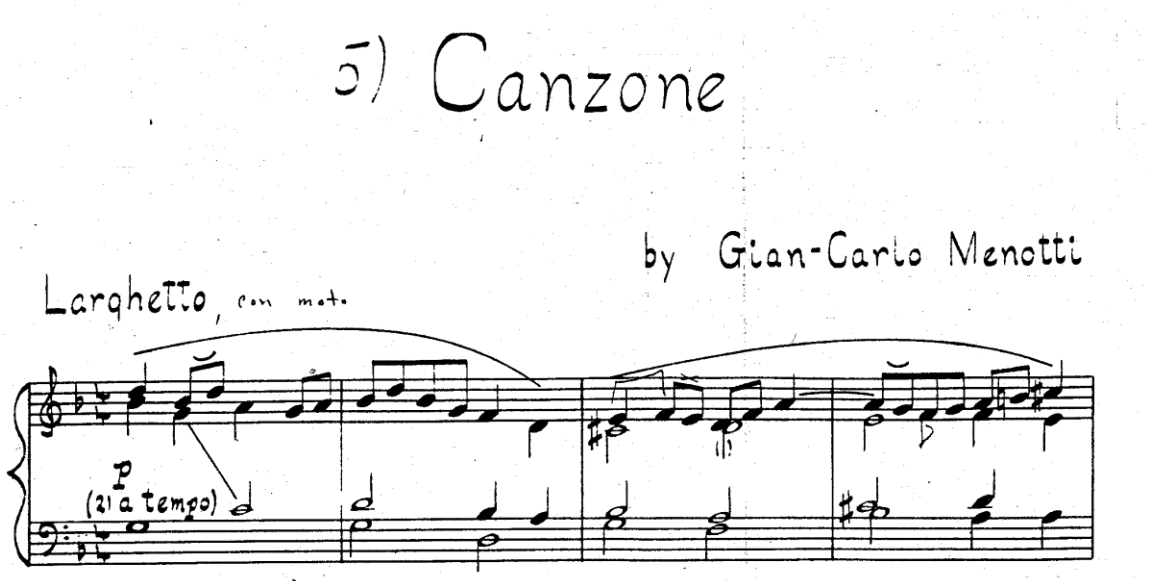


Fig. 32. "Canzone" from *Six Compositions* by Gian-Carlo Menotti

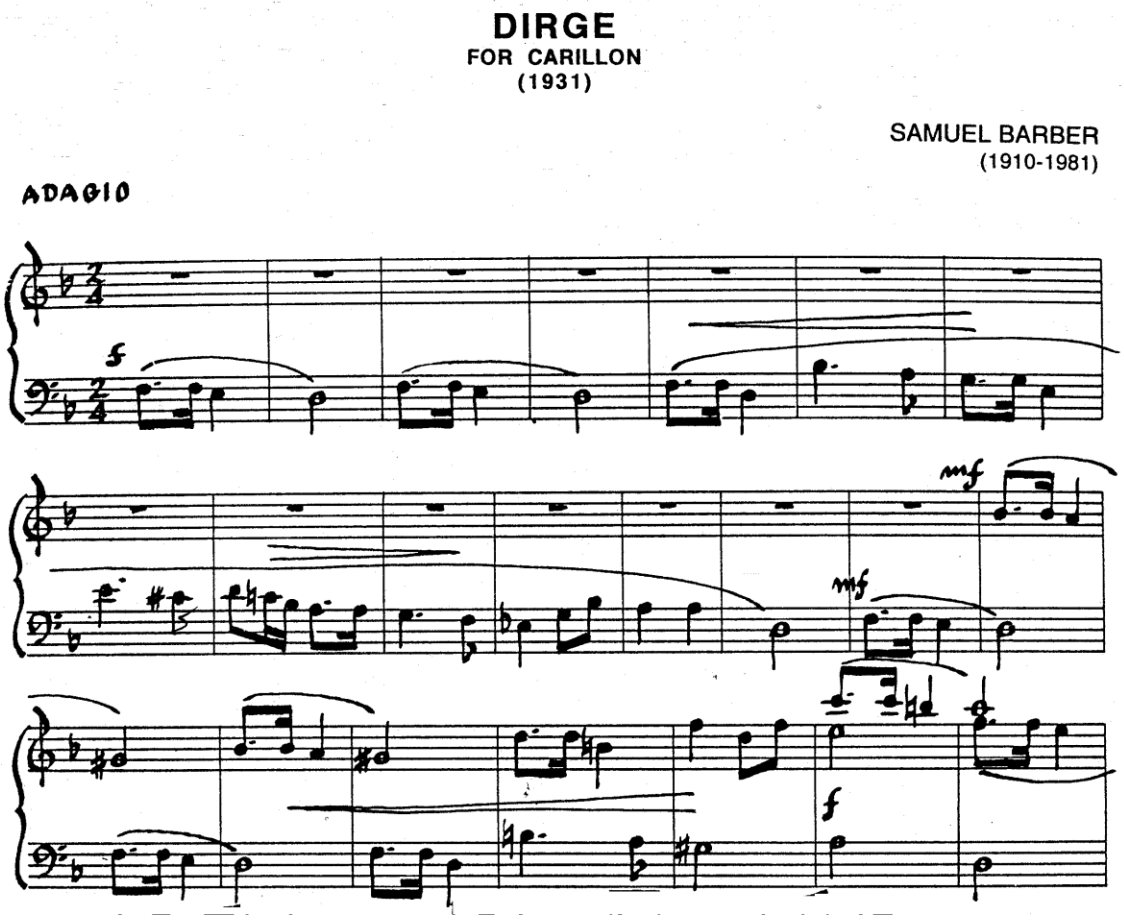


Fig. 33. "Dirge" from *Suite for Carillon* by Samuel Barber

History and Origins

The carillon evolved from the clock-tower chimes of the early Renaissance. These bells provided a signal that announced the hour so people would know the time. These early models were automated with a clock and large cylinder that had moveable pins to activate bells as it turned. These cylinders later became the engine for the much smaller music box.

Later, in 1510, the first manuals were installed. Then the bells could be used as a musical instrument instead of a mere timepiece. Carilloners often improvised or played folk tunes. In Belgium, 1746, the first notated original music composed expressly for

carillon was published, causing a collection of original music written for carillon to emerge.[19]

The twentieth century seemed to favor the carillon more as a concert instrument than other centuries. Celebrated composers such as Samuel Barber, Gian-Carlo Menotti, Alan Hovhaness, and George Crumb all wrote for the instrument. The compositions became more adventurous and moved beyond mere arrangements of folk and classical tunes.

[19] Ibid.

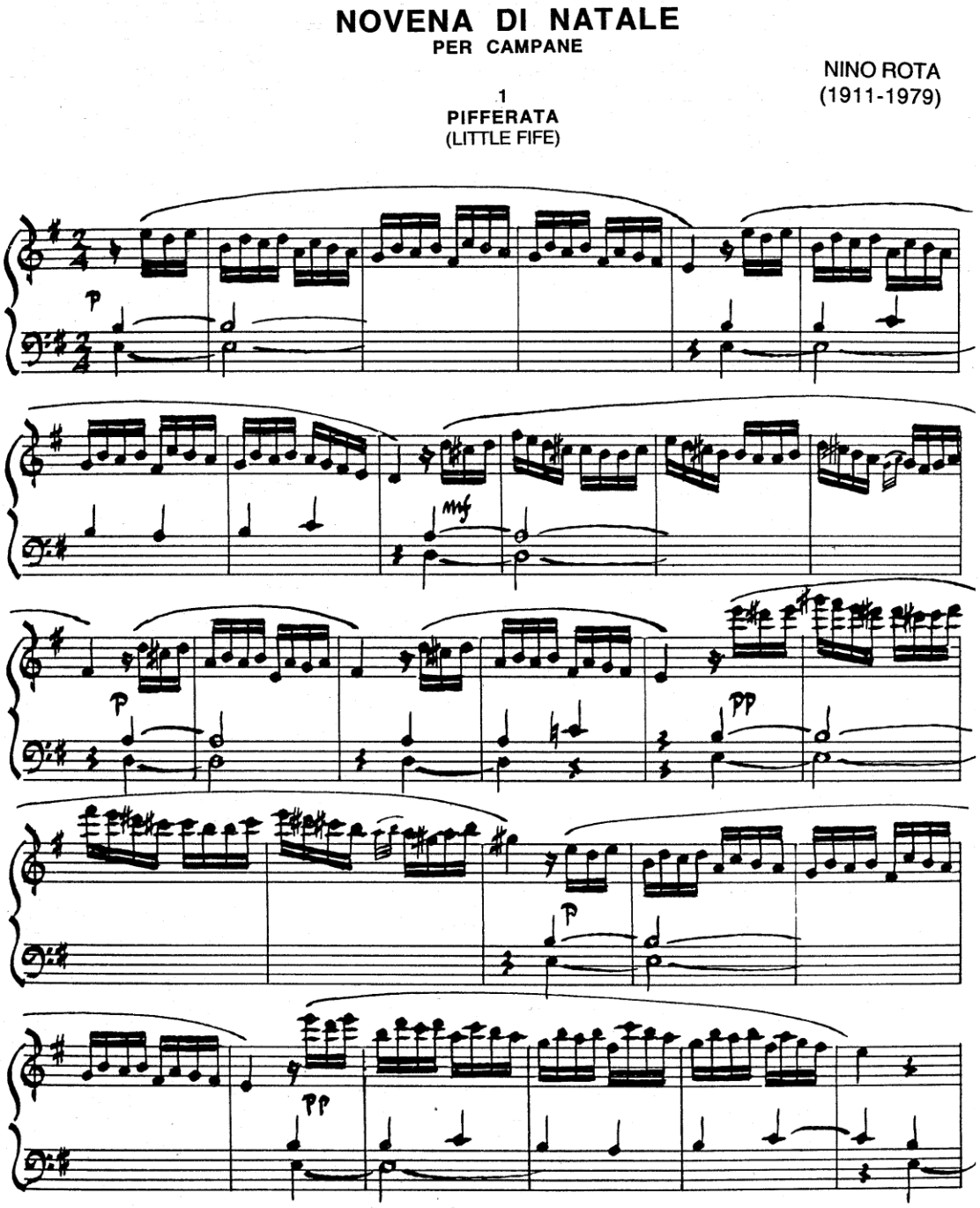


Fig. 34. *Novena di Natale* by Nino Rota

CHAPTER 5

DIDGERIDOO

Fig. 35

Physical Description

The didgeridoo (also spelled didjeridoo or commonly referred to as a didge, doo, or yidaki) is a wind instrument of Australian origin. Traditionally made from a eucalyptus tree that has been hollowed out by termites, the instrument is a long cylindrical tube approximately four feet in length, although length can vary between three and five feet. The width of the pipe is usually about 1.5 to 2 inches in diameter. Occasionally the bell may be flared like a trumpet and many didgeridoos are painted with Aboriginal designs.

Range, Timbre, and Pitch

The didgeridoo is blown in a manner similar to a tuba and produces a drone sound, which includes both the fundamental and a rich collection of high harmonics. Its fundamental pitch and overtones are dependent on the length, width, and shape of the pipe, varying the fundamental from 56 to 90 Hz.[20] Since the instrument has a rich harmonic structure, tones above the fundamental can be heard as well. Pitch and timbre are controlled by multiphonics and the shape of the oral cavity. As the player changes the jaw position, a change in resonance and timbre will occur by altering the upper harmonics of the sound while the fundamental drone remains the same, producing an effect similar to that of a Jew's harp and usually occurring in the 500 to 2500 Hz range.

It should also be noted that a slide didgeridoo exists. This instrument includes two tubes, one inside the other, with a "telescoping" action. The idea is that the performer can change the length of the pipe and thereby have some more control over pitch and tuning.[21]

Extended Techniques

Because of pitch limitations, extended techniques are considered common for the player. Circular breathing, multiphonics, vibrato, multiple articulations, flutter tonguing, and volume and timbre alteration are all possible. Additionally, as on a tuba, it is possible to overblow and produce the next harmonic. The next harmonic is between a seventh and a twelfth higher than the fundamental. This harmonic produces a drastic

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[20] David Hudson, interview by the author, e-mail survey, October 2002.

[21] Ibid.

change in timbre referred to as the emu, the toot, or the trombone sound, and is used sparingly. The interval is determined by the shape and length of the tube.

The didgeridoo is a drone instrument. As with other drone instruments, the performer must be able to sustain a tone for a long period of time. Therefore, circular breathing is considered common among quality players and composers may write long passages without giving a stop for breath.

The traditional didgeridoo player imitates animal sounds via multiphonics. Such animals include the dingo and the kookaburra. Players sing through the pipe while continuing to blow the drone. The multiphonics on the didgeridoo are only limited by the performer and are often improvised. Interaction between the vocal sound and the pitch of the vibrating pipe can produce harmonies and reinforced octaves.

Traditional articulations are made by rhythmically changing the size of the oral cavity to create a rhythm. An important rhythm that didgeridoo players learn is the kangaroo, which alternates between the sounds "Wa" and "Ooh" to simulate a kangaroo jumping across the ground.[22]

While the standard way to produce sound on a didgeridoo is to buzz the lips loosely like a tuba, another approach is occasionally used. The player may talk or sing directly into the tube. In this instance the instrument loses its standard quality and the performer is merely vocalizing into a long pipe that colors the vocal sound. However, this technique and the "toot" technique (overblowing the harmonic) are the only ways to make sound on the instrument without the fundamental drone sounding.

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[22] Dirk Shellberg, *Didgeridoo: Ritual Origins and Playing Techniques* (Diever, Holland: Binkey Kok, 1997), 102-105.

Limitations

While pitch manipulation is possible to the extent of the player's vocal agility and range, the fundamental pitch of the pipe (the drone sound) will always be heard, with the exceptions of overblowing the harmonic and talking through the pipe. This limitation results in the didgeridoo being traditionally known as a drone instrument providing rhythmic background for melody.

Volume is another concern. Unlike the tuba, which has an extraordinary dynamic range, the didgeridoo's dynamic range is much more compressed. Electric amplification can be used to increase the dynamic range of the didgeridoo. Additionally, the bell is often directed into a bucket or large can to increase sound and resonance.[23]

The didgeridoo is traditionally an improvisatory instrument and no notation is currently standard for it. While notation is fairly new to the didgeridoo, several notational strategies have evolved. First, lines (graphic notation) may be used to indicate the control of upper harmonic pitch and the adding of syllables to guide the multiphonics. Second, it is also possible to use Western rhythmic notation to indicate rhythm patterns. Last, many performers may find Western notation cumbersome and prefer to see text directions as guidelines for improvisation.[24]

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[23] James Jones, interview by the author, San Antonio, Texas, August 2002.

[24] Russ Landau, interview by the author, telephone, September 2002.

Notation

Dirk Schellberg, author of *Didgeridoo: Ritual Origins and Playing Techniques*, offers a graphic notation that includes vocal syllables. As traditional didgeridoo sounds often imitate animals, Schellberg's notation examples seek to reproduce these (Figs. 36 and 37). Many composers will simply provide text describing the effect they are trying to create and leave the performer with fewer constraints because it is so difficult to notate the sounds of the didgeridoo.

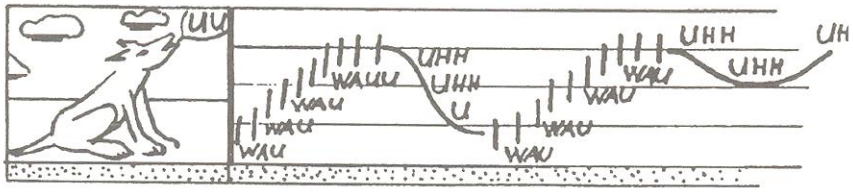

Fig. 36. The Dingo. This represents the howl of the dingo.

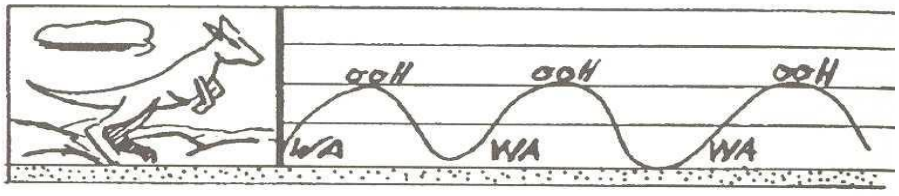

Fig. 37. The Kangaroo. This represents the motion of a kangaroo jumping across land.

Diagrams from Dirk Shellberg, *Didgeridoo: Ritual Origins and Playing Techniques* (Diever, Holland: Binkey Kok,1997), 102 - 103.

Fig. 38. A didgeridoo

The example on the following page, (fig. 39) by Russ Landau, shows written examples of notation. (A) the didgeridoo should be pitched in C, (B) "Didge groove" and (C) Didge "Solo Scream." This shorthand is typical of TV and film scores, which are generally unpublished.

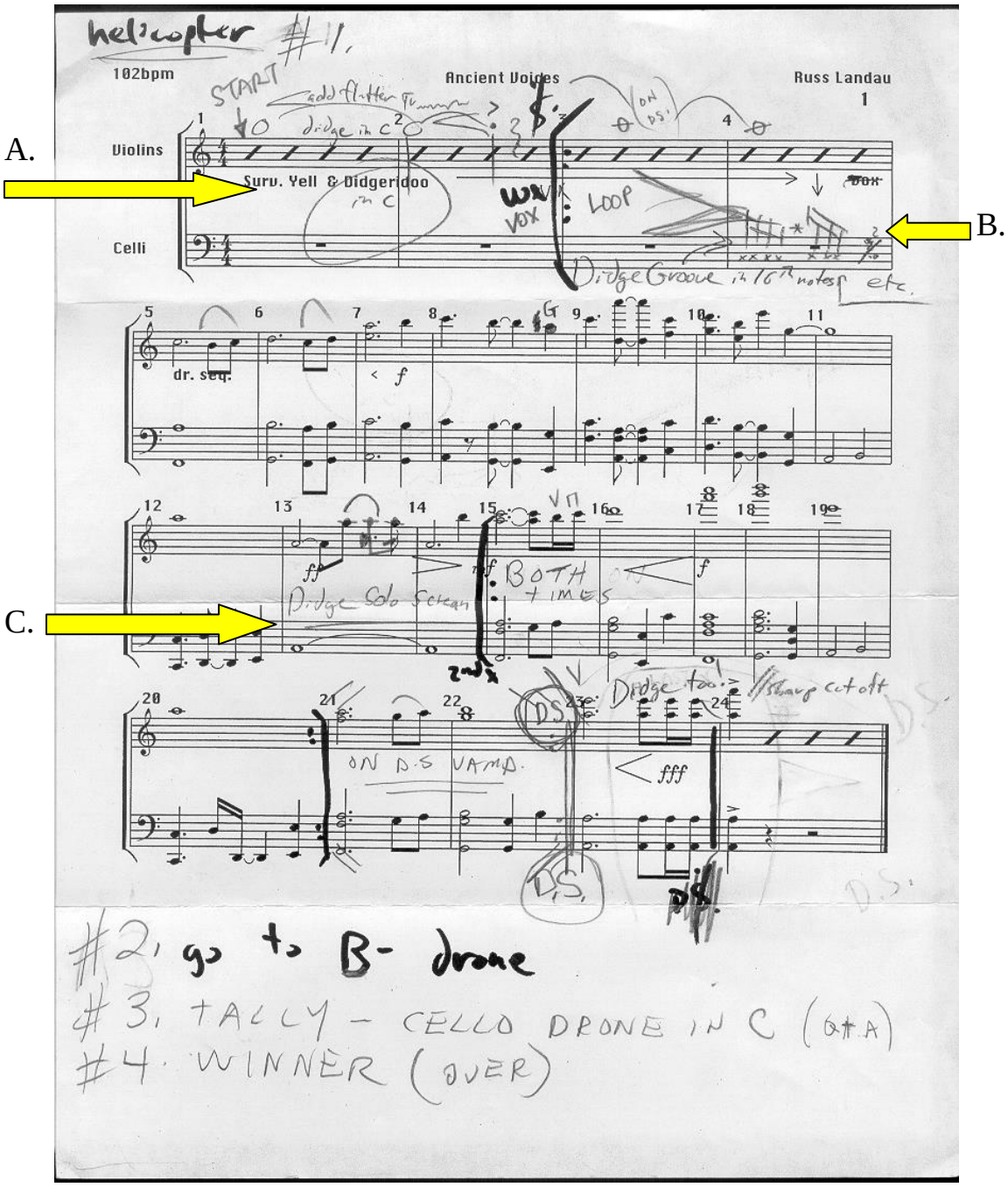

Fig. 39. Manuscript from the TV show "Survivor II: the Australian Outback" by Russ Landau

History and Origins

The didgeridoo is an ancient instrument used by the Australian Aborigines. The Aboriginal culture permits only males to play the didgeridoo. Traditionally it is used for spiritual and ceremonial purposes in conjunction with singing, clapsticks, and dancing. A larger version of the instrument exists that is blown only in religious ceremonies to honor Ngaljod, the rainbow snake.

Contemporary Music

The didgeridoo has been used by rock performers in modern music. Charley McMahon has performed with Midnight Oil and the Gondwanaland Project, and David Hudson has performed with Kate Bush, Madonna, Sting, Peter Gabriel, Yanni, and the Grateful Dead. Other contemporary performers using the didgeridoo include the Sunrize Band and Brother.[25]

[25] David Hudson, interview by the author, e-mail survey. October 2002.

Literature

The didgeridoo has also been used by contemporary composers of concert music such as:

Paul Geraci	(2003) *The Summoning*
Mazakazu Nakagawa and John Fillwalk	(2002) *Corroborree in 6* - (for DVD and Didgeridoo)
Moya Henderson	(1983) *Sacred Site* - (for organ and tape)
Drefus and Winunguj	(1971) *Sextet for Didgeridoo and Wind Instruments*
Pauline Oliveros	(1984) *Song for the Ancestors*

The didgeridoo has also been featured in the soundtracks of modern films and television shows such as: *'Til the End of the World, Mad Max – Beyond Thunderdome,* and "Survivor II: the Australian Outback."

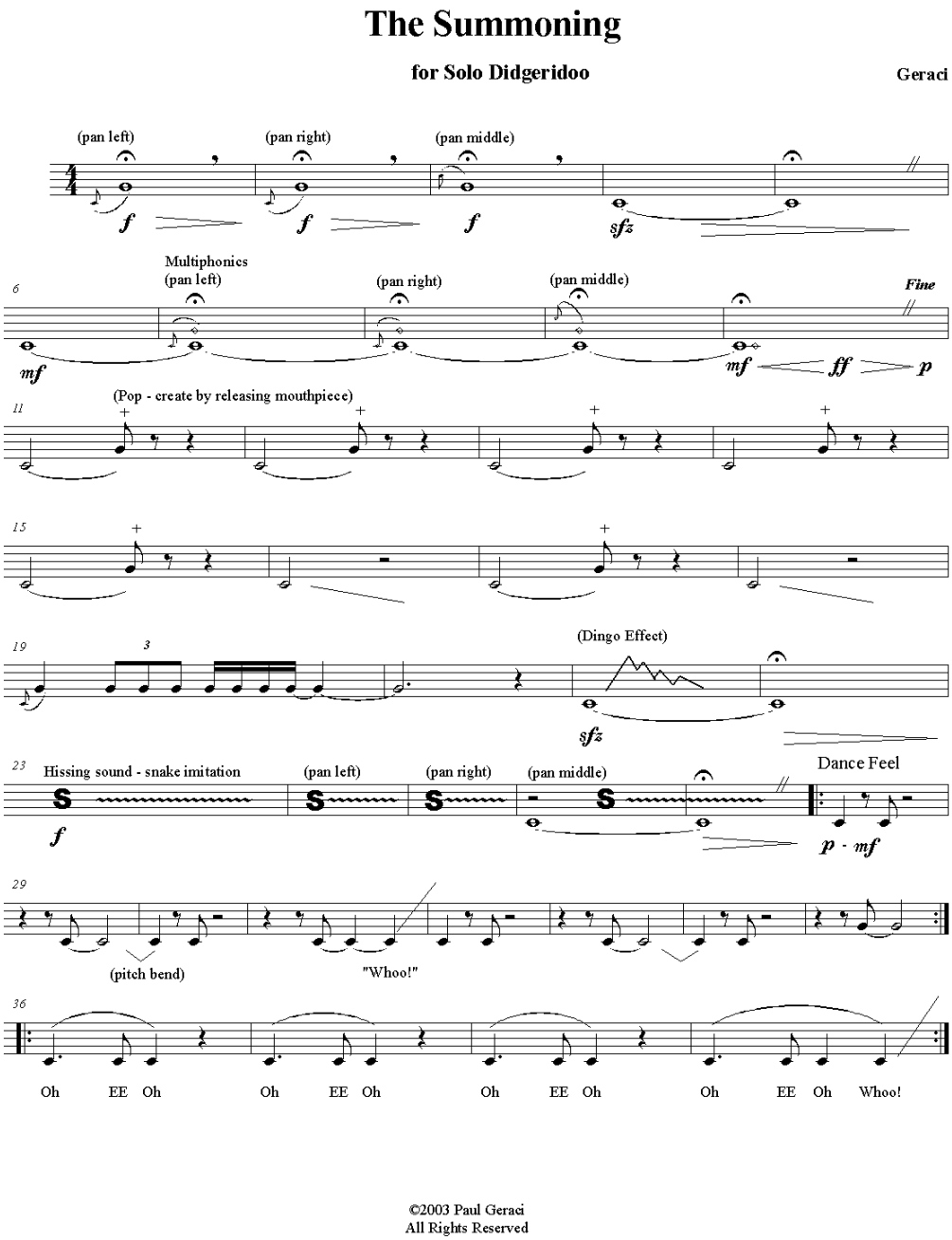

Fig. 40. *The Summoning*, for solo didgeridoo, composed by the author. Note the explanation of unfamilar effects and the notation used for them.

2 The Summoning

40

Oh EE Oh EE Oh EE Oh EE Oh EE Oh Oh EE Oh EE Oh EE Oh - EE Oh EE Oh

f

44

(Dingo Effect)

Oh EE Oh EE Oh EE Oh EE Oh EE Oh Oh EE Oh EE Oh EE Oh

49 Multiphonics

Oh EE Oh EE Oh EE OH EE Oh EE Oh Oh EE Oh EE Oh EE Oh EE Oh EE Oh EE Oh EE

ff

53

Oh EE Oh EE Ta Ta Ta - ah Oh EE Oh EE Ta Ta Ta - ah

57

rit.

Oh EE Oh Oh EE Oh Oh EE Oh

60

(Dingo Effect)

D.C. al Fine

Oh EE Oh

p

Fig. 41. *The Summoning*, for solo didgeridoo, composed by the author.

The notation at m. 49 indicates three things: 1) buzzing a tone, 2) performing syllables in a rhythm, and 3) singing tones above the buzz.

CHAPTER 6

ERHU

Fig. 42

Physical Description

The Erhu is a Chinese violin. The wooden sound box can be hexagonal, octagonal, or circular and is covered with snake skin. Unlike its Western counterpart, the erhu does not have a fingerboard. Additionally, it has only two strings and a captive bow. That is to say, the bow passes in between the strings. Strings were traditionally made of silk but now are typically nylon or steel.

Range and Tuning

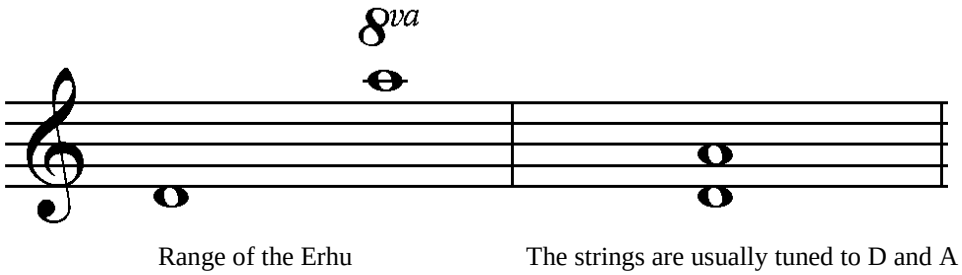

Fig. 43. Range and tuning of the erhu

Although the tuning of the modern erhu is D and A, many works contain different tunings such as C and G, or G and D. Xiazi Abing, also known as Blind Abing, is possibly the most legendary of erhu performers and often used G and D tunings. Some performers use heavier strings to achieve this tuning when performing his music.[26]

[26] Jonathan P. J. Stock, *Musical Creativity in Twentieth-Century China* (Rochester, New York: University of Rochester Press, 1996), 63.

Timbre and Technique

The tone of the erhu closely resembles that of the Western violin. In fact, the erhu is often used instead of the violin in Chinese orchestras. Orchestral erhu parts are often divided into a first and second part. The erhu is played vertically, unlike the horizontal violin. Although it has only two strings, the erhu is capable of playing most of the violin repertoire.

Because of the snake skin covering the sound box, frequent portamento, and the absence of the fingerboard, the erhu can produce a tone that has a distinct vocal quality. In addition to the sound box resonating, the snake skin also vibrates, which contributes to the sound. However, because of its construction, the erhu cannot match the violin's dynamic range. The absence of a fingerboard allows the performer to vary the timbre and effects by constantly adjusting the tension on the strings. Another difference is that the erhu is more touch sensitive. Extra pressure on the string will adjust the intonation, and locking in a pitch is more difficult than on a Western violin. All of these factors give the erhu its unique sound. Because the erhu has only two strings and no fingerboard, the performer has to shift hand positions frequently, resulting in a portamento or glissando between pitches. These pitch bends are characteristic of the instrument and add to its exotic sound.

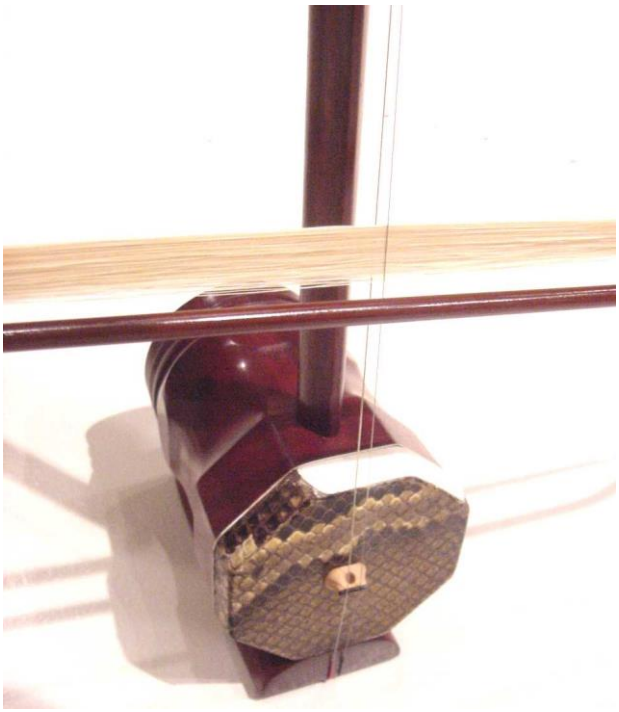

Fig. 44. The captive bow. Note how the bow passes between the strings.

Extended Techniques

The erhu is capable of tremolos, trills, and pizzicatos similar to a violin. Some effects are limited, however, whereas others are facilitated on the instrument. For example, triple and quadruple stops are obviously impossible on a two-stringed instrument. Double stops, while possible, are unusual and difficult because of the captive bow. Yet the erhu can produce a few striking effects that the violin cannot: birds chirping, dogs barking, and horses neighing. The bird effect is found in *Bird's Song in a Desolate Gorge* by Liu Tianhua, and Huang Haihuai uses the horse effect in *Horse Race*.[27] Though no method provides a standard for notating these effects, fig. 45 shows

[27] Jonathan P. J. Stock, interview by the author, e-mail, December 2002.

how the bird effect appears in *Bird's Song in a Desolate Gorge.* The absence of the fingerboard allows the performer to merely touch a string to change pitch. Harmonics can be produced, as on the Western violin, by touching the strings very lightly.

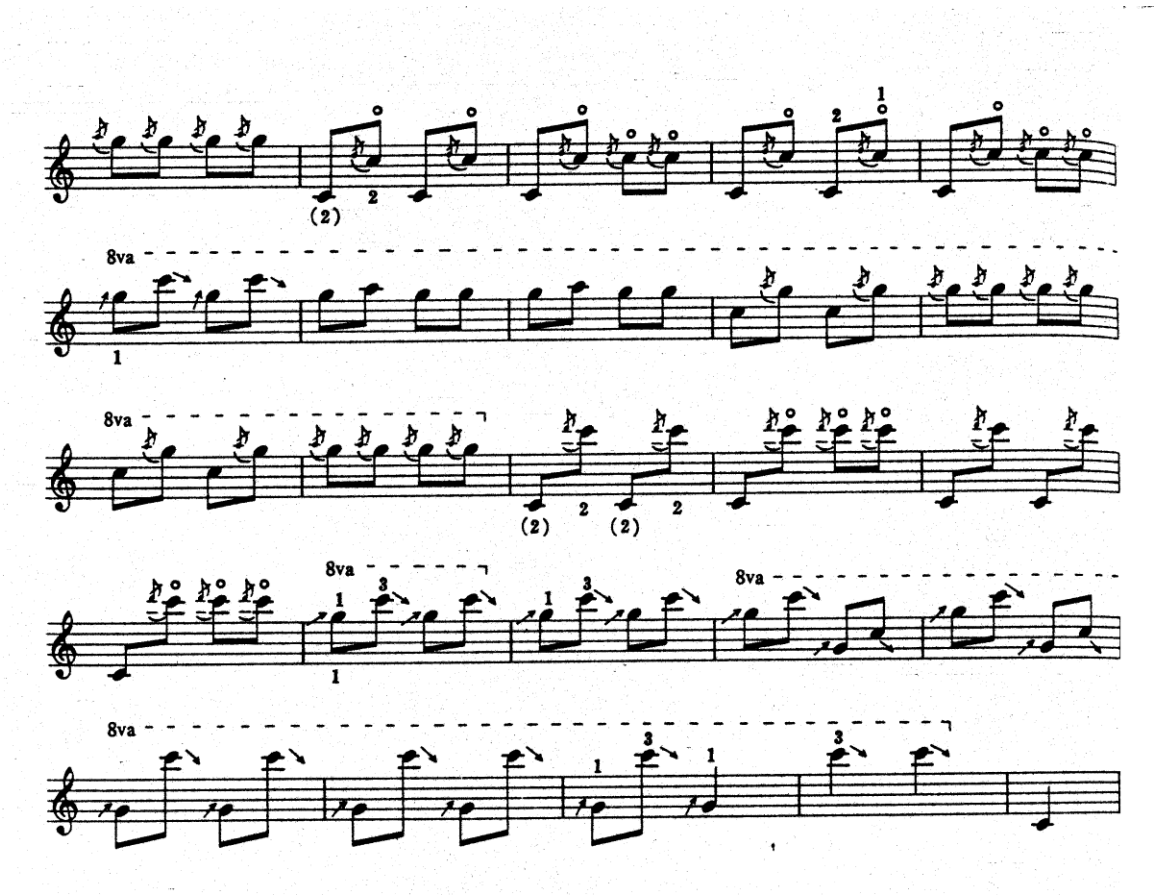

Fig. 45. Example of the "birds" effect in *Bird's Song in a Desolate Gorge* by Liu Tianhua

Excerpt from Liang Mingyue, *Music of the Billion: An Introduction to Chinese Musical Culture* (New York: Heinrichshofen Edition, 1985), 149. Used by permission of C.F. Peters Corporation. On behalf of Noetzel Verlag

Fig. 46. The frog of the bow. Note the hook used to hold the bow hairs, which can detach from the hook.

Notation

Notation has never had an important role in the erhu's literature. Most performers were taught by rote and a strong oral tradition ensured the survival of many works. Three types of notation exist for the erhu: gongche, cipher, and modern Western staff notation. Gongche is an ancient form of notation and is quite rare today.

History and Origins

The erhu is a descendent of the huqin, a plucked Chinese stringed instrument dating back to the eighth century. In the eleventh century the huqin became a bowed instrument. The name *huqin* may be translated as "Northern barbarian" (hu) "stringed instrument" (qin). The prefix "er," the Chinese word for two, identifies it as a two-

stringed fiddle. The instrument was performed at ancient Chinese courts.[28]

The erhu has survived as both a court instrument and an instrument of the poor. Often being associated with blind musicians, it was the common instrument of street beggars. One blind musician named Hua Yanjun, better known as Xiazi Abing or Blind Abing, added considerably to the repertoire of the erhu.[29]

Today the erhu is not approached as an instrument of the poor. Instead, it is regarded as a professional concert violin being taught in music colleges and conservatories throughout China. A greater demand now exists for virtuosic playing in a more Westernized style. Even the notation presently uses Western staves in favor of the old Chinese gongche and cipher scores.

Literature

Rodger Nelson	(2001) *Gathering Violets*
Jiang Fengzhi	*Autumn Moon over the Han Palace*
Rong Zhai	(1814) *Xiansuo shisan tao*
Xiazi Abing	(ca. 1915-1930) *The Moon Reflected on the Second Springs*
	(ca. 1915-1930) *Cold Spring Wind*
	(ca. 1915 - 1930) *Listening to the Pines*
	Moon Mirrored in the Pond

[28] Jonathan P. J. Stock, "A Historical Account of the Chinese Two-Stringed Fiddle Erhu" *Galpin Society Journal* 5 (March 1993) : 87-91.

[29] Jonathan P. J. Stock, *Musical Creativity in Twentieth-Century China* (Rochester, New York: University of Rochester Press, 1996), 62.

Liu Tianhua	(1928) *Bird's Song in a Desolate Gorge*
	Night Music
	Beautiful Moonlit Eve
	(ca. 1918) "Groaning in Sickness" from *Ten Solos*.
Huang Haihuai	(1964) *Horse Race*
Lu Xiutang	*Yearning for Home*

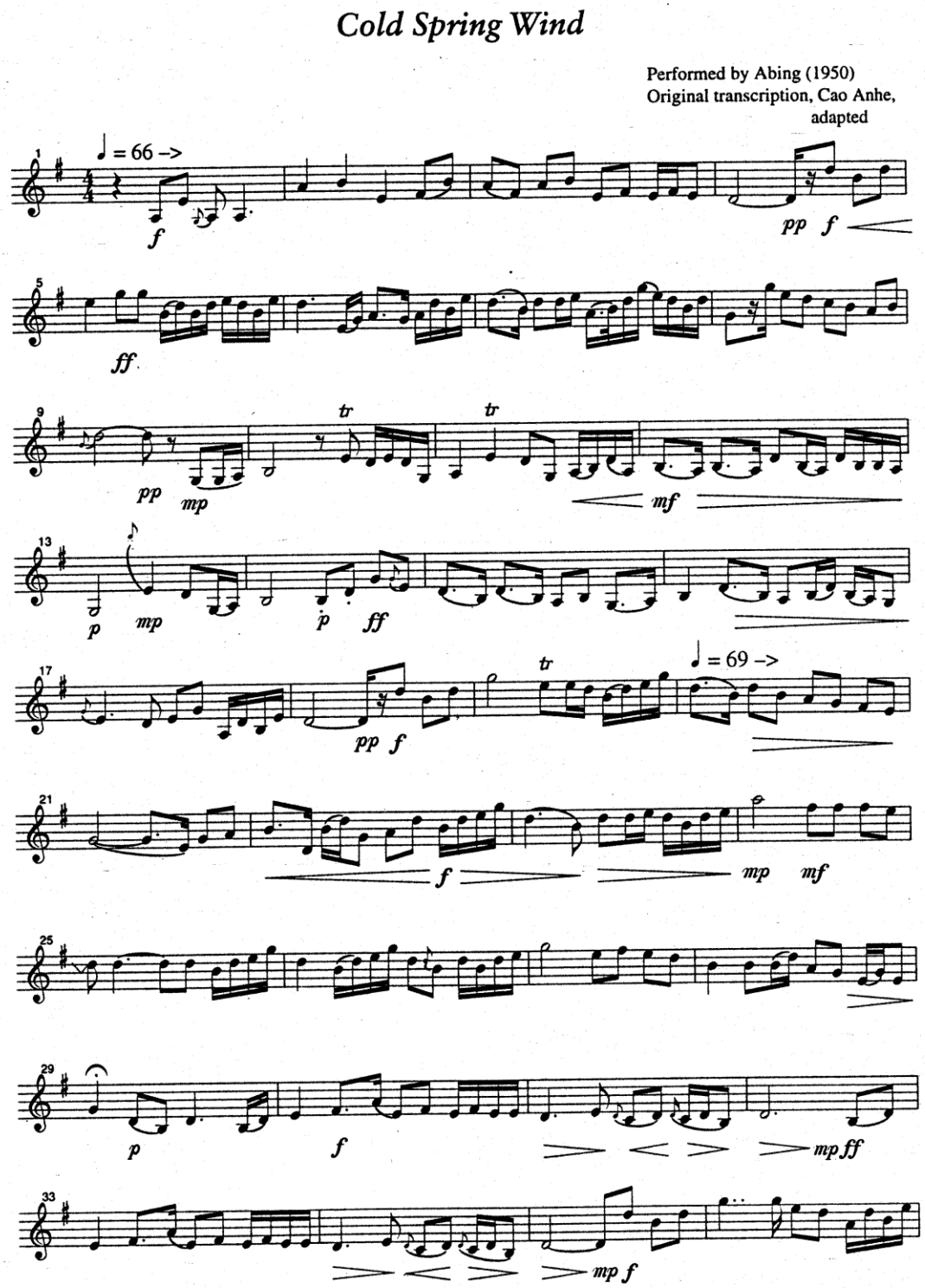

Fig. 47. Transcription of *Cold Spring Wind* by Xiazi Abing

Excerpt from Jonathan P. J. Stock, *Musical Creativity in Twentieth-Century China* (Rochester, New York: University of Rochester Press, 1996), 169.

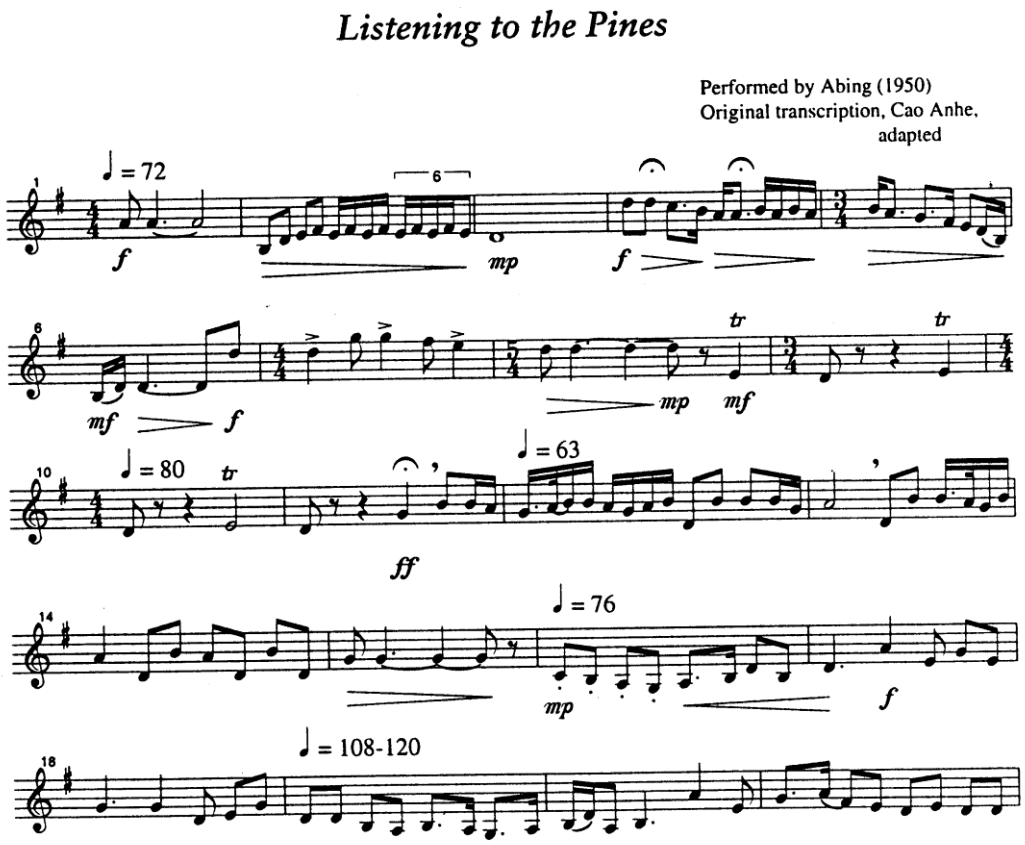

Fig. 48. Transcription of *Listening to the Pines* by Xiazi Abing

Excerpt from Jonathan P. J. Stock, *Musical Creativity in Twentieth-Century China* (Rochester, New York: University of Rochester Press, 1996), 171.

CHAPTER 7

GLASS HARMONICA

Fig. 49. A Glass Harmonica. Courtesy of the Franklin Institute Online, www.fi.edu

Physical Description

The glass harmonica is the invention of Benjamin Franklin. This glass harmonica, or glass armonica as he called it, consists of several glass bowls blown to specific sizes to produce discrete pitches. They are put on a turning rod that is motorized and the rotation carries the glass bowls through a trough of water to keep the bowls wet. When the performer touches a bowl, the rubbing motion is automatic because of the turning rod's rotation.

Range

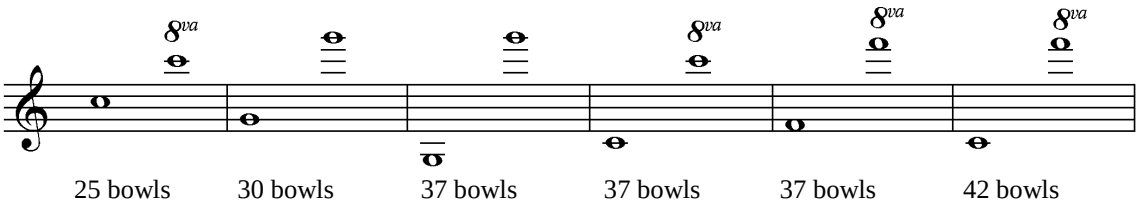

Fig. 50. Range of the glass harmonica

Because the glass harmonica is a custom-built instrument, its range depends on the number of bowls. Glass harmonicas can have 25, 30, 37, or even 42 bowls. An instrument with 37 bowls spans three octaves.[30]

[30] Jesse Whipkey, webmaster, "G. Finkenbeiner Inc." [Web page]; Available from http://www.musicalglass.com/GLASS%20HARMONICA.htm; accessed November 2002.

Timbre and Technique

The tone of the glass harmonica has been both feared and admired by many, including Paganini, who referred to it as "such a celestial voice," and Thomas Jefferson claimed it was "the greatest gift offered to the musical world of this century." Franz Mesmer, an early pioneer of hypnotism, used the glass harmonica in his sessions. Its tone was also said to deepen the emotions, thus it could make a sad man plunge deeper into despair. In the 1800s, German officials banned the instrument, claiming that its tone contributed to insanity, convulsions, and premature births. Yet despite its controversial history, the magical timbre that the instrument produces still fascinates composers and listeners alike.[31]

Playing the glass harmonica begins with the rotation of the glasses, accomplished by a motor or, in Franklin's day, by a foot-operated treadle. The fingers are moistened with distilled water and the player touches the bowls he or she wants to sound. The arrangement of the bowls is chromatic and is sometimes colored to indicate certain pitches.

Although the glass harmonica is a polyphonic instrument, it has more limitations than do keyboard and guitar instruments. Intervals are limited to the spread of the performer's fingers. Because the bowls decrease in size as they increase in pitch, greater intervals are available in the upper range.

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[31] Thomas Bloch, "The Glassharmonica," translated by Michelle Vadon [Web page]; Available from http://www.musicalglass.com/gh.html; Internet; accessed November 2002.

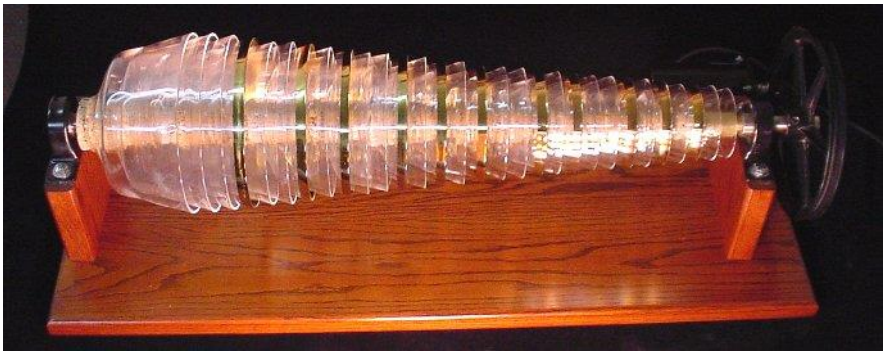

Fig. 51. Glass harmonica with thirty bowls

Literature

Opera

David August von Apell	(1808)	*Cantata Il trionfo della musica glassharmonica*
Ferruccio Busoni	(1925)	*Doktor Faust*
Ludwig van Beethoven	(1815)	"Melodram" from *Leonore Prohaska*
Gaetano Donizetti	(1835)	"Scena della pazzia" from *Lucia di Lammermoor*
Gary Eister	(1997)	*The Glass Harmonica*
Richard Strauss	(1919)	*Die Frau ohne Schatten*
Johann Friedrich Reichardt	(1801)	*Der Tod des Herkules Tod*

Orchestra

Antonin Reicha	(1806)	*Grand solo pour harmonica et l'orchestre*
Johanna d'Arc	(1806)	*Melodram nach Schiller*
Johann Adolph Hasse	(1769)	*Kantate L'Armonica*
Camille Saint-Saëns	(1887)	*The Carnival of the Animals*
Carl Maria von Weber	(1811)	*Adagio e Rondo*

Karl Leopold Röllig (ca. 1790) *6 Konzerte für Glasharmonika*

Chamber Music

Johann J. S. von Holt Sombach *Adagio for glass harmonica and string quartet*

Etienne Nicolas Mehul *Konzertstück*

Wolfgang Amadeus Mozart (1791) *Adagio und Rondo*, K. 617

Johann Gotlieb Naumann (1789) *Quartet* for glass harmonica, flute, viola and cello

Johann Friedrich Reichardt (ca. 1786) *Grazioso*

Johann A. P. Schulz (1799-1800) *Largo für die Harmonika*

History and Origins

The concept of striking glasses filled with varying amounts of water to create distinct pitches goes back to the ninth century. In 1743 an Irishman named Richard Puckeridge initiated the idea of rubbing the glasses instead of striking them to cause vibrations. Soon several glasses were set up to obtain multiple pitches. This instrument became known as the "seraphim" or the "musical glasses". Today it is also known as the glass harp and even sometimes referred to as the glass harmonica.

In 1761 Benjamin Franklin improved upon Puckeridge's idea. Instead of filling the glasses with water, he had them blown to distinct sizes that would sound specific pitches. Therefore, unlike the seraphim, the glass harmonica never needs to be tuned.

Although the instrument was an American invention, it quickly found its home in Germany. Mozart and Beethoven both wrote for the instrument and approximately 400 pieces were written for it until its decline 75 years later. In 1835, some medical studies said that the tone of the instrument made people mad and that it frightened animals and could make people ill. Thus, for health and public safety, the glass harmonica was

banned in Germany. These superstitions may include a hint of truth, as the glass bowls used were said to have a high lead content and may have contributed to illness.[32]

While the glass harmonica has never made a complete recovery, it (or its close relative, the seraphim) can be found in performances of transcriptions of well-known tunes. Camille Saint-Saëns used a glass harmonica in the aquarium movement of *Carnival of the Animals* (see fig. 52). More recently, in 1997, a one-act opera by Gary Eister entitled *The Glass Harmonica* was commissioned. The play includes such notable characters as Franklin, Mesmer, and the ghost of Mozart.

[32] Ibid.

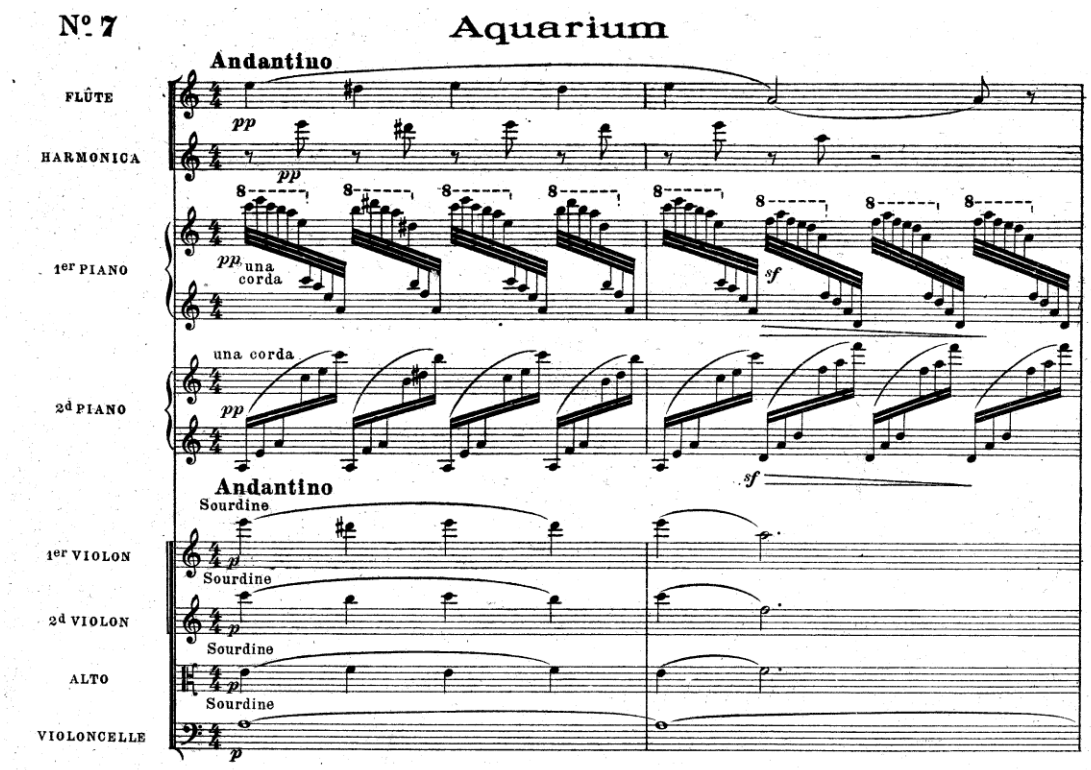

Fig. 52. *Carnival of the Animals* by Camille Saint-Saëns

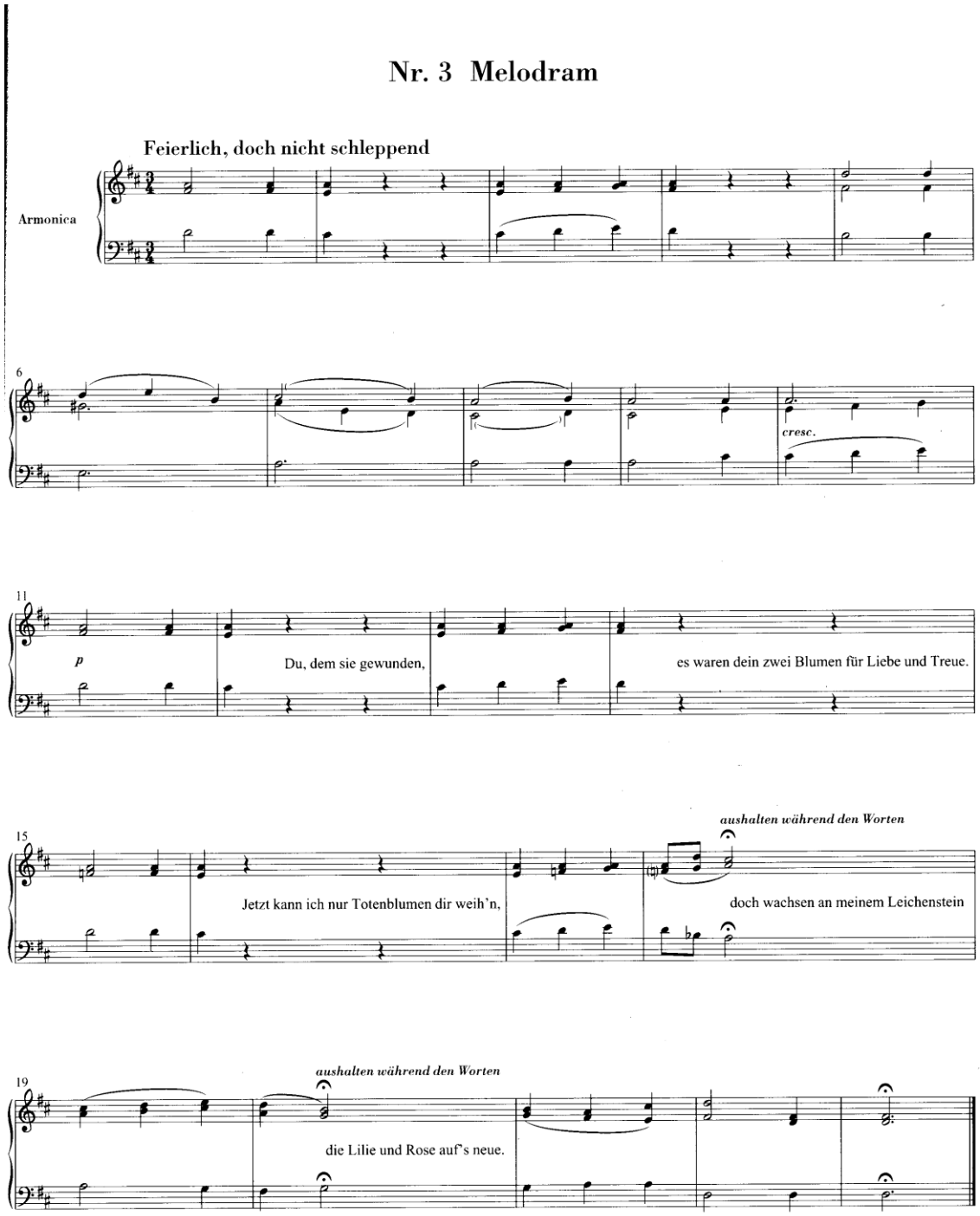

Fig. 53. "Melodram" from *Leonore Prohaska* by Beethoven

W. A. MOZART

Adagio und Rondo in c/C

für Glasharmonika, Flöte, Oboe, Viola und Violoncello

KV 617

Vollendet Wien, 23. Mai 1791

Adagio

Flöte

Oboe

Viola

Violoncello

Adagio

Glasharmonika

Fig. 54. *Adagio und Rondo in C* by Mozart

CHAPTER 8

HAMMERED DULCIMER AND CIMBALOM

Fig. 55

Physical Description

The hammered dulcimer is a member of the chordaphone family, or more specifically, the zither family. This instrument is not to be confused with the mountain or Appalachian dulcimer, which evolved much later. The hammered dulcimer is usually trapezoidal in shape and has two bridges and two sound holes for two sets of strings. Metal strings are attached to tuning pegs and run horizontally across the instrument. The sound board is made of wood. Some instruments have built-in legs while others require a stand.

Fig. 56. A cimbalom

The cimbalom (also spelled cymbalom or cymbalum) is a large hammered dulcimer, which originated in Hungary, and often has a metal frame and a built-in cabinet with legs to stand on. Though usually found in folk and gypsy music, it has occasionally found its way into orchestral settings. The cimbalom has a range from four and a half to five chromatic octaves with triple-strung notes, and can have up to 125 strings. It also has a damper pedal, which operates similarly to a piano's damper pedal.

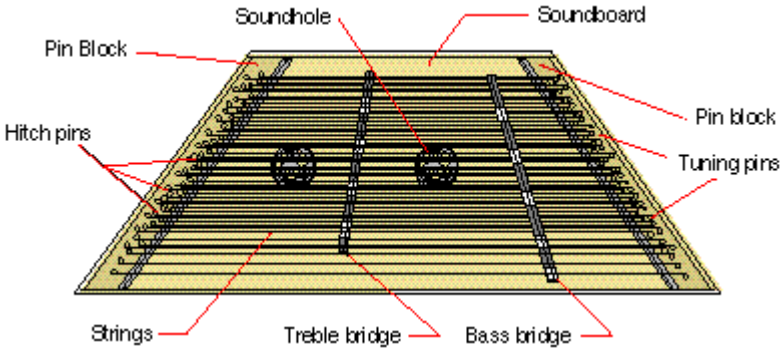

Fig. 57. The parts of the hammered dulcimer

Range

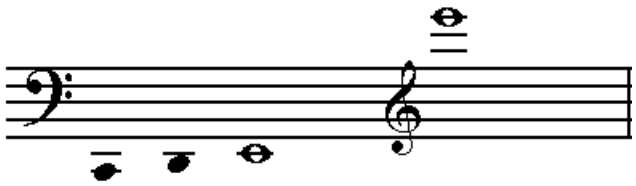

Fig 58. Range of the cimbalom

Dulcimer ranges will be smaller and more variable.

Tuning

The hammered dulcimer can employ various tuning schemes. Traditionally it is tuned to play in the keys of C, G, D, and A, the preferred keys of fiddlers. Therefore, smaller dulcimers are generally diatonic instruments confined to specific keys. In contrast, larger instruments and the Hungarian cimbalom have more chromatic capabilities. Notice the differences in tuning in the following tuning charts (figs. 59 and 60). The dulcimer enjoys a more compact organization of pitches, but the cimbalom has the larger range and capacity to perform in all keys. It should also be noted that, although the following are common tuning systems among dulcimers, other systems and transpositions do exist.

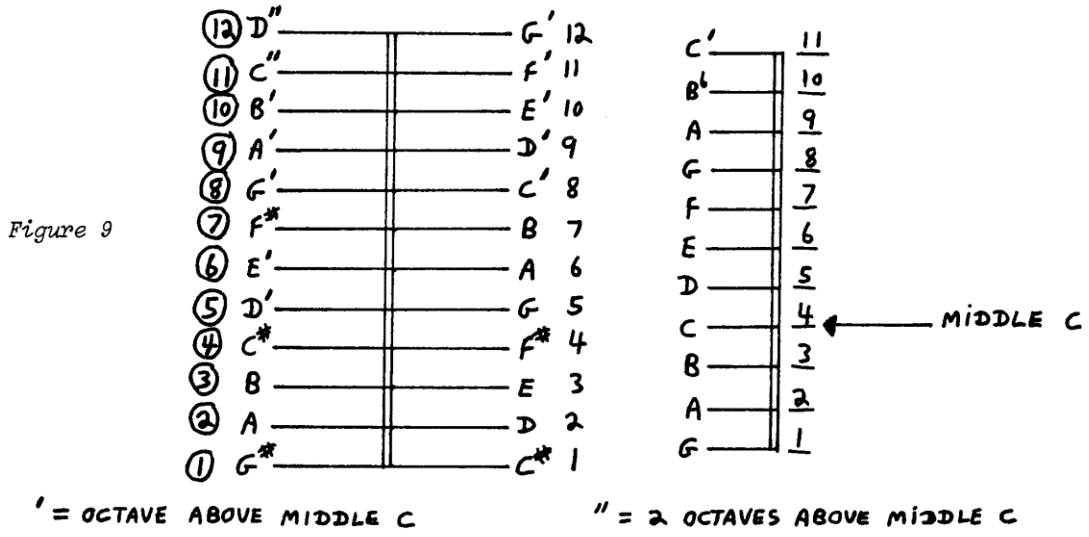

Fig. 59. A common tuning for the dulcimer from Phillip Mason, *The Hammered Dulcimer Instruction Book* (Washington D.C.: Communications Press, Inc., 1977), 11.

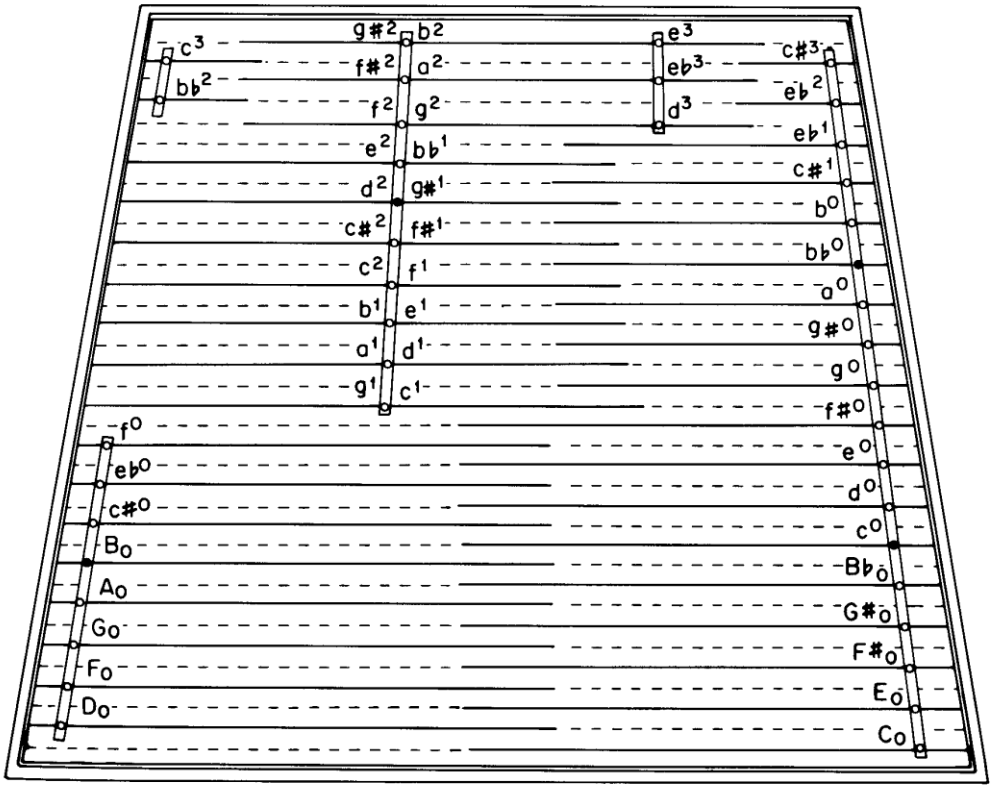

Fig. 60. Tuning for the cimbalom from Andrew Stiller, *Handbook of Instrumentation* (Los Angeles, California: University of California Press, 1985), 317.

Timbre and Technique

The timbre of the dulcimer has a distinct attack, which is more like the harpsichord's attack than that of the piano. Its sustain closely resembles that of a sitar, honky-tonk piano, or a combination thereof. As the name implies, small hammers are used to strike the strings. This method of sounding the strings is unlike the mountain or Appalachian dulcimer, which is plucked. Hammers can come in a variety of shapes. Some are padded and others are not. The type of hammer used affects the tone of the instrument. Because the player uses only two hammers (one per hand), generally the performer can only strike two notes simultaneously, although sometimes two adjacent strings may be struck at the same time. Multiple pitches may be rolled as on a piano or harp. Trills and tremolos are also possible.

Fig. 61. A pair of hammers

The dulcimer's tone will ring out until the sound decays or the string is dampened. The performer can dampen the strings with the hand or, in the case of the cimbalom, by use of the pedal; however, the pedal does not affect notes above Eb^3. A timbral variation can be achieved by playing near the bridge (sul ponticello). Bartók calls for the cimbalom to play pizzicato in his *First Rhapsody* (See fig. 62).

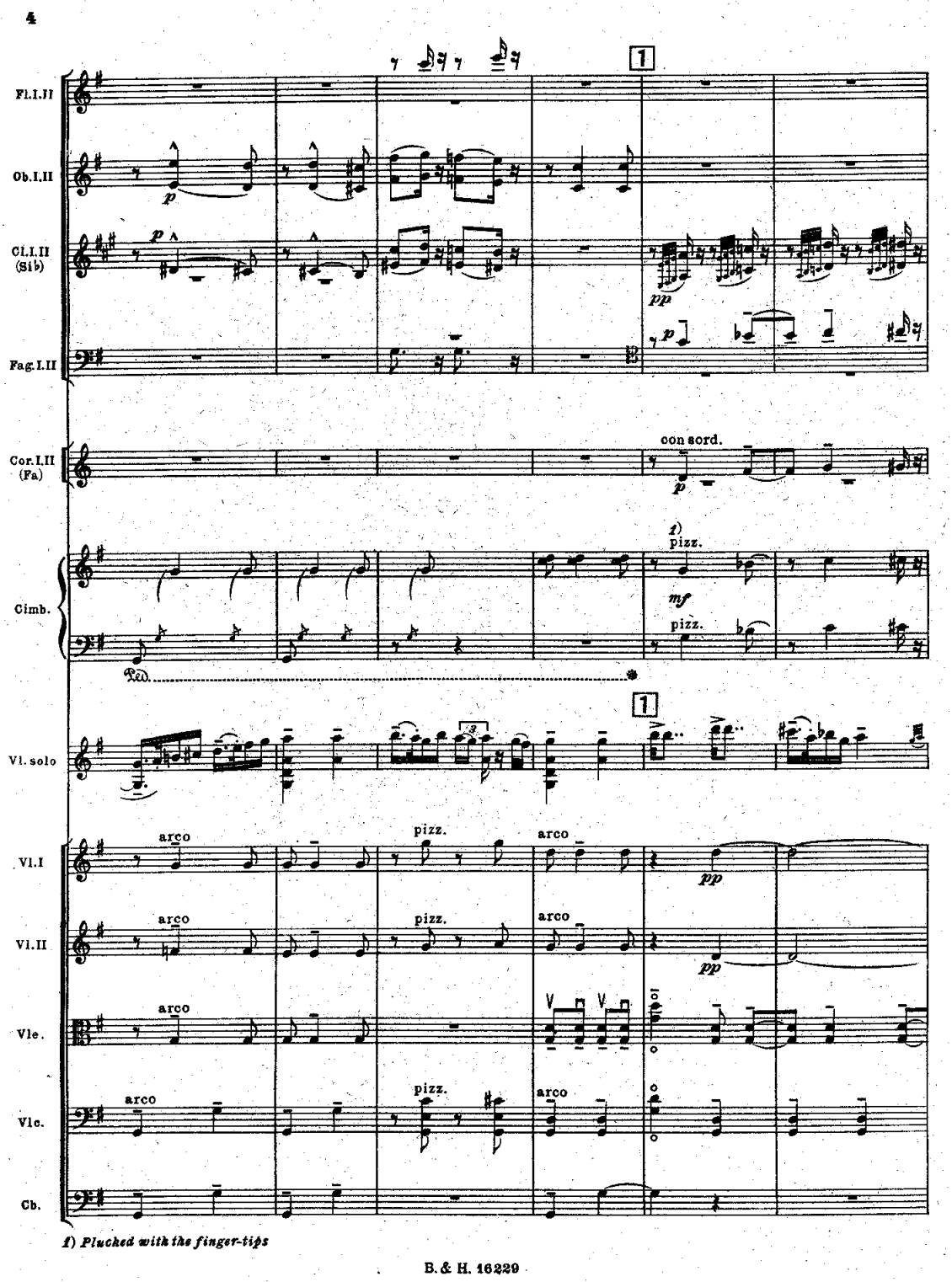

Fig. 62. *First Rhapsody* by Béla Bartók

Note the cimbalom playing pizzicato and the footnote "plucked with the finger-tips."

Literature

While the hammered dulcimer is largely confined to folk music or transcriptions, the Hungarian cimbalom has been employed by various composers in concert repertoire. Some composers (such as Stravinsky and Bartók) have indicated that, if a cimbalom is unavailable, the part should be played on the piano or harp. Excerpts from Peter Hamlin's *Hardanger Concerto* also include a hammered dulcimer and appear in the Hardanger Fiddle entry in figs. 76 and 77.

Igor Stravinsky	(1917) *Renard*
	(1920) *Ragtime*
Béla Bartók	(1931) *First Rhapsody*
Zoltán Kodály	(1926) *Hary Janos Suite*
Richard Strauss	(1923) *Dance Suite* (after Couperin)
Pierre Boulez	(1965) *Eclat*
Henri Dutilleux	(1985) *L'Arbre des songes*
Peter Maxwell Davies	(1984) *Sonatina for Violin and Cimbalom*

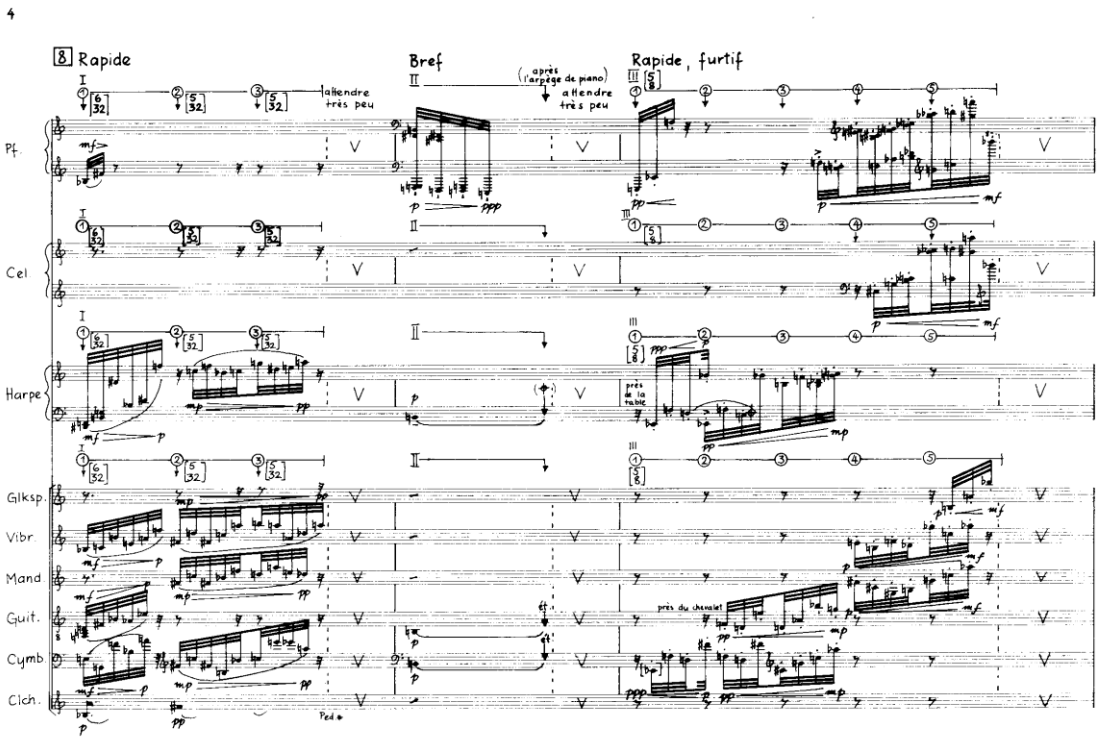

Fig. 63. *Eclat* by Pierre Boulez. Note the agility of the cimbalom.

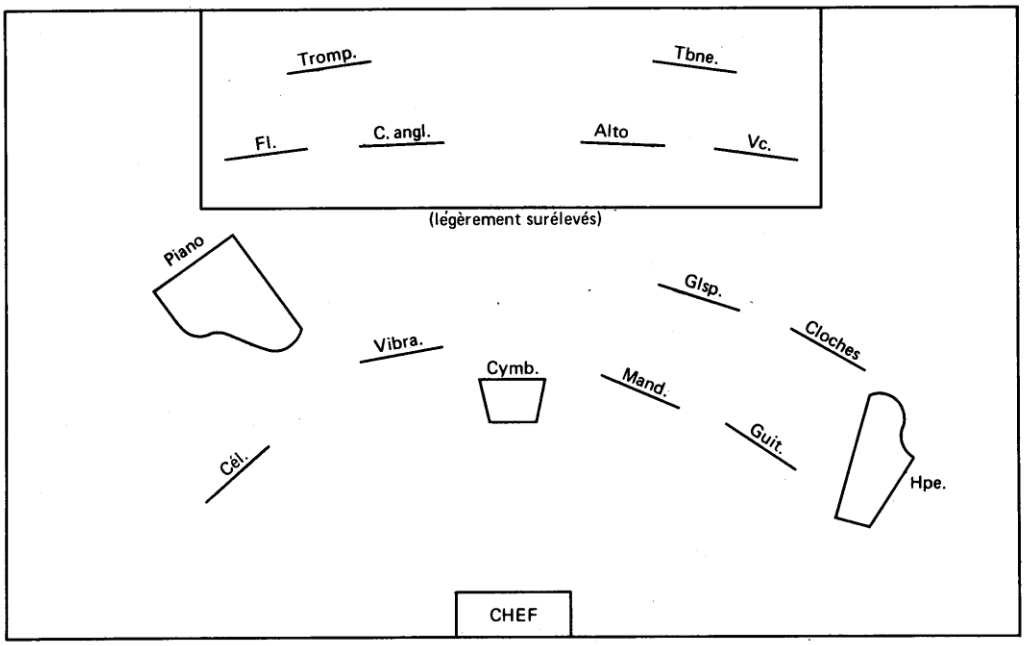

Fig. 64. Boulez's recommended placement of the cimbalom

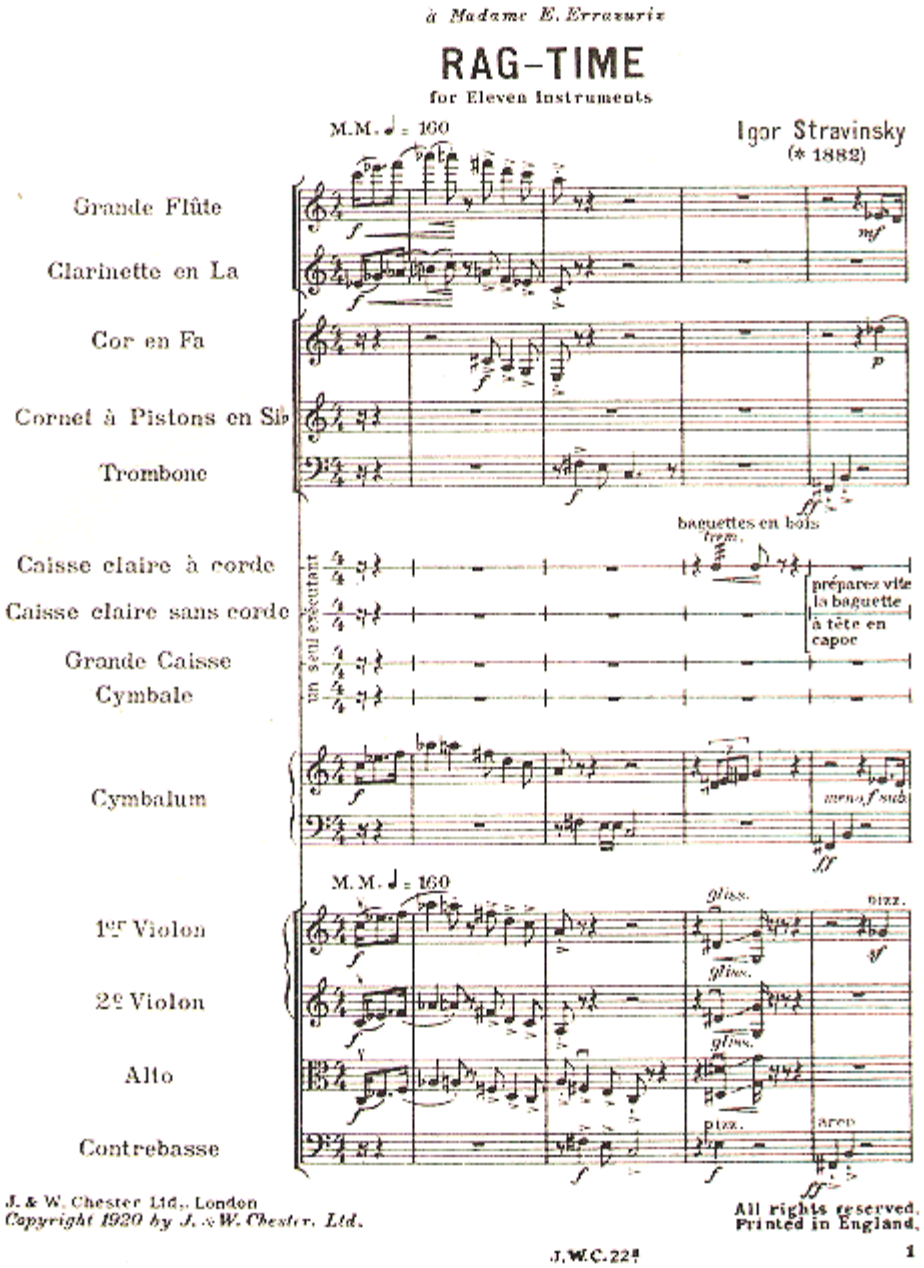

Fig. 65. *Ragtime* by Stravinsky

Note the cimbalom's place in the score order and the use of the grand staff.
Igor Stravinsky, *Ragtime* (London: J & W Chester Ltd., 1920).

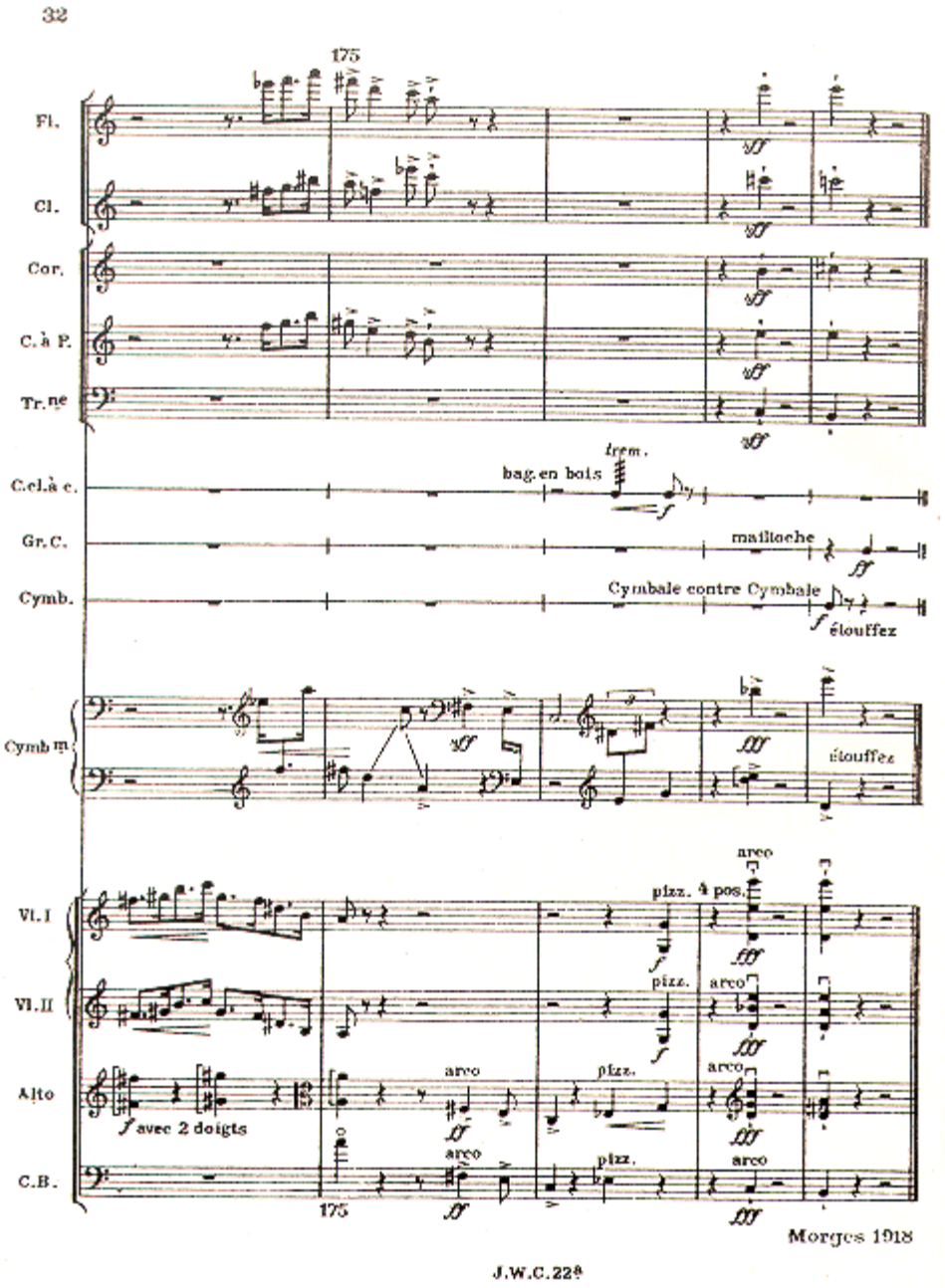

Fig. 66. *Ragtime* by Stravinsky

Igor Stravinsky, *Ragtime* (London: J & W Chester Ltd., 1920).

History and Origins

The first direct ancestor of the dulcimer is the psaltery, which was popular in the Middle Ages. This instrument was often triangular or trapezoidal and was similar to the dulcimer except for two major differences: it did not have a bridge, and the strings were plucked instead of struck. Later on, the psaltery began to be struck instead of plucked, and thus became the bridge to the dulcimer.

Fig. 67. Laurence Kaptain, cimbalom and Sir George Solti

The dulcimer had many variations in different countries. Indeed, similar instruments appear under different names in many cultures: the santur in Persia; the doulcemer in France, England, and later Spain; the cimbalom in Eastern Europe; and the Hackbrett ("chopping board") in Germany. Two variations appeared in Italy: the

hackbrett and the doulcemer. There is also evidence that the dulcimer was played by women in all of these cultures.[33]

The Hungarian cimbalom, a descendent of the hackbrett, was invented in 1874 by V. J. Schunda of Budapest. Although a cimbalom had been in existence, Schunda gave his instrument legs, created a damper pedal mechanism, and increased the instrument's range to four octaves.[34]

The American hammered dulcimer originated in Europe. As an inexpensive, portable, and easy to build instrument, it was ideal in the 1800s for Americans living in the frontier land. It quickly became an American folk instrument used to accompany dance or fiddle tunes such as reels, jigs, hornpipes, and waltzes. In 1924 Henry Ford (of automobile fame) established Henry Ford's Early American Orchestra which included a violin, dulcimer, cimbalom, and bass or tuba.[35]

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[33] Paul M. Gifford, *The Hammered Dulcimer: A History* (Lanham, Maryland: Scarecrow Press, 2001), 31-27, 31, 36-37.

[34] Mary Remnant, *Musical Instruments: An Illustrated History* (Portland, Oregon: Amadeus Press, 1989), 174.

[35] Nancy Groce, *The Hammered Dulcimer in America* (Washington D.C.: Smithsonian Institution Press, 1983), 36-37.

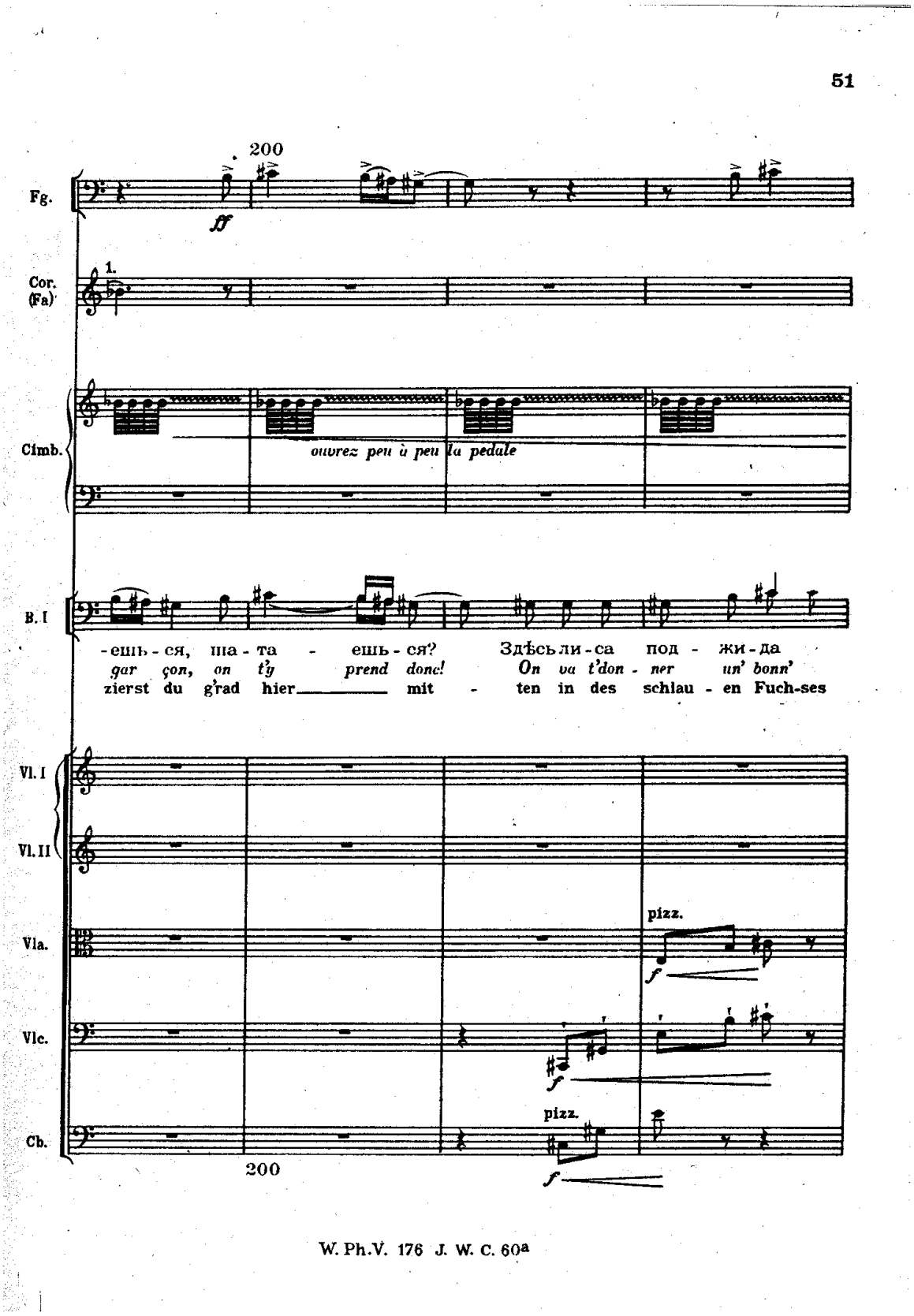

Fig. 68. *Renard* by Igor Stravinsky. Note the texture created by the cimbalom tremolo. Igor Stravinsky, *Renard* (London: J & W Chester Ltd., 1917).

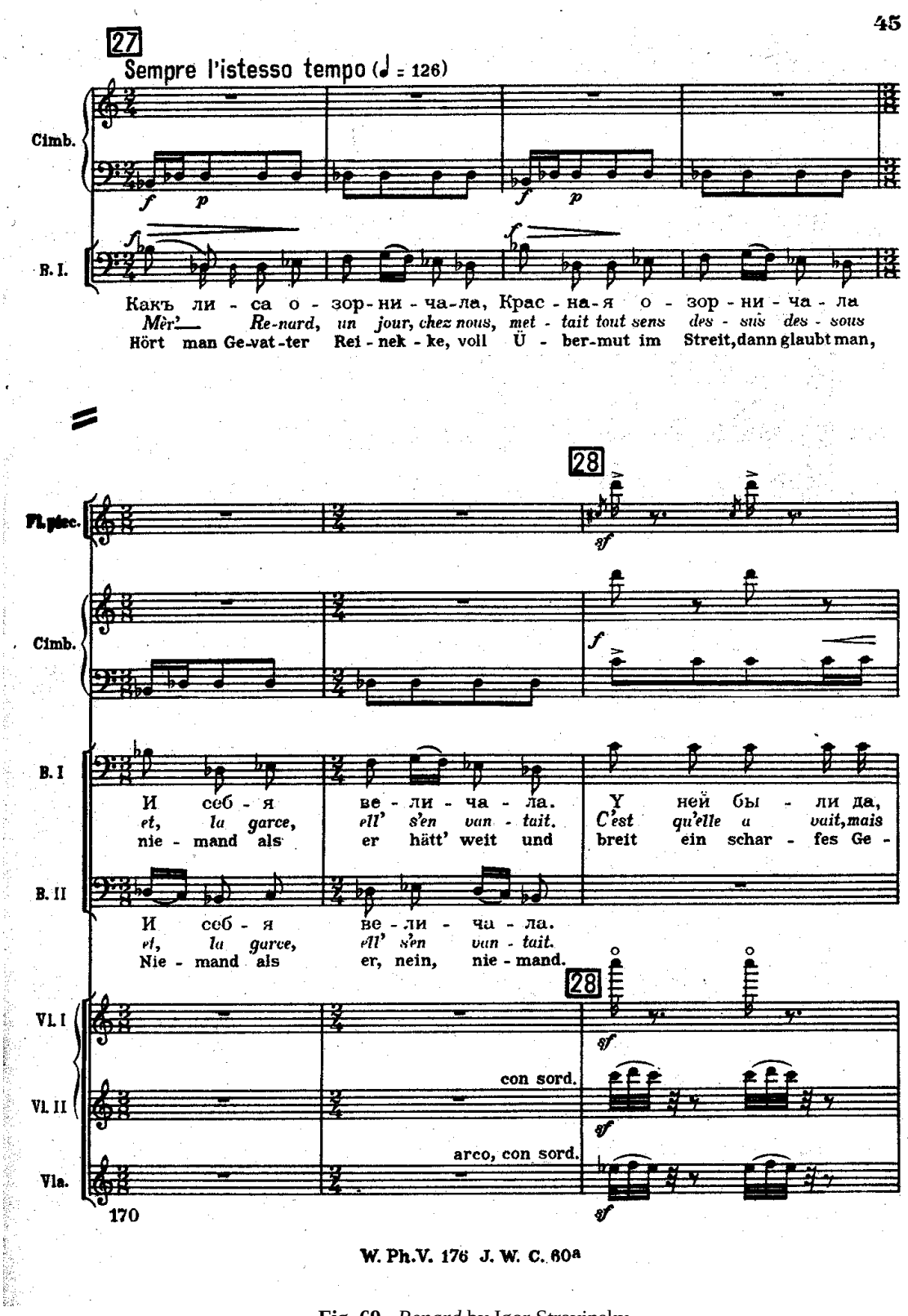

Fig. 69. *Renard* by Igor Stravinsky
Stravinsky uses the cimbalom to accompany the vocalist.
Igor Stravinsky, *Renard* (London: J & W Chester Ltd., 1917).

CHAPTER 9

HARDANGER FIDDLE

Fig. 70. Photo by Bevan Wulfenstein

Physical Description

At first glance, the Norwegian hardanger fiddle (also called the hardingfele) looks like a normal violin with ornate engravings, fancy inlays, and extra tuning pegs. Its body is often highly decorated and the scroll is often carved in the shape of a maiden or an animal. Under closer examination one will notice a major physical difference from the Western concert violin; underneath the fingerboard run four or five sympathetic strings. In this respect the hardanger fiddle is a closer cousin to the viola d'amore than to

the violin. The main strings made of steel or gut are lighter than violin strings, and the sympathetic strings are made of steel. The hardanger fiddle has a flatter bridge than the violin's more rounded one, making double and triple stops easier and allowing a drone pitch to be emphasized during performance (see figs. 76, 80, and 81). The fingerboard is also flatter than that of the Western violin, and the f holes are slightly more indented.

Range

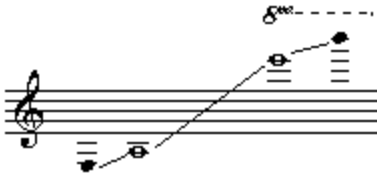

Fig. 71

With the exception of the bottom note, the range of the hardanger fiddle is almost identical to that of the Western violin.

Tuning

Fig. 72. A common tuning of the four main strings and the five sympathetic strings

The tuning of the hardingfele frequently involves scordatura. In fact, there are at least 20 different scordatura tunings for the instrument. The above diagram displays the most common tuning. Troll tuning is a specialized tuning that emphasizes the major third

between the top two strings, and is traditionally only employed between the hours of midnight and dawn.[36]

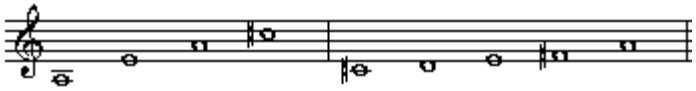

Fig. 73. An example of troll tuning. Tuning of the four main strings and five sympathetic strings

Timbre

The hardingdfele has a rich tone filled with enhanced brilliance and resonance from the sympathetic strings with a resonance that can be so profound that it is sometimes easy to mistake one hardingfele for 3 martelé violins. This resonance is best heard in multiple stops that are easier to play on the hardingfele than on a Western violin because of the flat bridge. As a folk instrument often used to accompany dancing, multiple stops are quite common. Traditionally, the hardingfele is a polyphonic instrument frequently using one string as a drone while another plays a melodic line.

[36] Pandora Hopkins, *Aural Thinking in Norway: Performance and Communication with the Hardingfele* (New York: Human Sciences Press Inc., 1986), 160-162.

Fig. 74. Note the set of strings under the ornate fingerboard.

Fig. 75. The carved scroll and extra tuning pegs
Photo by Bevan Wulfenstein

Techniques

The techniques are much the same as those of the modern Western violin. These include pizzicato, multiple stops, harmonics, tremolo, ponticello, sul tasto, martelé, louré, spiccato, jeté, col legno, vibrato, scordatura, and glissandi. (For more information on extended violin technique the reader may consult an orchestration text.)

History and Origins

The hardanger fiddle is the national instrument of Norway. It is thought to have been invented in the mid-1600s near the fjord of Hardanger, hence its name. There exist over one thousand fiddle folk tunes called *slaatter*. These folk tunes all have regional origins and therefore display stylistic differences in the tunes of Telemark, Nordfjord, Bergen, and other Norwegian locales. The folk music of Norway often has a connection

with myth and the supernatural. The hardanger fiddle was also often used to accompany dancers.[37]

Modern Works

Like many other folk instruments, the hardanger fiddle was traditionally taught using oral traditions. Therefore, it was only in the last century that tunes were first transcribed and notated. Some modern composers have begun to write for this instrument as well.

Howard Shore	(2002) "Riders of Rohan" from *The Lord of the Rings*
Peter Hamlin	(1996) *Hardanger Concerto*
Johan Kvandal	(1995) *Fantasy for Hardanger Fiddle and Strings,* Op. 82
	(1978) *Quintet for Hardanger Fiddle and Strings,* Op. 50
Geirr Tveitt	(1965) *Concerto for Hardanger No. 2, "Three Fjords,"* Op. 252
	(1955) *Concerto for Hardanger No. 1,* Op. 163

[37] Nils Grinde, *A History of Norwegian Music* (Lincoln, Nebraska: University of Nebraska Press, 1991) 91-93.

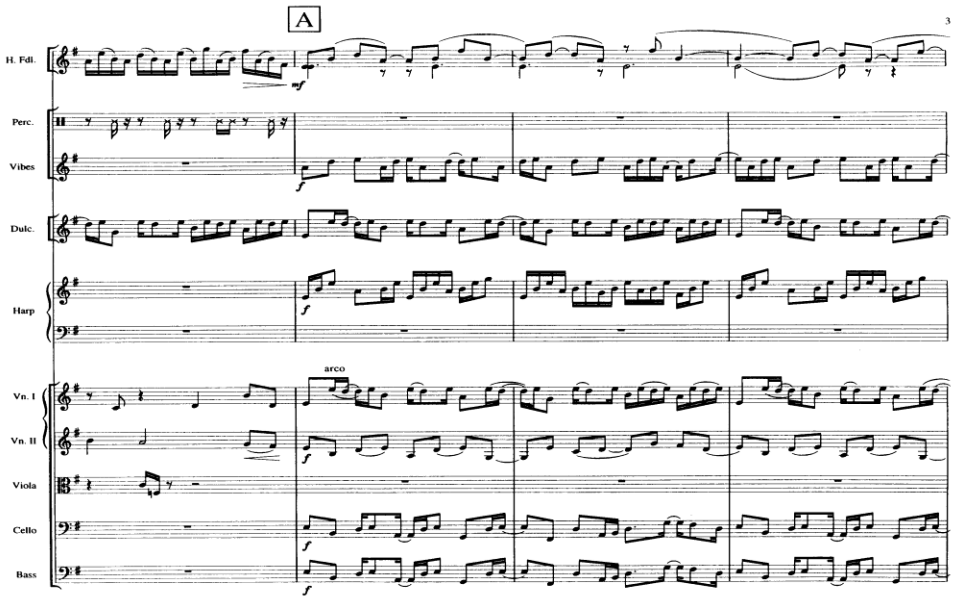

Fig. 76. An excerpt from Peter Hamlin's *Hardanger Concerto*. Note the E drone pitch.

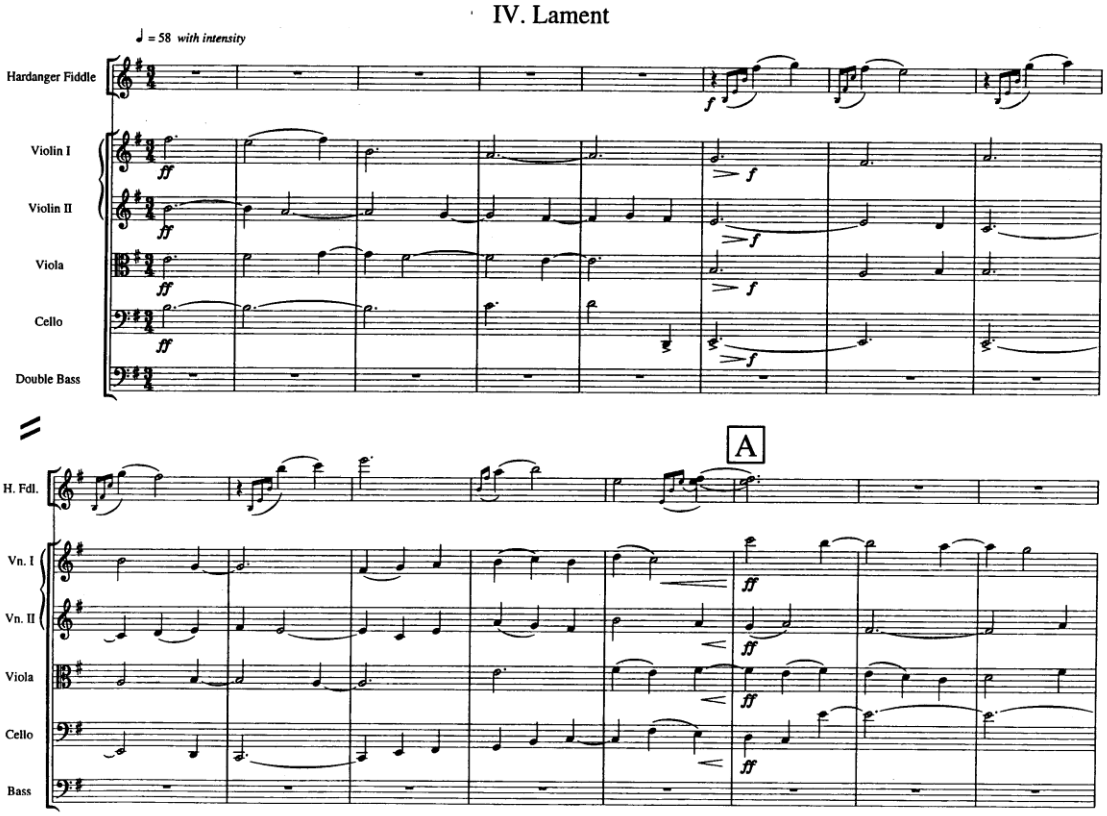

Fig. 77. Another excerpt from Peter Hamlin's *Hardanger Concerto*
Note the characteristic use of grace notes.

Fig. 78. Close-up of the hardanger fiddle. Photo by Bevan Wulfenstein

Fig. 79. The carved scroll with 9 tuning pegs. Photo by Bevan Wulfenstein

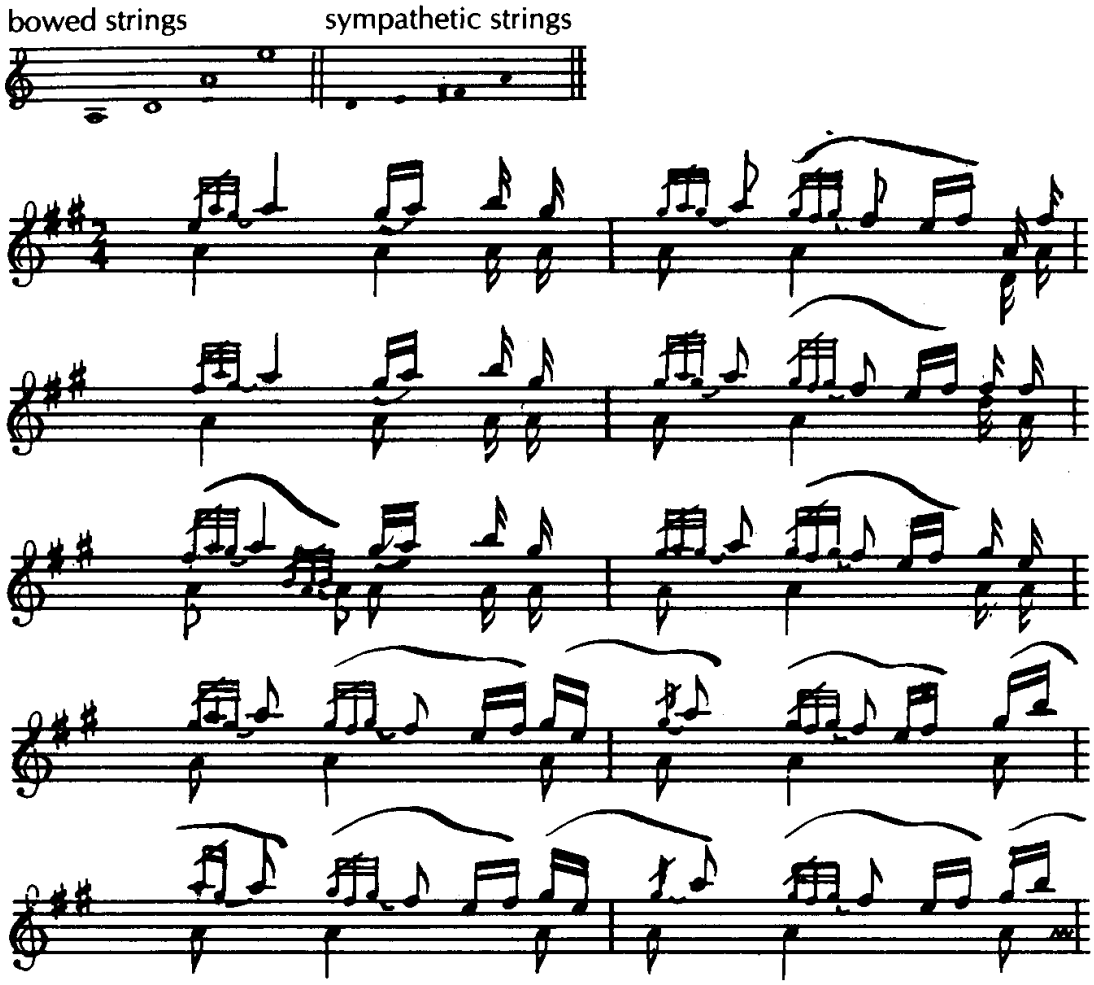

Fig. 80. *Førnesbrunen*, a slaatter example. Note the flatter bridge facilitates the use of the drone pitch A.

From Pandora Hopkins, *Aural Thinking in Norway; Performance and Communication with the Hardingfele* (New York: Human Sciences Press, 1986), 112.

Courtesy of Pandora Hopkins

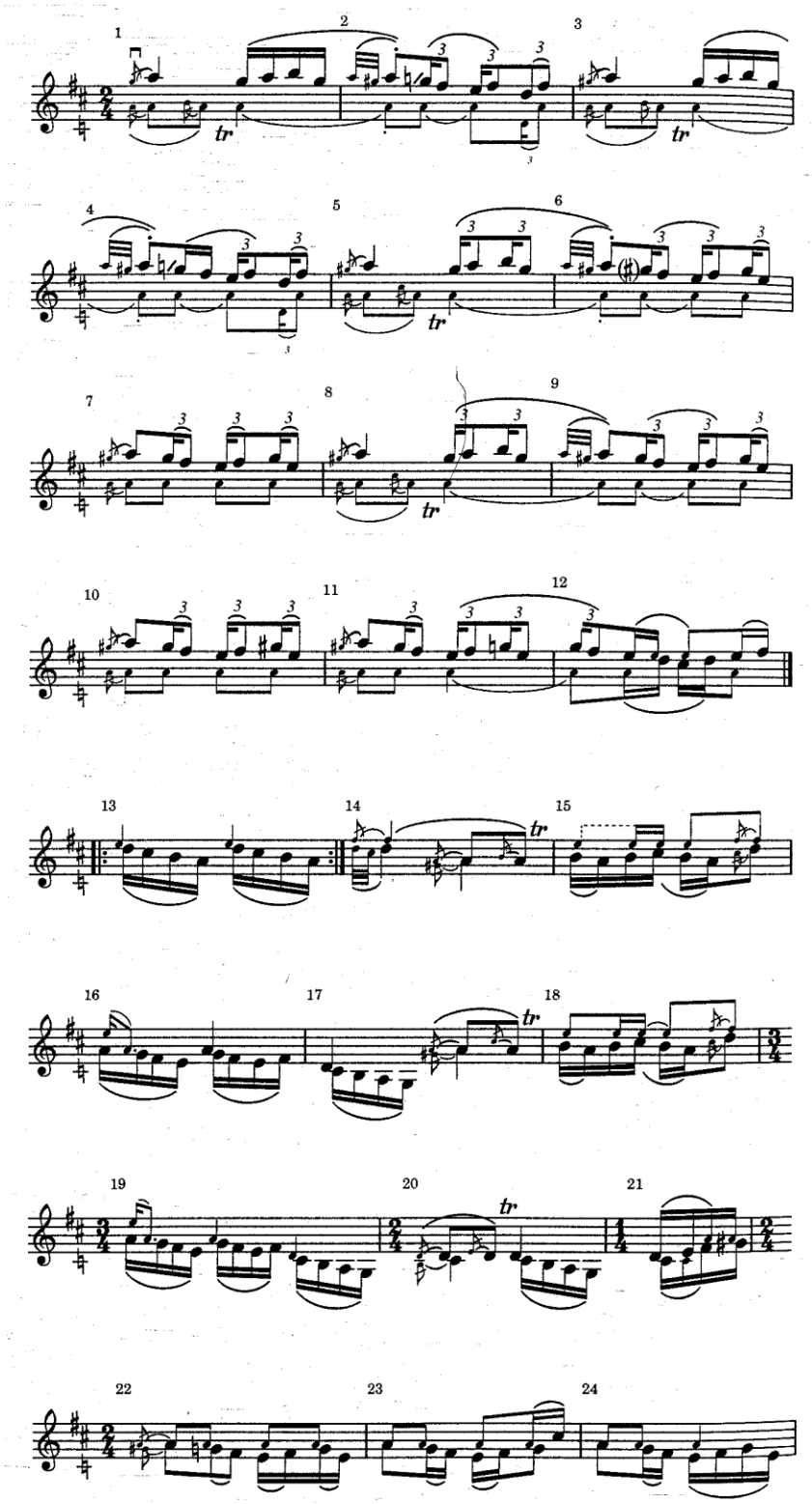

Fig. 81. Another example of Slaatter entitled *The Bay from Förnes*

From Nils Grindes, *A History of Norwegian Music* (Lincoln, Nebraska: University of Nebraska Press, 1991), 100.

CHAPTER 10

HARMONICA

Fig. 82

Physical Description

The most common members of the harmonica family are the marine-band, chromatic, and blues harmonicas. Other types include the tremolo, bass, and double bass harmonicas. The standard marine-band model (also known as the diatonic) is four inches long, one inch wide, and 3/4 of an inch tall. Its ten holes each contain two reeds, one for blow and one for draw. The chromatic harmonica has a key on the right side to activate an additional bank of reeds. The blues harmonica is almost identical to the diatonic but the reeds are more easily overblown, thus facilitating pitch bends characteristic of blues music. Harmonicas, or harps as they are sometimes called, are available in a variety of different keys.

Other Types

The tremolo harmonica has four reeds per hole. The two reeds on the blow are tuned to the same note, but one is slightly sharp. The same is true for the draw. Such slight de-tuning creates a chorus effect. The bass harmonica is larger and has "blow only" holes and no reeds for draw. The notes are arranged low to high from left to right. This design restricts any triadic chords and the only polyphony permitted would be small cluster chords. The double bass looks like two harmonicas on top of each other (see fig. 85). Like the bass model it has "blow only" holes.[38]

Range

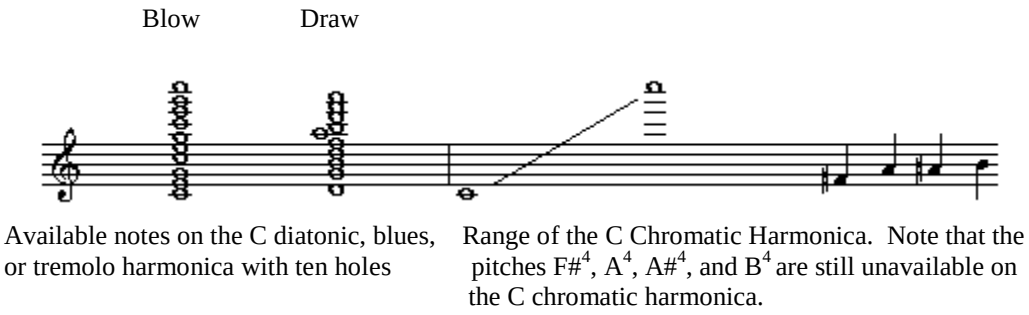

Fig. 83. Range of the harmonica

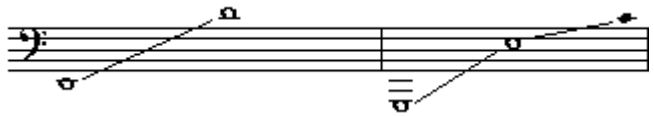

Fig. 84. Range of the bass harmonica and double bass harmonica

[38] Andrew Stiller, *Handbook of Instrumentation* (Los Angeles, California: University of California Press, 1985), 283.

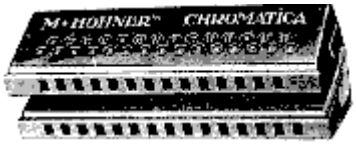

Fig. 85. The Double Bass Harmonica

Hole	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Blow, Slide In	C#	E#	G#	C#	C#	E#	G#	C#	C#	E#	G#	C#
Blow, Slide Out	C	E	G	C	C	E	G	C	C	E	G	C
Draw, Slide Out	D	F	A	B	D	F	A	B	D	F	A	B
Draw, Slide In	D#	F#	A#	B#	D#	F#	A#	B#	D#	F#	A#	D

Fig. 86. Pitch chart for the twelve-hole chromatic harmonica

Tone Production and Tuning

The harmonica, like the accordion, is a member of the free-reed family. This family differs from other reed families in that the reeds vibrate and produce pitch according to their size and not according to the shape and size of the air column. The method of tone production in free-reed instruments ensures that pitch will remain stable throughout most dynamics. However, overblowing a free reed will cause a fluctuation in pitch.[39]

Harmonicas are available in a variety of keys. Often a performer will have multiple instruments to accommodate songs in different keys. It is also possible to custom tune the harmonica by strategically placing reeds of distinct pitches in the blow

[39] Ibid., 279.

and draw slots, thus enabling an otherwise diatonic harmonica to play a whole-tone, an octatonic, or any synthetic scale.

Pitch, Timbre, and Dynamic Range

The harmonica can serve as a melodic or harmonic instrument. Because of the way the blow and draw are set up, blowing into multiple holes will create a major chord (C E G C), which can be identified as tonic. Drawing out will produce a half-diminished seventh chord (D F A B) that can function as a substitute for the dominant. Although the harmonica is a polyphonic instrument, it does have its harmonic limitations. For instance, it is impossible (without custom tuning) to play a IV chord (F A C), as C requires blow and F and A require draw. The performer can avoid these problems by playing incomplete chords or arpeggiating them.

The difference between blow and draw can also have an effect on timbre. The timbre will have more of an edge and grow slightly more strident as the volume is increased. The timbre of the harmonica is most often associated with country and blues music and with Western film scores.

The harmonica has the unique ability to perform at the softest levels, even softer than the violin or the clarinet. However, the other dynamic extreme is more limited, as it cannot go beyond a forte level. Once the harmonica reaches that level, the reeds will be overblown and pitches will start to bend. To compensate for this inadequacy, the performer desiring additional volume will often use a microphone to amplify the performance.

Extended Techniques

The harmonica can perform most of the effects that brass instruments can. These include multiple tonguings and flutter tonguing. A shake or lip trill can also be imitated between adjacent blow or draw holes on the harp, and half-step trills are available through the use of the trigger on the chromatic harmonica. Multiphonics, while possible, cannot exist while drawing. Half step trills are also possible using the trigger on the chromatic harmonica (see fig. 87).

The harmonica is capable of vibrato by fanning the hand in back of the instrument where the tone sounds. As mentioned before, overblowing the reeds can cause pitch bends, and a skillful player can use these pitch bends for inflection. The harmonica is capable of great expression when this technique is applied. Because of the frequent use of microphones with the harmonica, electronic effects processing is also a possibility.

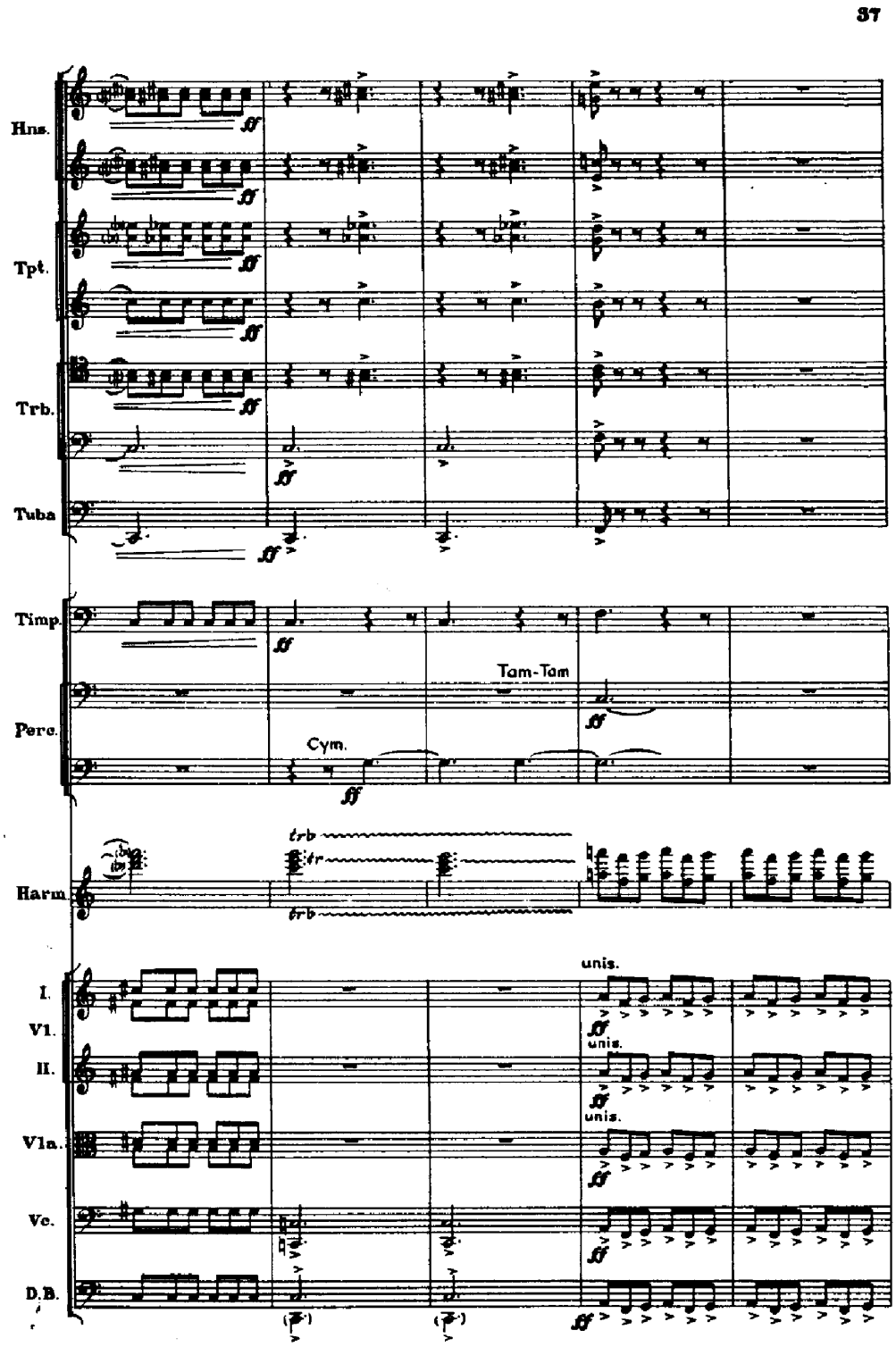

Fig. 87. Example of a trigger trill in the *Harmonica Concerto* by Malcolm Arnold
Also notice that the last two bars of the harmonica part are in octaves; these octaves are technically unplayable without sounding two chord notes in between.

Malcolm Arnold, *Harmonica Concerto* (London: Patterson's Publications, 1954).

History and Origins

The harmonica was invented by Christian Friedrich Ludwig Buschmann, a German clock maker. Because the instrument was easy to play and inexpensive to produce, it had immediate popularity. Despite the harmonica's appeal, composers were not inclined to write for it until around 1930. This may be the result of its inability to function well outside of its given key. The Hohner company, located in Germany and founded in 1857, is the world's largest harmonica manufacturer.[40]

Larry Adler was the premiere performer of the classical harmonica during the twentieth century. Many works were written specifically for him, including the *Harmonica Concerto* by Malcolm Arnold, *Suite Anglaise* by Darius Milhaud, and the *Romance for Harmonica* by Ralph Vaughan Williams. Because Adler was such a virtuoso performer, Milhaud feared that no one but Adler would be able to perform his work and therefore rescored it for a violin, and later for the accordion. It now bears the sub-title "for Harmonica (Violin or Accordion) and Orchestra."[41]

Alan Hovhaness also double-cast his concerto as *Concerto No. 6 Harmonica Concerto or Concerto for Flute, Oboe, and String Orchestra*. Although labeled a concerto, the harmonica is always accompanied by the flute or oboe. By doubling the line, the composer has ensured that the composition will still be performable should a harmonica player be unavailable.

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[40] Henry Doktorski, "The Classical Harmonica" 1998 [On-line article]; Available from http://trfn.clpgh.org/freereed/history/harmonica.html; Internet; accessed September 2002.

[41] Ibid.

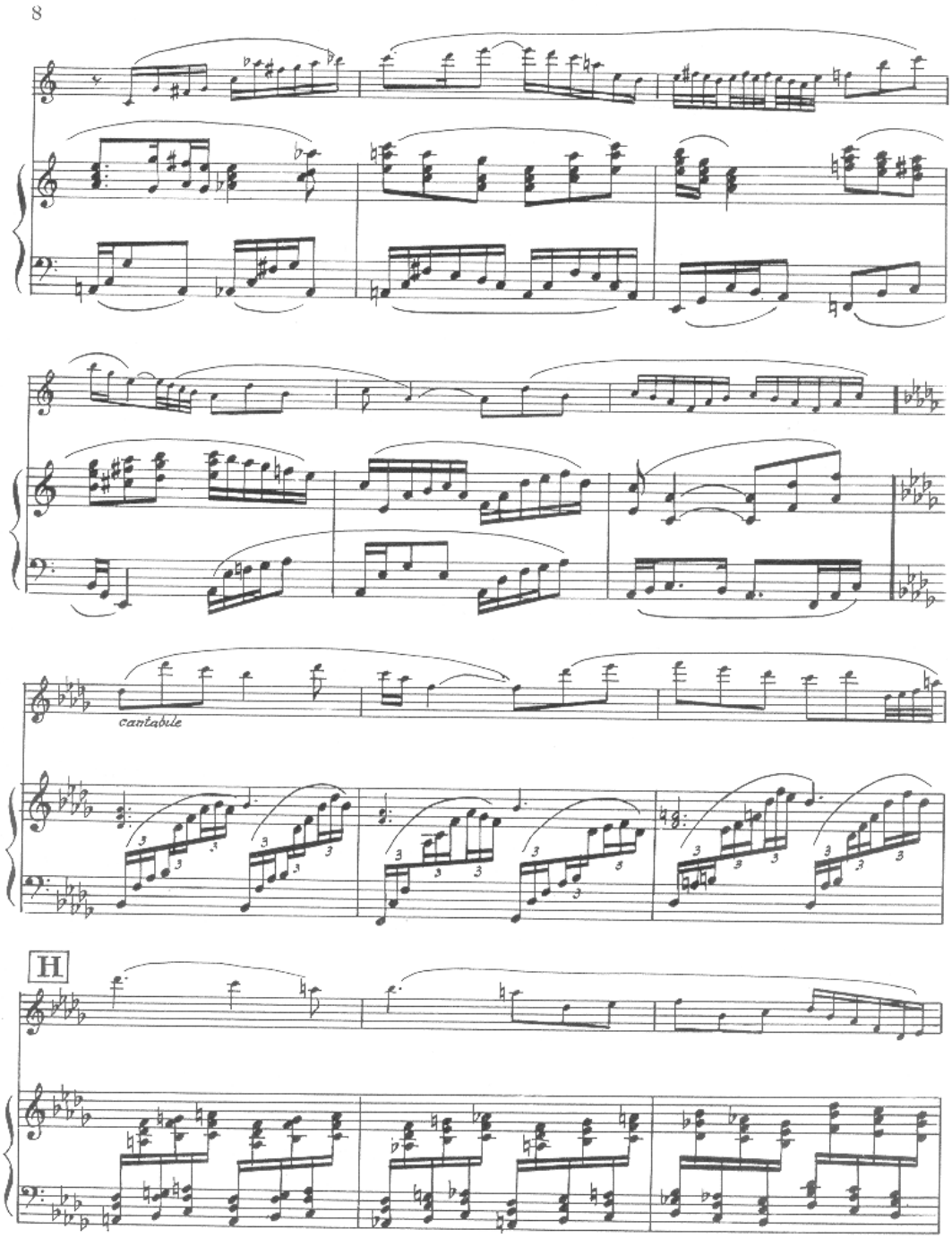

Fig. 88. *Suite Anglaise* by Darius Milhaud

Reduction for piano by the composer
Darius Milhaud, *Suite Anglaise* (New York: Boosey and Hawkes, 1947, corrected edition 1982).
Used by permission.

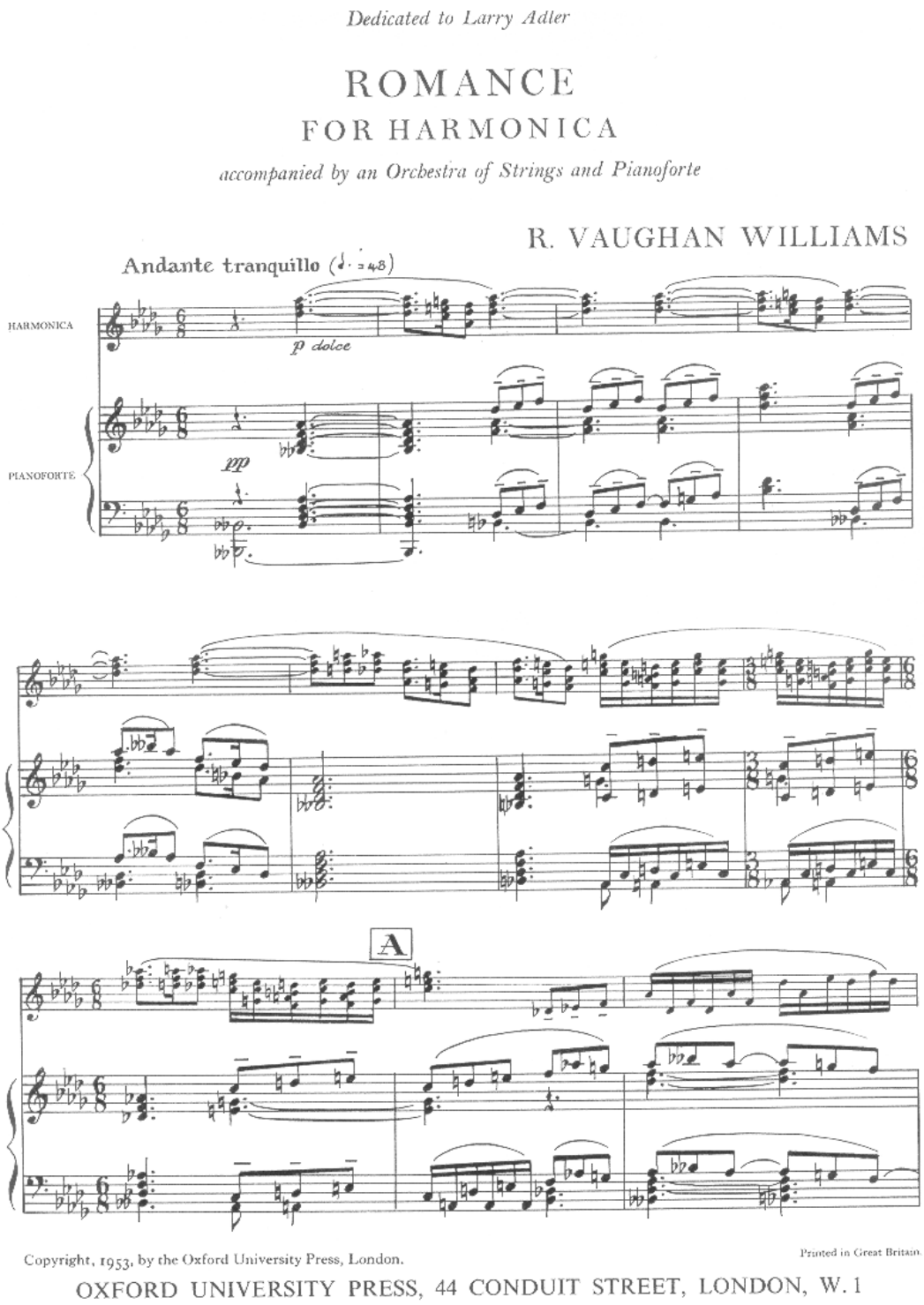

Fig. 89. *Romance for Harmonica* by Ralph Vaughan Williams

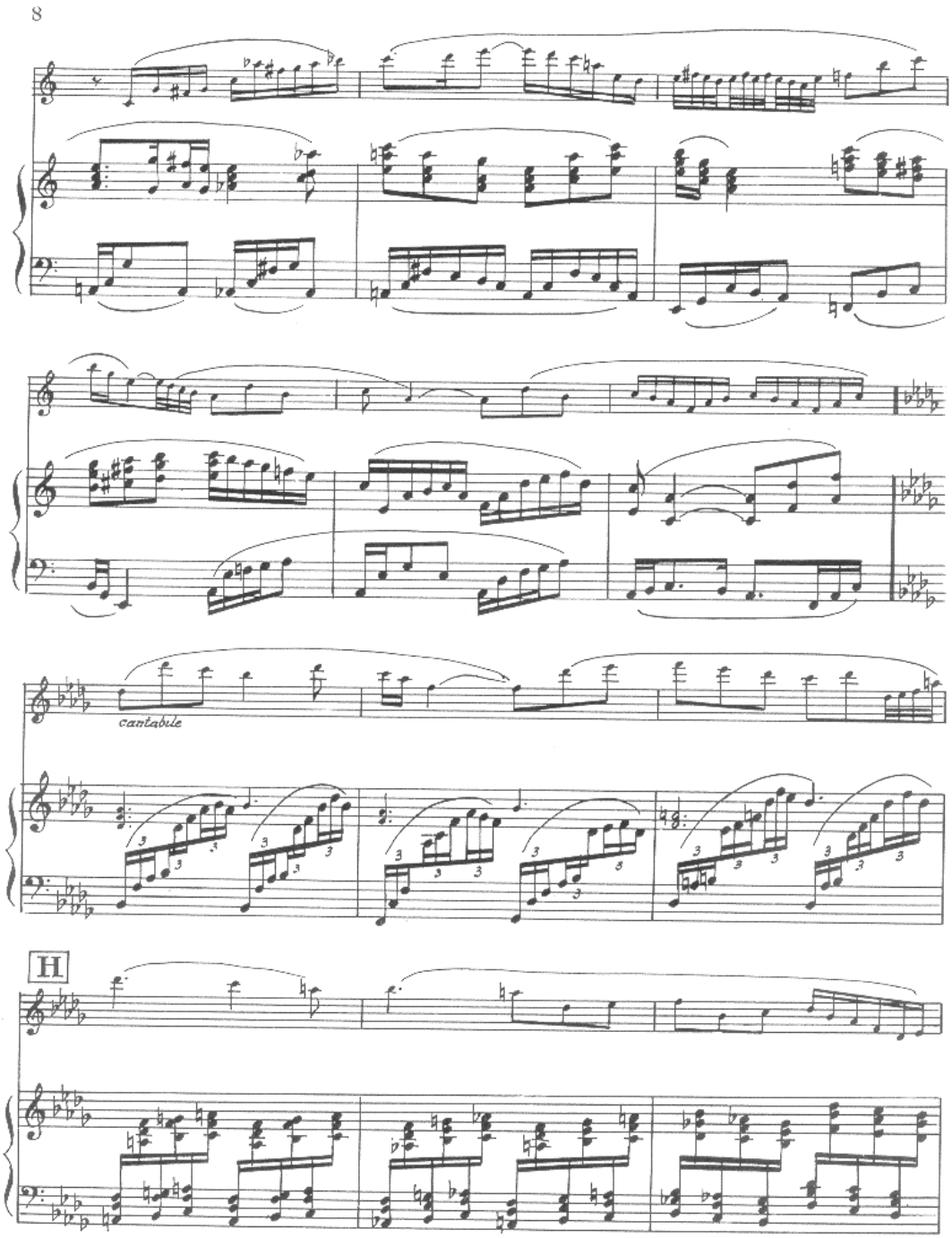

Fig. 90. Another excerpt from *Romance for Harmonica* by Ralph Vaughan Williams

Literature

In addition to the multiple examples of harmonica in popular music, twentieth-century concert music composers often wrote for it as well.

John Philip Sousa	(1930) *The Harmonica Wizard* (harmonica band)
Darius Milhaud	(1942) *Suite Anglaise*, Op. 234
Ralph Vaughn Williams	(1952) *Romance for Harmonica*, accompanied by an Orchestra of Strings and Pianoforte.
Malcolm Arnold	(1954) *Concerto for Harmonica and Orchestra*, Op. 46
Hector Villa-Lobos	(1955-1956) *Concerto for Harmonica and Orchestra*
Gordon Jacob	(1957) *Divertimento*
	(1957) *Five Pieces* for harmonica and piano
Henry Cowell	(1962) *Concerto for Harmonica and Orchestra*
Norman Dello Joio	(1948) *Concertino for Harmonica and Orchestra*
Alexander Tcherepnin	(1953) *Concerto for Harmonica and Orchestra*, Op. 86
Alan Hovhaness	(1953-1954) *Concerto No. 6*, Op. 114
	(1956) *Seven Greek Folk Dances*
James Moody	(1972) *Quintet for Harmonica and Strings*

CHAPTER 11

HIGHLAND BAGPIPES

Fig. 91

Physical Description

The Highland bagpipe is a traditional Scottish instrument. It consists of several parts: the bag, the drone pipes, the blowpipe, and the chanter. Traditionally made from sheepskin, though sealskin or other animal hide may be used, the bag forms the center of the instrument and has five stocks where the other pipes connect to it. The three drone pipes are cylindrical. Each has its own single reed, and often a tassel connects all of them. The blowpipe allows the piper to fill the bag with air and is equipped with a non-

return valve. The chanter has a double reed and a conical bore. It has seven finger holes and an additional hole on the back for the thumb (see fig. 94).

The bagpipe is not directly controlled by a piper's airstream. The performer blows air into the bag through the blowpipe and then squeezes the bag, forcing the air to vibrate the reeds of the chanter and drones. Because of the non-return valve in the blowpipe, the bag can be continually inflated without causing a break in the sound.

Range

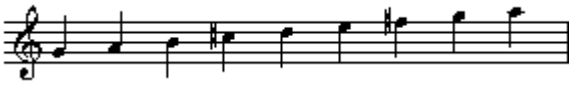

Fig. 92. Notes available on the chanter

The chanter is pitched in A and ranges diatonically from G^4 to A^5.

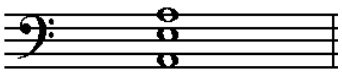

Fig. 93. The drone pitches are A^3, E^3, and A^2.

Tuning, Pitch, and Timbre

The chanter can play nine notes (G A B C D E F G A). The C on the pipes actually sounds as C# and the F sounds as F#. Therefore, starting and ending on A forms a mixolydian scale. It is important to know, however, that the Highland pipes do not conform to just intonation or equal temperament and consequently certain notes do not match up with the Western major scale. Also notable is that the A on most sets of pipes

is tuned sharp (459 hz), which is close to being pitched in Bb (467 hz).[42] Although the pipes are pitched in A, their notation is in concert pitch. A large part of pipe music is learned by ear and there are successful performers who do not read traditional Western notation. The Bagpipes have a loud strident tone intended for outdoor use.

Fig. 94. The chanter of the Highland bagpipe

Extended Techniques

The most common extended technique applied on the pipes is the use of grace notes. Because the sound does not stop and there is no articulation, pipers use various grace notes to accentuate repeated notes. There are many different grace note combinations the piper may employ. These are characteristic of bagpipe music. Although we use the term *grace note* from the vocabulary of Western Classical music, the Highland piper refers to them as cuts, strikes, cranns, and rolls. See the charts under Irish flute and uillean pipes for a list of these techniques (figs. 105 and 160).

[42] Roderick D. Cannon, *The Highland Bagpipe and Its Music* (Edinburgh: John Donald Publishers Ltd, 1988), 30-31.

Though the technique is rarely used, it is possible to bend notes by using a half-hole fingering on the chanter. This type of portamento can be difficult because the piper fingers the chanter just below the first knuckle and not with the fingertips.[43]

Limitations

The pressure on the bag forces the air through the pipes and causes the reeds to vibrate. This system of tone production makes the bagpipes incapable of many techniques common among other wind instruments. These limitations include: volume, articulation, tuning and pitch. The Highland bagpipe has only one dynamic: loud. Spatial arrangements, such as keeping the piper off stage or outside, can be made so it can blend with softer instruments.

While the bagpipe is a wind instrument, the player's tongue never contacts the reed. Furthermore, the bag is responsible for the air being forced through the pipes and therefore all control of articulation is lost. The piper compensates by the use of grace notes. Accents, staccato, and legato attacks are impossible.

The Highland bagpipe is limited to its nine notes and its drones' fixed pitches. Thus, the composer is forced to write with a limited palette. If the pipes are used in combination with other instruments, tuning may be a serious problem. Not only is the A sharper than A440, but the pipe scale will not match up accurately with other instruments.

[43] William Jones, interview by the author, San Antonio, Texas, August 2002.

History and Origins

Almost every culture seems to have had a version of pipes. The earliest ones found date from ca. 2800 B.C. in Babylonia. It is difficult to say when the bags came into use. Evidence suggests they were implemented as early as 1300 B.C.; however, this evidence is isolated and does not seem influential on the mainstream construction of the instrument. More reliable evidence reveals that the bag was in use in the last century B.C.[44] Probably a drone was added soon after the invention of the bag. Later, possibly in the thirteenth century, a bass drone was added. Experts speculate that the Highland bagpipe appeared ca. 1400.[45] In 1755 Leopold Mozart made use of the dudelsack, a German bagpipe very similar to the great Highland pipe in most respects. The selection on page 117 (fig. 98) entitled *Sinfonia in D* "Die Bauernhochzeit" translates to "Peasant Wedding." This scoring is appropriate culturally because pipes would be present at such an event. Note the repeated pitches where the piper would automatically insert a grace note to obtain the articulation.

Since 1549 the great Highland bagpipe has been considered a military instrument in Scotland and England. Scottish regiments have almost always employed at least one piper and one drummer. Different songs were used not only as a source of inspiration but also as a means of communication, whereby a commander could signal attack and retreat. Later on, it was British colonialism that helped the Highland bagpipe continue to thrive.

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[44] Francis Collinson, *The Bagpipe* (Boston: Routledge and Kegan Paul, 1975), 42-43.

[45] Roderick D. Cannon, *The Highland Bagpipe and Its Music* (Edinburgh: John Donald Publishers LTD, 1988), 5, 8.

The bagpipe enabled poor Scottish men to join the army as musicians. The need for military pipers also gave rise to a number of bagpipe teachers.[46]

Piobaireachd was the form of classical Highland bagpipe literature. It is thought to be the invention of the McCrimmon family ca. 1600.[47] It consists of a ground, or a theme, followed by several variations and ending with the ground. Piobaireachd is considered the highest form of bagpipe music. Sometimes modern competitions ask bagpipe soloists to perform piobaireachd.[48]

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[46] William Jones, interview by the author, San Antonio, Texas, August 2002.

[47] Roderick D. Cannon, *The Highland Bagpipe and Its Music* (Edinburgh: John Donald Publishers LTD, 1988), 5, 8.

[48] William Jones, interview by the author, San Antonio, Texas, August 2002.

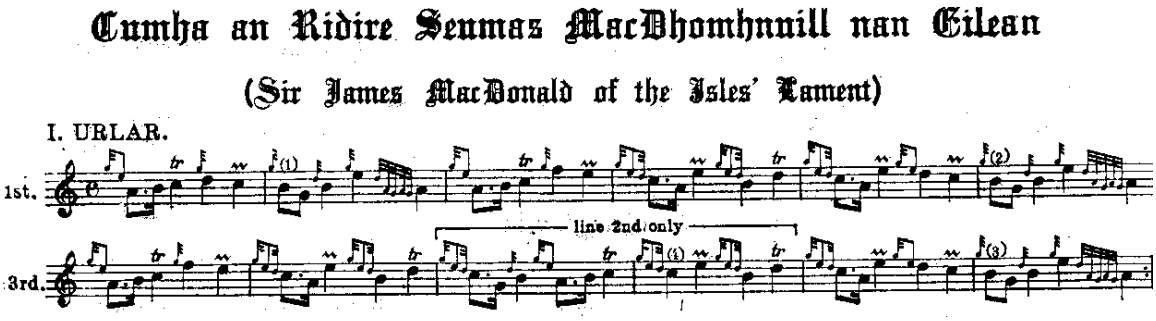


Fig. 95. An example of piobaireachd from Archibald Campbell, *The Kilberry Book of Ceol Mor*, 5th ed. (Glasgow, Scotland: Piobaireachd Society and Grainger & Campbell, 1980), 68.

Fig. 96. Highland piper in a pipe band

Fig. 97. The Highland Bagpipes

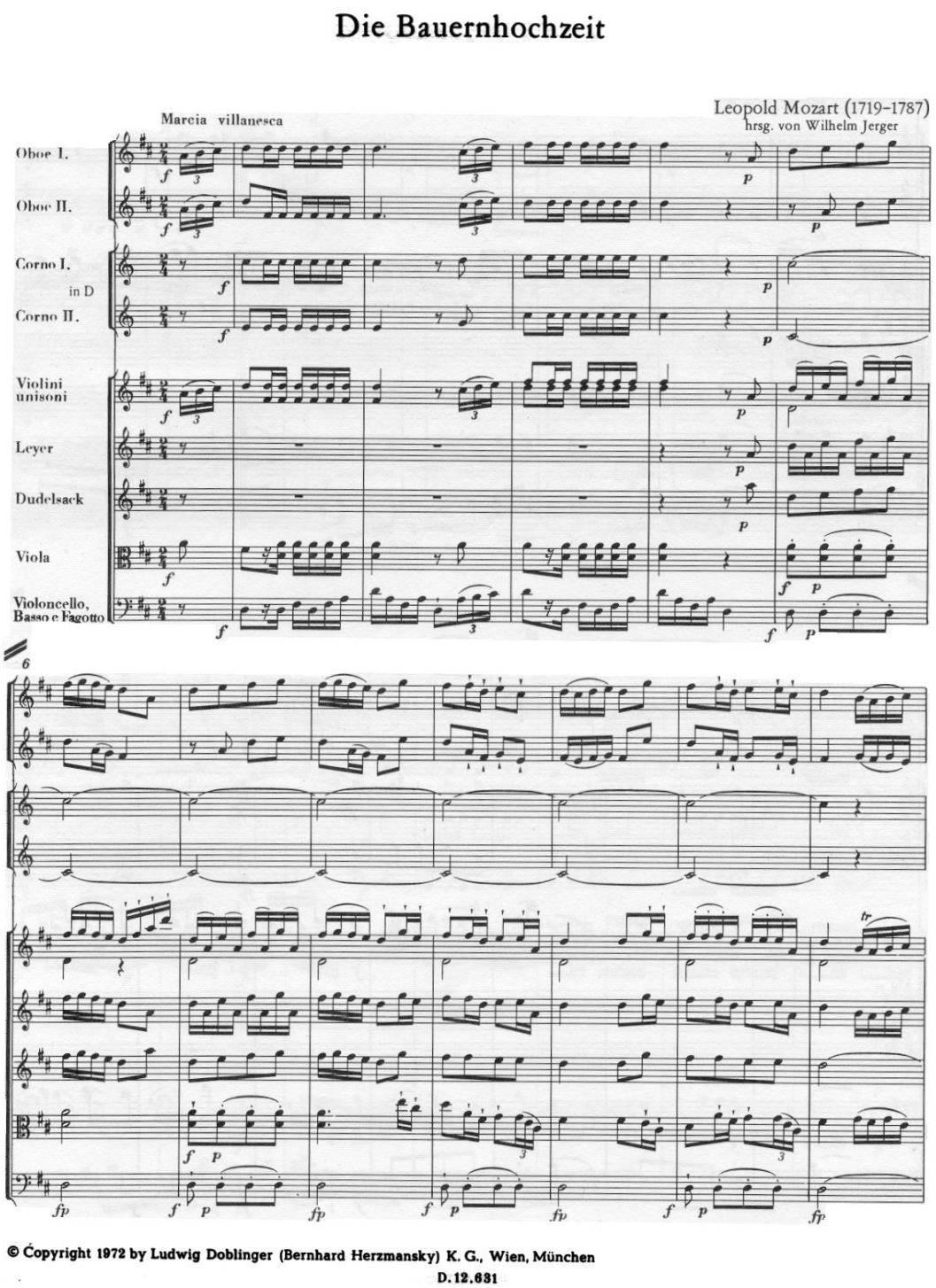


Fig. 98. An example of early Bagpipe music by Leopold Mozart

From *Sinfonia D-Dur - Die Bauernhochzeit* (ed. by W. Jerger)
© 1972 by Ludwig Doblinger (B. Herzmansky) KG., Vienna-Munich.

Contemporary Music

The Highland bagpipe is most often found in the modern marching pipe band, which consists of both pipes and drums. While Highland pipes are not regularly heard in traditional concert settings, the following works have been composed for bagpipes and orchestra.

Scott Macmillan	(2001) *MacKinnon's Brook Suite*
Edward McGuire	(1997) *Calgacus* for bagpipes and orchestra
Peter Maxwell Davies	(1994) *Cross Lane Fair* for Northumbrian Pipes, bodhran, and orchestra
	(1984) *An Orkney Wedding* for Highland pipes and orchestra
Shaun Davey	(1983) *The Pilgrim*
Leopold Mozart	(ca. 1775) *Sinfonia in D* "Die Bauernhochzeit"

CHAPTER 12

IRISH FLUTE AND TIN WHISTLE

Fig. 99. Irish Flutes

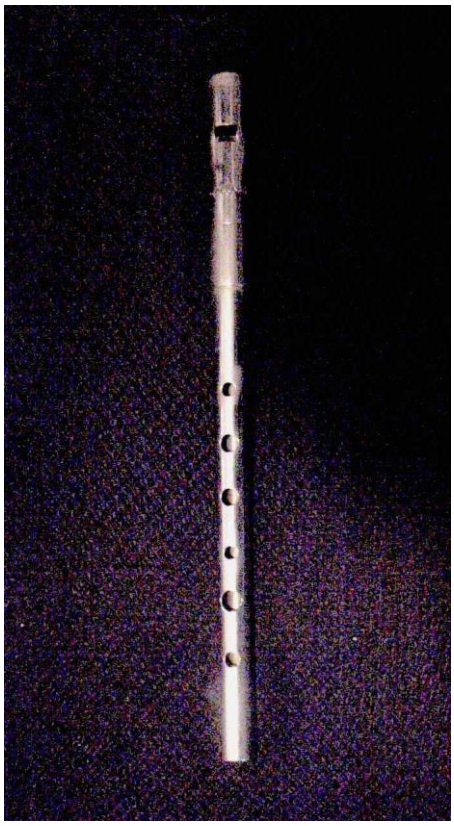


Fig. 100. Tin Whistle

Physical Description

The Irish flute is actually a classical flute. It differs from the modern flute in that it is made from wood, has a conical bore with a cylindrical head, and has open holes with

few or no key mechanisms. The fingering is also different from the Boehm system on modern flutes.

The tin whistle, also known as the penny whistle or Irish whistle, is no longer made from tin. Instead, whistles are now constructed from nickel or brass. The tin whistle has an adjustable head joint with a fipple and six holes in the body, although some custom models may have seven. Whistles can come in a variety of sizes and keys.

Fig. 101. Variety of tin whistles from left to right

Whistle pitched in low D

Whistle pitched in low G

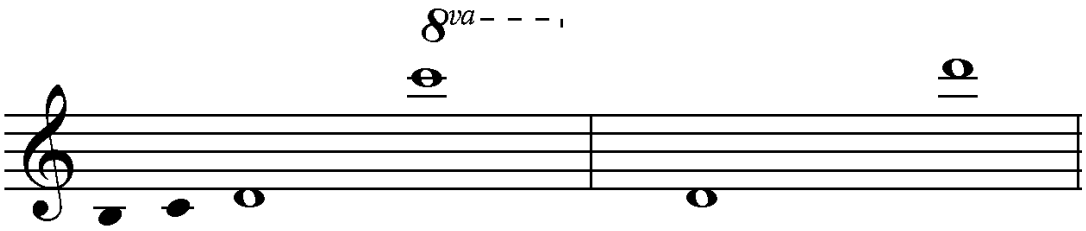
Whistle pitched in low Bb

Whistle pitched in low A

Whistle pitched in C

Whistle pitched in D

Range



Range of the Irish Flute Range of the Tin Whistle

Fig. 102

The lowest note on the traditional Irish flute is D^4, but many modern innovations in construction have extended the range to C^4 or B^3. The tin whistle's practical range goes up to D^6. Although it is possible to play higher, tones become shrill and intonation is skewed.

Timbre, Tuning, and Dynamics

Although similar to the modern metal flute, the Irish flute has the distinctly darker timbre that Irish musicians prefer over the brighter metal sound. The dynamic range is almost equal to that of a modern flute. The Irish flute overblows the octave but has no register key. Its few key mechanisms are used to produce chromatic pitches and are rarely employed in traditional Irish folk tunes. Most traditional Irish flutists use the scales and modes in fig. 103 because they contain few half-hole fingerings.

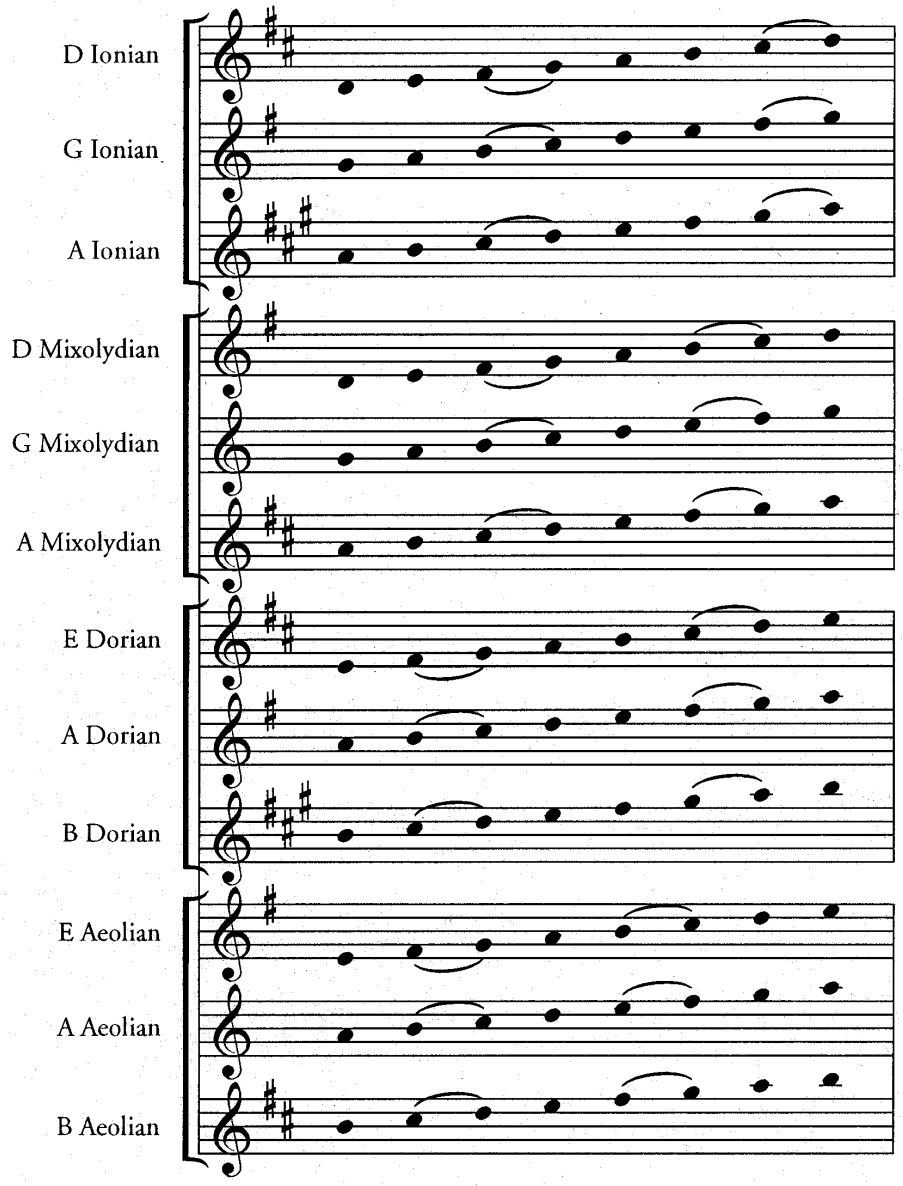


Fig. 103. From Grey Larsen's *The Essential Guide to Irish Flute and Tin Whistle*

The tin whistle has six holes, and some holes are larger than others. Uncovering each hole produces a major scale. Although half-hole techniques make the instrument chromatic, it plays best in the key for which it was designed. Therefore, the tin whistle is available in a variety of keys. Unlike the fipple recorder, the tin whistle has no thumb or register hole.

The tin whistle has a thin but pure sound. Because of the fipple, the air stream cannot be redirected or allow intonation to be adjusted. Therefore, the dynamic range of the whistle is extremely limited. A faster air stream will allow the instrument to overblow an octave, but pitches will become increasingly sharp. Any attempt to lower dynamics will result in pitches going flat. If the tin whistle is to be used in any large ensemble such as a symphony orchestra, it may be advisable to provide some sort of amplification to compensate for its dynamic limitations. Otherwise, in more intimate ensembles such as pub bands, duos, and trios, the high-pitched whistle should be heard well.[49]

Technique and Ornamentation

Most techniques of the modern flute translate well to the Irish flute. Open holes on both the Irish flute and whistle and their fingering systems allow for more possibilities for inflection than a traditional orchestral flute. Half-hole techniques may be employed for the purpose of pitch bending. The modern flute demands the player make pitch bends with alterations in the air stream direction and rotation of the head joint. Because of their ease, pitch bends are frequently used in traditional Irish flute performance.[50]

Because the fingering system is directly related to the chanter on the uillean pipes, ornaments such as cuts and strikes are used to re-articulate notes without tonguing. This also helps to keep rhythmic drive constant, as many traditional pieces are danced to and accompanied by the flute. A cut is a quick lift and return of a finger, which produces a

[49] Grey Larsen, interview by the author, Bloomington, Indiana, 22 November 2002.

[50] Ibid.

grace note a step above. A strike is produced by bouncing a finger on and off the hole, which creates a grace note a step below. The strike is more percussive than the cut. It should be noted, however, that the grace notes produced by cuts and strikes are practically imperceptible, and when performed they sound like re-articulations of the same pitch.[51]

When cuts and strikes are grouped together they form rolls and cranns. The cranns consist only of cuts and must use two different holes for cuts, thus producing differently pitched grace notes. The rolls and cranns can be performed over different durations. Although on paper it seems that this re-articulation could be accomplished with the tongue, distinct inflections are actually created by several patterns of cuts and strikes.[52]

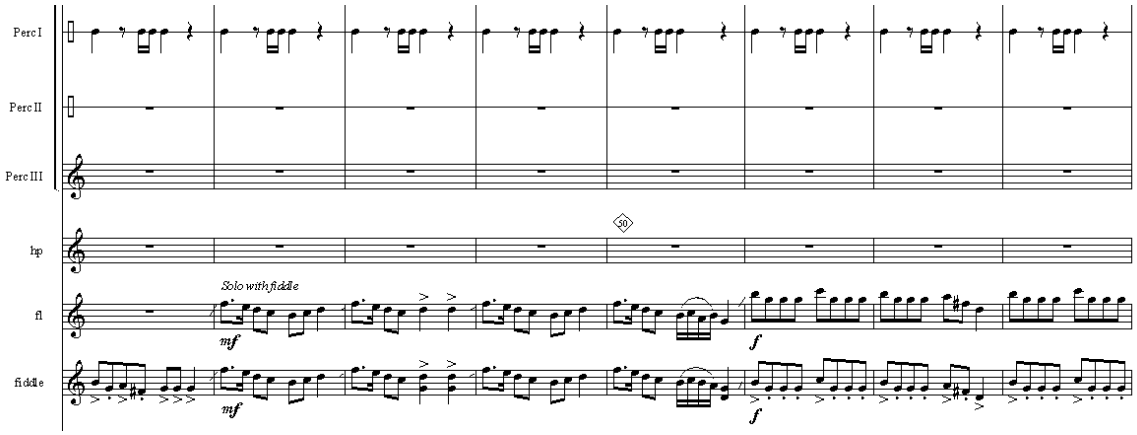


Fig. 104. An excerpt from the second movement of the author's *Celtic Trilogy*. Note the combination of traditional Irish instruments: Irish flute, fiddle and bodhran drum in the Perc. I part.

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[51] Ibid.

[52] Ibid.

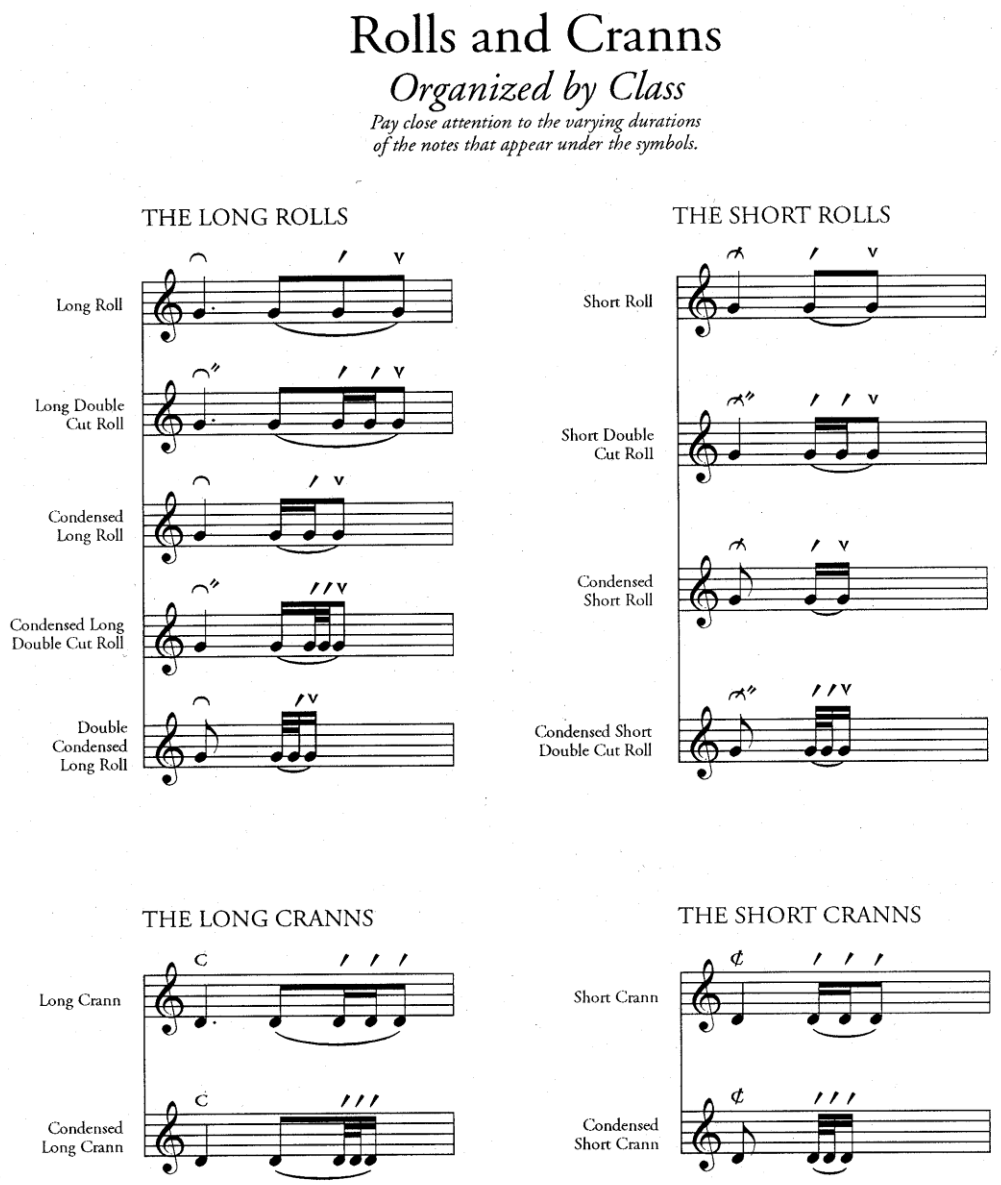

Fig. 105. The above chart is from Grey Larsen, *The Essential Guide to Irish Flute and Tin Whistle* (Pacific, Missouri: Mel Bay Publications, 2003). Larson uses a slash (/) to denote a cut and an upbow (V) to denote a strike.

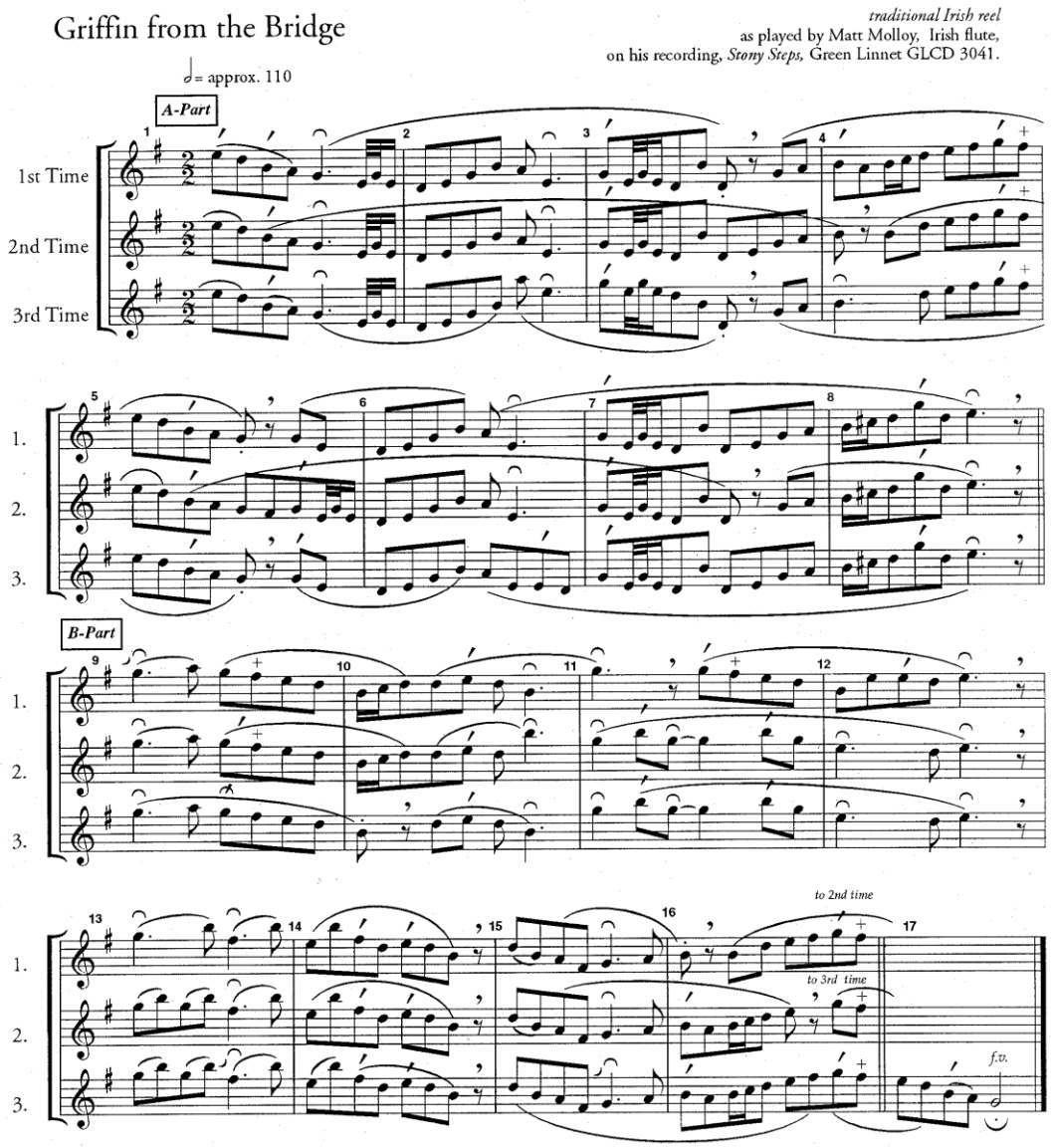

Fig. 106. *Griffin from the Bridge*. Transcription of a performance showing the variations the flutist uses each time through the reel. From Grey Larsen, *The Essential Guide to Irish Flute and Tin Whistle* (Pacific, Missouri: Mel Bay Publications, 2003).

Fig. 107. Grey Larsen and his Irish Flute

History and Origins

To call either of these instruments "Irish" is somewhat misleading, as neither of them are indigenous to Ireland. The flute is essentially the same instrument as used in the Classical era. Irish folk musicians, however, were the ones who retained this instrument after the Boehm fingering system was applied and the flute began to be made from metal. The older fingering system (on both the flute and the whistle) was almost identical to the one used on the uillean pipes chanter, which was already familiar to players. Also, the sound of the "Irish" flute had already taken its place in the traditional folk music of Ireland.

Almost every culture has a form of whistle or flute. The tin whistle is a descendent of the flageolet, another fipple flute. The term "penny whistle" is often associated with the tin whistle, but whether that term refers to the cost to purchase, the cost to manufacture, or the pennies earned by performers of this instrument is unknown.

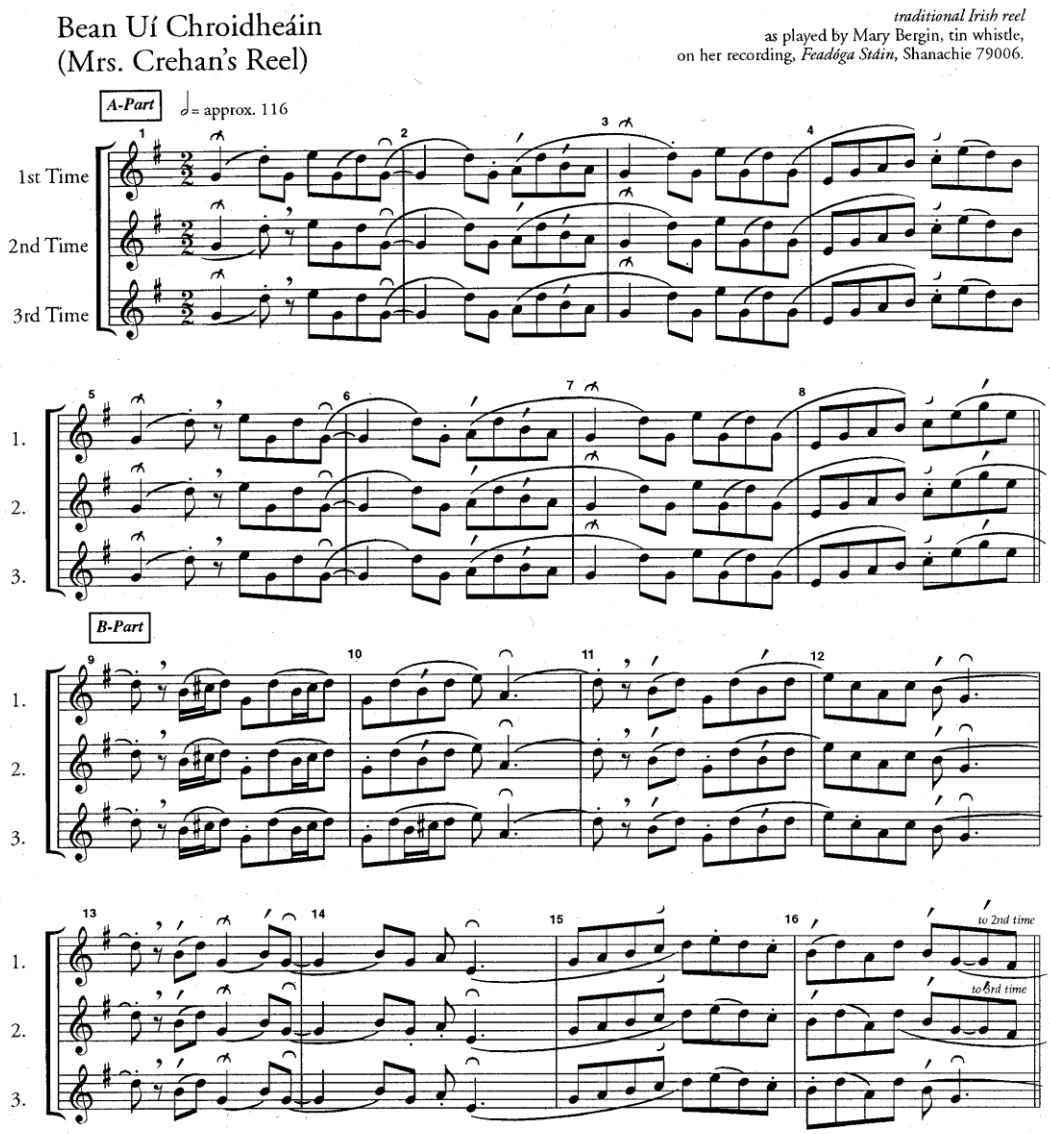

Fig. 108. Tin whistle transcription from Grey Larsen, *The Essential Guide to Irish Flute and Tin Whistle* (Pacific, Missouri: Mel Bay Publications, 2003).

CHAPTER 13

KOTO

Fig. 109. Kyoko Okomoto

Physical Description

The koto, a large Japanese stringed instrument, is a member of the zither family. Sometimes referred to as a Japanese floor harp, the koto's body is made of paulowina wood. It measures six feet in length, one foot in width, and two inches in thickness with a slightly convex shape. It has thirteen strings, each with a movable bridge that is traditionally made of wood or ivory but now usually made from plastic.

The strings were once made from silk, but most koto strings are now made from nylon.

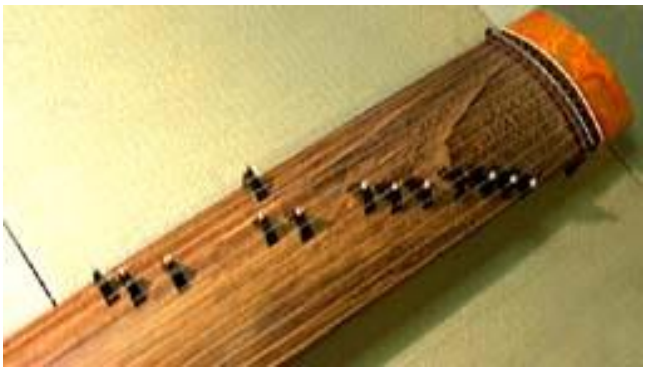

Fig. 110. and **Fig. 111.** Koto pictures courtesy of Japan Information Network

Range and Tuning

The koto's range is dependent on how high and low the top and bottom strings are tuned. The general range of the koto is between A^2 and E^6. Because of the different tunings, the strings never have fixed pitches and are therefore always referred to by number instead of pitch. String 1 is often set to D^4. Usually the octave is repeated on every sixth string, which begets some form of pentatonic scale. Some of the more common tunings can be found in fig. 113. Note that the lowest possible tunable note is A^2 or G^2. Range is influenced by location of the bridges and tension and height of the strings.

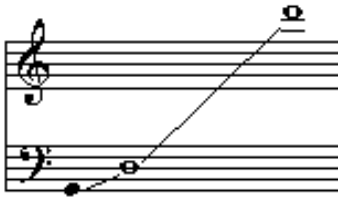

Fig. 112. Koto Range

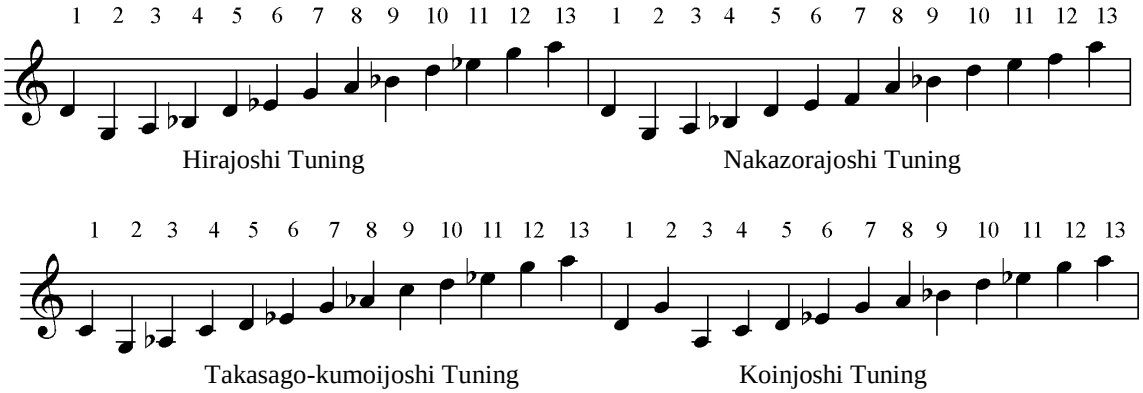

Fig. 113. Koto range and tunings

Timbre and Dynamics

The koto has a distinctive timbre which at first might resemble that of a harp or banjo. But since the method of striking the strings can affect timbre and the left hand can affect the sound as well, the final coloring of the sound is quite unlike the modern Western harp. While the koto does have a particularly strong attack due to the tsume (the plectra worn on the fingers), it lacks the sustaining power of the sitar and guitar.

Fig. 114. The bridges of the koto

Fig. 115. The tail of the koto where extra strings are kept coiled

Koto pictures courtesy of Japan Information Network

The koto is frequently used in ensemble settings. Traditionally these are small groups (koto, shamisen, and shakuhachi; koto and voice; or multiple kotos) where there is no difficulty hearing the koto. Scoring for the koto in a large ensemble requires particular attention to dynamics. While the koto is capable of producing sounds in the "chamber-music" forte range, it can be easily lost in a forte ensemble tutti section. The koto is most effective in thin textures.

Technique

Traditionally, the performer sits on the floor to play the koto, but some modern performers choose to put the koto on a stand and play while seated in a chair. The strings of the koto are plucked with a tsume (fig. 116), which is a type of plectrum worn around the thumb, index, and middle fingers of the right hand. The thumb is the finger that plucks the string unless the note is otherwise marked with a 2 for the index finger or 3 for

the middle finger. The left hand is responsible for adding embellishments such as vibrato and pitch bend, and for moving the bridges to re-tune the koto for key changes.[53]

Fig. 116. Tsume, the plectra worn on the fingers

Tsume picture courtesy of Japan Information Network

The koto requires a performer to master several special techniques with both right and left hand. The following is a list of some of the more important koto techniques that composers may find valuable:

Right Hand Techniques

1. Sukuizume - Backstroke with the tsume of the right thumb.
2. Awasezume - Two strings an octave apart, struck simultaneously with the thumb and middle finger.
3. Kakite - Two adjacent strings struck so quickly that they sound together.
4. Oshiawase - Two adjacent strings struck by the thumb while the lower string is bent sharp by the left hand, causing a unison.

[53] Bonnie Wade, *Tegotomono: Music for the Japanese Koto* (Westport, Connecticut: Greenwood Press, 1976), 18-19.

5. Uranren, ren, or sararin - Downward glissando.
6. Nagashizume, ryu, or kararin - Downward glissando with emphasis on the high and low strings. The middle strings in the glissando are played softly.
7. Hikiren- Upward glissando over all strings. If the glissando does not go over all strings, it is termed a han-hikiren or a hikisute.
8. Chrirashizume, chirashi, or san - A fast, light movement with the pick of the middle finger causing a swishing sound.
9. Surizume - Using the picks to make a scraping sound, usually on strings 5 and 6.

Left Hand Techniques

1. Ko or oshide - Pressing on the string to the left of the bridge to obtain a higher pitch. The pitch may be bent one, two, or three semitones.
2. Oshi-hanashi - Releasing pressure on a plucked string to create a pitch bend downward and settling on the pitch of the open string.
3. En or ato-oshi - Raising the pitch after the string has been struck, thus creating a pitch bend or portamento.
4. Yogin or yuri-iro - A vibrato created by lightly touching the string to the right of the bridge.
5. Keshizume - Obtaining a metallic timbre by lightly touching a plucked string with the fingernail to the immediate right of the bridge.

Notation

Early koto music was usually taught by rote in an oral tradition. Furthermore, the koto was, at one point in time, reserved for blind performers only. With some exceptions of old surviving works in koto tablature notation, the Western staff system is now typically employed. To accommodate the above techniques, Wade and Adriaansz offer similar charts to further clarify notational symbols.

Table of symbols:

▲	Yamada symbol directing the player to make an oshide, then release it in quick succession.
·· or ıı)	Tsuki-iro technique, similar to the above.
⌃	releasing of oshide.
ıı	Keshizume technique, producing a twang.
←	Chirashizume technique, producing a swishing sound (Yamada).

Fig. 117. Notation chart from Bonnie Wade, *Tegotomono* (Westport, Connecticut: Greenwood Press, 1976), 206.

Fig. 118. Koto picture courtesy of Japan Information Network

←⟶	Surizume technique, producing a scraping sound (Yamada ←⟶).
↖	Backward flick technique related to chirashizume.
∨	Sukuizume technique, a backstroke (Yamada ∨).
⁓	Uraren (sararin) technique, a fluttering downward glissando begun on string 13.
╲	Hikiren technique, an upward glissando.
╱	Nagashizume (kararin) technique, a flowing downward glissando.
ヒ	Hiki-iro technique.
左	Left hand pluck.
お	Quick, ornamental pitch.
オ	Oshide a whole step.
合	Ai-no-te.
3 ——	Trail up successive strings with third finger of right hand.

Fig. 119. Notation chart from Bonnie Wade, *Tegotomono* (Westport, Connecticut: Greenwood Press, 1976), 207.

: sararin (ren uraren)

: nagashizume (kararin)

: hikiren

: waren, chirashizume; diamond-shaped notes indicate the sounded tones

: surizume

ス : sukuizume

ケ : keshizume

ヨ : yokozume

: en (ato-oshi); the small note indicates the time value of the new tone

ヒ : ju (hiki-iro)

ツ : chitsu (tsuki-iro)

: glottal stop

: a spoken syllable

Fig. 120. Notation chart from Willem Adriaansz, *Kumiuta and Danmono: Traditions of Japanese Koto Music* (Los Angeles: University of California Press, 1973), 266.

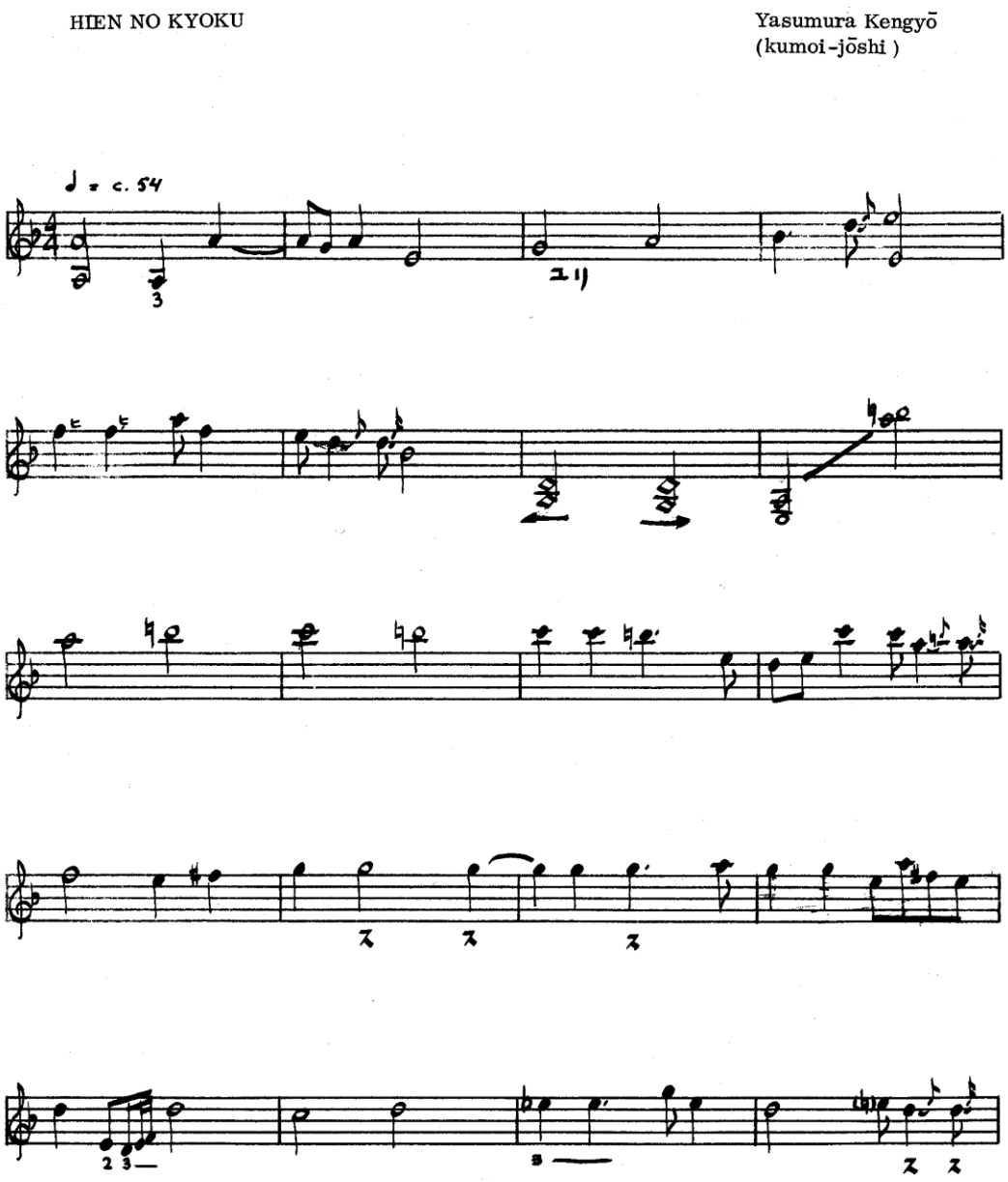

Fig. 121. *Hien no Kyoku* by Yasumura Kengyo

Excerpt from Willem Adriaansz, *Kumiuta and Danmono: Traditions of Japanese Koto Music (*Los Angeles: University of California Press, 1973), 344.

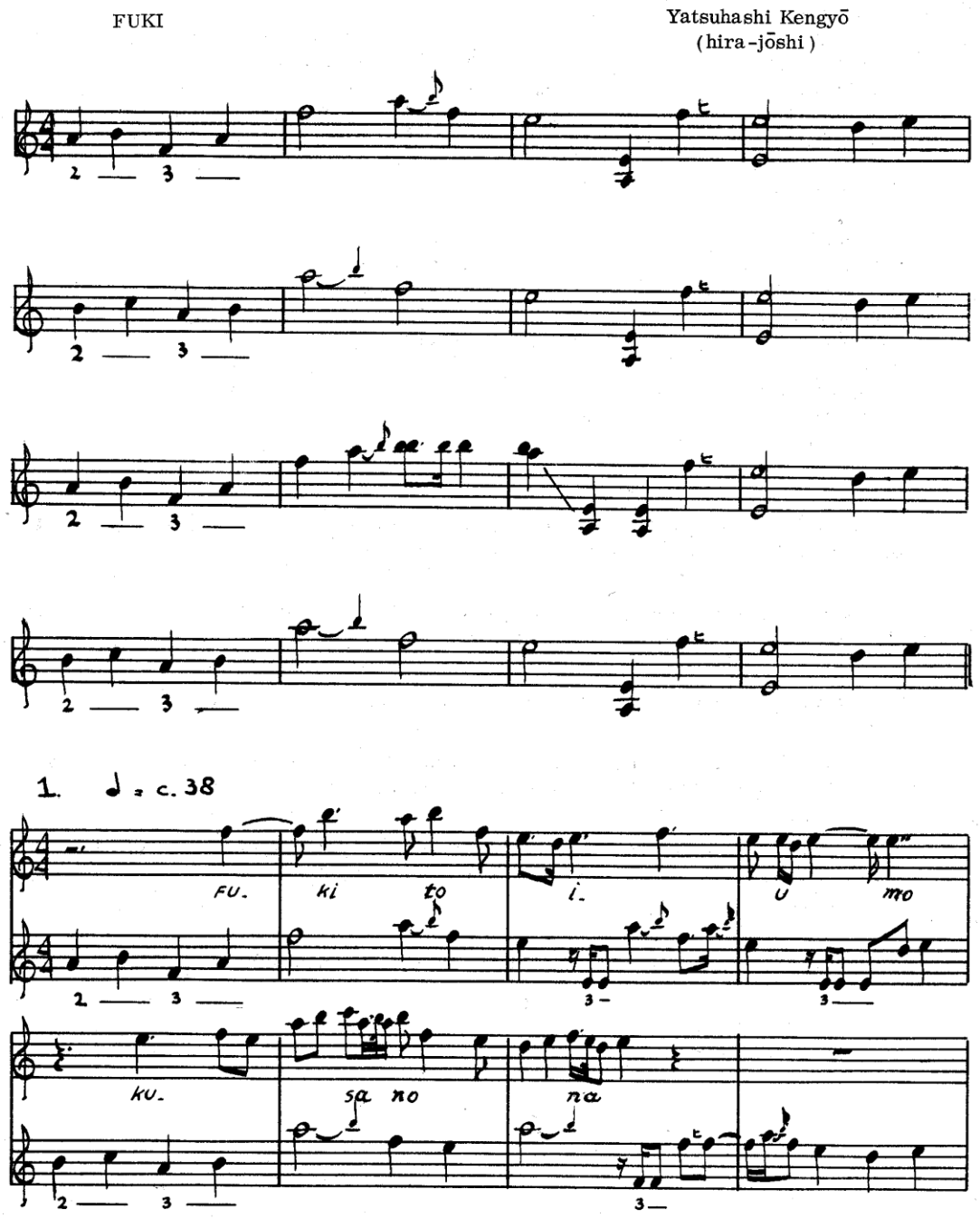

Fig. 122. *Fuki* by Yatsuhashi Kengyo. This is possibly the first Kumiuta. Note the instrumental introduction and the first section with the vocalist.

Excerpt from Willem Adriaansz, *Kumiuta and Danmono*: *Traditions of Japanese Koto Music (*Los Angeles: University of California Press, 1973), 270.

Fig. 123. Reiko Obata. Note the koto on a stand and the performer playing from a chair.

Composing for Koto

Reiko Obata recommends that composers wishing to write for koto construct a usable scale that will span the koto's thirteen strings. These scales can be Western, non-Western, tonal, modal, or synthetic.[54] Kyoko Okomoto, Director of the Washington D.C. Koto Society, encourages composers to acquire some koto experience before writing. She also recommends that composers learn the various left and right hand techniques. Okomoto also advises that "The koto does not have to be fast or loud. Space is important."[55]

[54] Reiko Obata, interview by the author, e-mail, January 2003.

[55] Kyoko Okomoto, interview by the author, telephone, February 2003.

History and Origins

The koto has had a long history. In early times it was used as a solo instrument in noble courts and later it was an official occupation reserved for only blind male performers. Still later, the koto was a symbol of well-bred families and was often played by women.

The koto traditionally participates in three main genres of Japanese music: kumiuta, danmono, and tegotomono. The kumiuta is the earliest genre and consists of five or six short songs. These songs are performed by a vocalist and the koto supports the vocal line by providing the accompaniment. The danmono is a purely instrumental form divided into sections with precise numbers of beats. Tegotomono is the most modern of the three and derives from a combination of koto and shamisen traditions, best described as instrumental musical interludes between vocal portions of a song but with the same importance as the voice.

Literature

Note that the word 'kengyo' is a title given to a koto performer of the highest level and is not a last name of a composer or performer.

Henry Cowell	(1965) *Concerto II for Koto and Orchestra*
	(1961-1962) *Concerto No. 1 for Koto and Orchestra*
Virgil Thomson	(1961) *Variations for Koto*
Michio Miyagi	(1930) *Haru no Umi* (Spring Sea) for koto & shakuhachi
Kikusue Kengyo	(Before 1892) *Saga no Aki*
Yoshizawa Kengyo	(1855) *Chidori no Kyoku* (Song of the Plovers)
Yasumura Kengyo	(Before 1779) *Hien no Kyoku*

Yatsuhashi Kengyo (Before 1685) *Fuki*

(1644) *Rokudan No Shirabe* (Six Variations on a Theme)

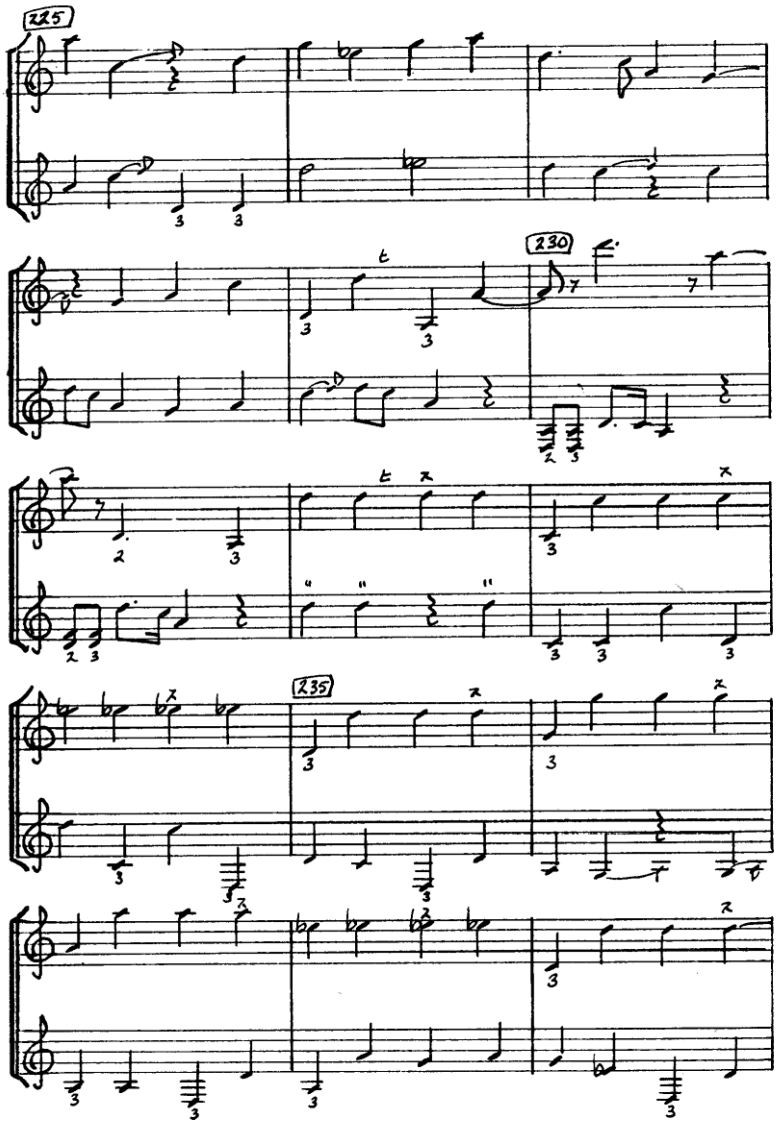

Fig. 124. *Saga no Aki* by Kikusue Kengyo. This is a tegotomono work for two kotos and voice. This section is one of the tegoto sections where the voice is silent.

Excerpt from Bonnie Wade, *Tegotomono* (Westport, Connecticut: Greenwood Press, 1976), 264.

CHAPTER 14

SHAKUHACHI

Fig. 125

Physical Description

The shakuhachi is the traditional flute of Japan. It is an end-blown flute made of bamboo, measuring approximately twenty-two inches in length and slightly curved. The instrument itself is thick and stout and has five finger holes: four on the front and one on the back for the thumb. Although these flutes do come in a variety of sizes, this is the standard size and number of holes. The mouthpiece is cut outward and the performer blows against a sharp edge made from ivory. Shakuhachis can also be made from hardwoods, and plastic may be substituted for the ivory.

Range

Fig. 126

D^4 to F^6 is the normal range. Pitch can be bent down to B^3 or sometimes Bb^3, and can sometimes go as high as $G\#^6$, depending on the player.

Tuning and Pitch

The five holes allow the shakuhachi to play the notes D^4, F^4, G^4, A^4, C^5, and D^5, giving the shakuhachi a distinctly pentatonic sound. With half-hole techniques, shading, embouchure angulation, and over-blowing, the shakuhachi has a full chromatic range of two and a half octaves. The shakuhachi is also capable of producing microtones between chromatic pitches.

One of the first things one will notice about a shakuhachi performance is that the player frequently changes the angle of the instrument. The degree of angulation helps to bend the pitch to a new note. Therefore, one way of playing the note E would be to finger F and angle the flute until the pitch is brought down to E. Alternative ways of playing different notes on the shakuhachi exist, which affect the timbre and dynamic. For example, if the performer plays F^4 by covering all holes except the D hole, then they are playing "Big F", which has a loud dynamic and full tone. But F^4 can also be played by

fingering G^4 and angling the flute until F^4 is achieved. This is known as "little F" because the dynamic is drastically softer and the tone has a whispering quality.[56]

Shading is another method of sounding tones that lie between the holes. To shade a note, the performer covers the hole with the finger but lifts it slightly so a tiny amount of air can escape. Shading will also affect pitch and timbre. The half-hole technique is similar to recorder playing. This manner of approaching pitches that lie between the holes results in the least amount of timbral change.[57]

In traditional shakuhachi performance, one will also notice that special attention is given to the last note of a phrase, which is often accompanied by a grace note. This subtlety is a hallmark of the master performer.[58]

Although the shakuhachi is capable of playing all chromatic pitches, it is often played in the keys of F and D because of the pentatonic pattern of the five holes that correspond to specific scales common to Shinto and Buddhist religious music.

Timbre and Dynamics

The timbre of a shakuhachi can vary significantly. The performer can alter the balance between the breath sound and the pure tone of the instrument by directing the air stream more across the edge or more into the flute. Another timbral effect the shakuhachi can produce is called Mura Iki, which is best described as a billowing splintered timbre

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[56] Michael Gould, interview by the author, Ann Arbor, Michigan, 22 September 2002.

[57] Ibid.

[58] William P. Malm, *Japanese Music and Musical Instruments* (Rutland, Vermont: Charles E. Tuttle Company, 1959), 160.

that actually produces two different tones, each in a different octave.[59] The Mura Iki sound somewhat resembles a multiphonic sound on a saxophone.

The shakuhachi commands a wide dynamic range. The most notable dynamic feature is the ability to enter from no sound at all (niente) much like the clarinet, up to a loud forte. As mentioned above, there are "big notes" and "little notes" that carry a dynamic as well as timbral difference.

Extended Techniques

Its five large open holes and lack of any key mechanism cause the shakuhachi to be considerably less agile than the Western flute. Although it is an end-blown vertical flute, as opposed to the Western transverse model, most of the flute's extended techniques are possible: flutter tonguing, multiphonics, double and triple-tonguing, microtones, trills, and pitch bending. Nevertheless, most of these techniques are quite rare in traditional Japanese music, except for the pitch bending and microtones, which are characteristics of the shakuhachi.

A performer will bend notes by changing the angle of the flute or by rolling over holes so the size of the hole is gradually changed until it is fully opened or closed. These glissandi can be very smooth across many pitches, unlike glissandi on the modern transverse flute. Additionally, a rapid change in angulation will produce a vibrato effect, as it will slightly alter the pitch.

[59] Michael Gould, interview by the author, Ann Arbor, Michigan, 22 September 2002.

Notation

While much of shakuhachi music is improvised, it does have its own form of notation. Since the shakuhachi is often a solo instrument and is considered very free, strict adherence to rhythm is not necessary. When performing in a duet or an ensemble, rhythm is counted in beats similar to those of Western music notation.

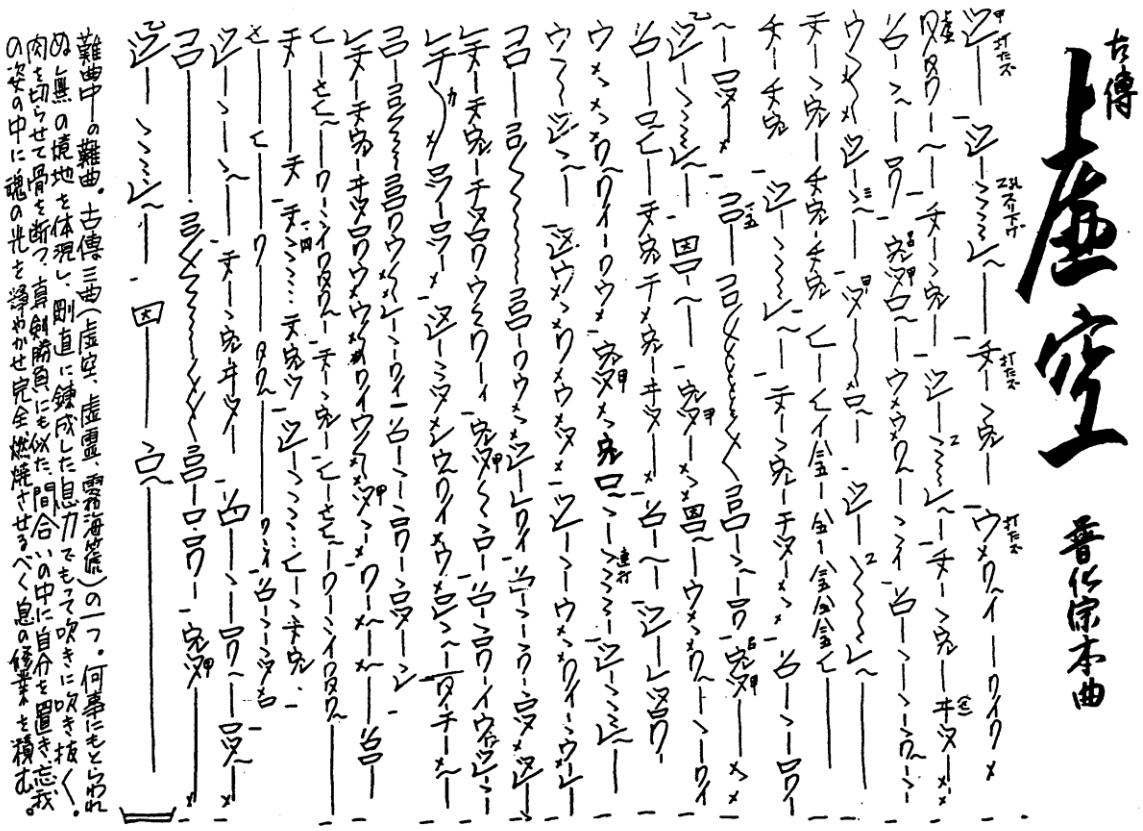

Fig. 127. The traditional notation of the shakuhachi

Traditional shakuhachi notation is read from top to bottom and right to left. Different characters represent pitches while the long lines indicate a longer duration of a note. Slashes through characters indicate a pitch bend. It is important for the composer to understand that many shakuhachi flute players do not read Western notation. Though

most are unable to read a traditional staff, most can understand note letter names such as D, F, and G; therefore, it is advisable to know the player's abilities. Then, if needed, the names of notes can be written in the staff to help the player. Among the many different schools of shakuhachi playing are more modern ones that encourage the learning of the Western notation system.

History and Origins

Fig. 128. Komoso priests playing shakuhachi wearing the traditional basket hats

Although the shakuhachi is a traditional Japanese instrument, it originates from China. From its arrival in Japan in the Nara period (A.D. 600 - 700), the shakuhachi has undergone many physical changes. The distinct evolution in the mouthpiece eventually included the tsu, a piece of ivory that provided a hard surface on which to split the air stream. During the Muromachi period (1333 - 1615), the length was altered, resulting in

a higher pitched instrument called the hitoyogiri. There have also been shakuhachi with more than five holes.[60]

The modern shakuhachi is longer and thicker than the hitoyogiri and consequently sounds lower. This shakuhachi originates from the Edo period (1615 - 1868) and was played by the Komoso. The Komoso were originally Buddhist priests who wore basket hats, but later many Komoso were ronin samurai. These warrior monks were then forbidden to carry their katana and wakizashi swords. The shakuhachi, cut from the root and being a strong piece of bamboo, doubled as a weapon for the Komoso who employed it as a bat or club.[61]

The shakuhachi is often used as a religious tool and not purely as a musical instrument; it can be used for reflection, expression, or mediation. Most of the folk songs written for shakuhachi have natural titles and often express a scene in nature.

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[60] William P. Malm, *Japanese Music and Musical Instruments* (Rutland, Vermont: Charles E. Tuttle Company, 1959), 151-152.

[61] Ibid. 157.

Fig. 129. Grand Master Michael "Chikuzen" Gould and his shakuhachi

Modern Literature

Tom Baker	(2001) *Five Shades of Time: Concerto for Shakuhachi*.
Toru Takemitsu	(1990) *Autumn*, for shakuhachi, biwa, and orchestra
	(1973) Aki
	(1967) *November Steps*, for shakuhachi, biwa, and orchestra
	(1966) *Eclips*
John Cage	(1983-85) *Ryoangi*, for twenty instruments plus shakuhachi, voice, and contrabass trombone soloists
Ryo Noda	(1981) *Murasaki no fuchi 1*, for saxophones or shakuhachi and saxophone
Pauline Oliveros	(1969) *SY*YdY=1/The Indefinite Integral of Psi Star Psi d Tau=1* (4 vocalists, 4 cellos, 4 bassoons, amplification, heartbeat, shakuhachi)

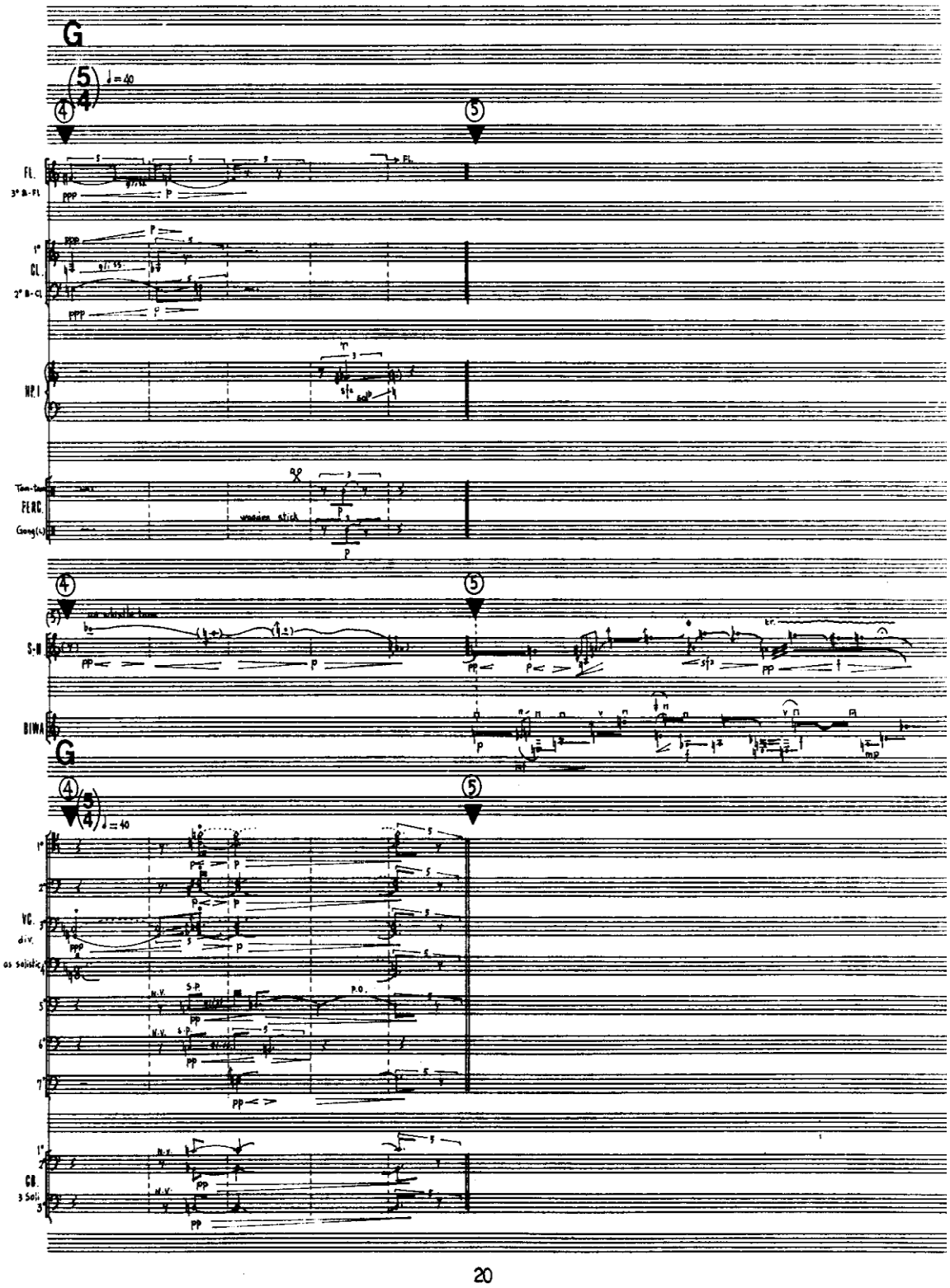


Fig. 130. An excerpt from *Autumn* by Toru Takemitsu. Courtesy of Editions Salabert

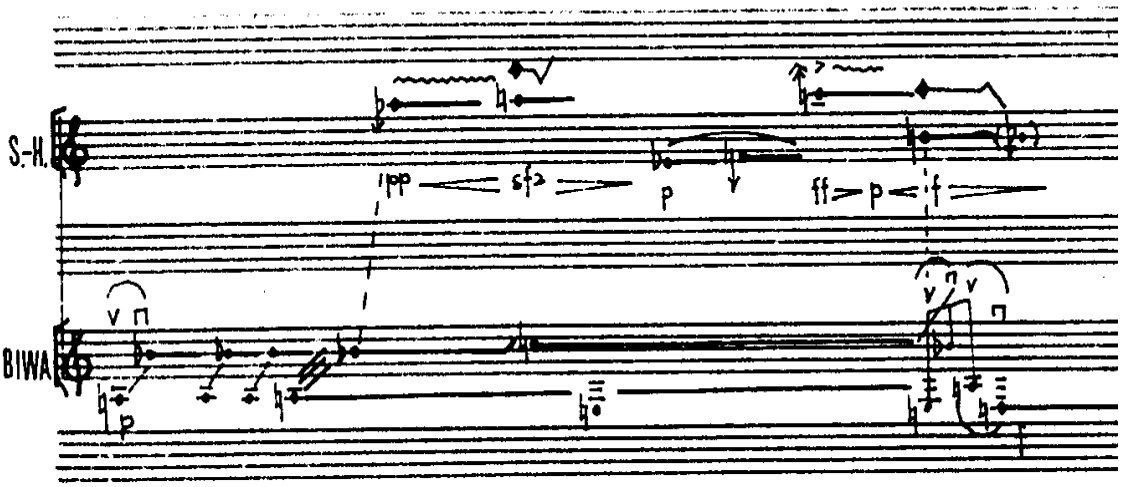


Fig. 131. Another excerpt from *Autumn* by Toru Takemitsu. Courtesy of Editions Salabert

Note how Takemitsu exploits the microtonal possibilities of the shakuhachi by calling for notation that includes arrows to display quarter tones. Also of interest is the composer's use of glissando and wide dynamic range. In this excerpt, the shakuhachi is featured with the biwa, another traditional Japanese instrument which resembles a small guitar or lute.

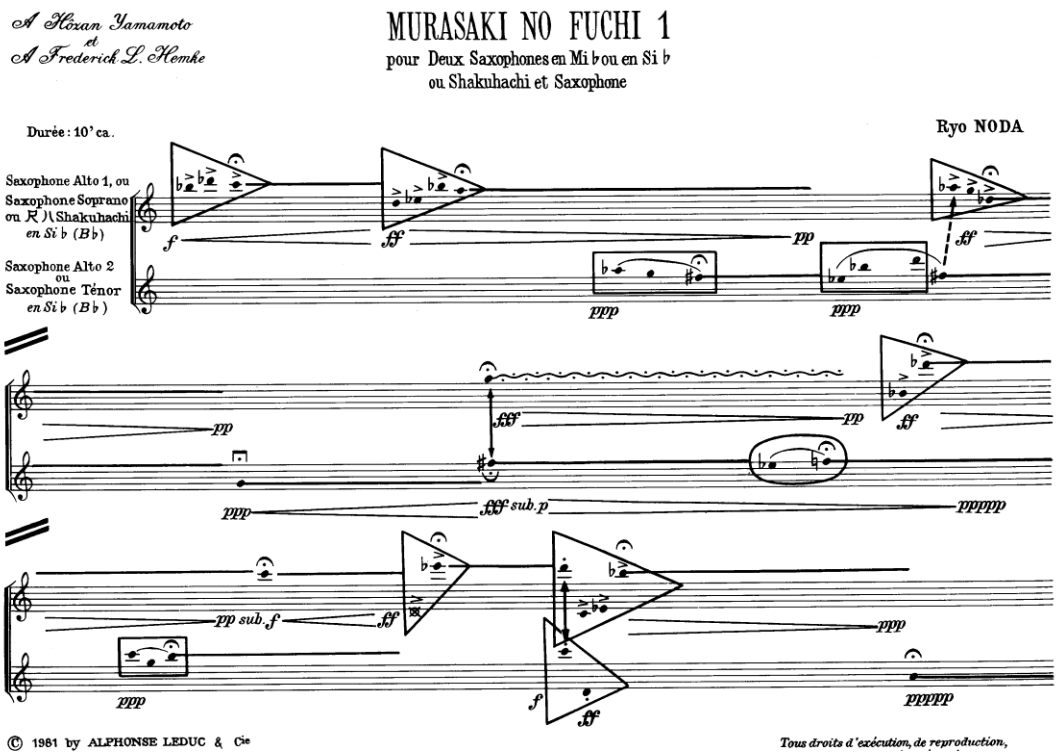


Fig. 132. An excerpt of *Murasaki no Fuchi* 1 by Ryo Noda

Ryo Noda uses a combination of traditional Western, artistic, and original notation. Although much of this style of notation needs to be explained in a preface legend, it can sometimes be more accessible to a performer who does not comprehend Western notation at all. Additionally, the shakuhachi is often thought of as a free instrument, meaning that in traditional solo music the player determines the relative length of notes and rhythm of pitches.

CHAPTER 15

SITAR

Fig. 133. Anupalma Bhagwat

Physical Description

The sitar is the champion instrument of Indian classical music. This large string instrument remotely resembles the guitar. The body is made from a hollowed-out gourd and acts as a sound resonator. Some sitars may have an additional gourd on the neck of the instrument. The sitar is a fretted instrument with twenty brass frets and strings passing both over and under the frets. Most sitars have six or seven strings above the frets plucked with a wire pick known as a mizrab. Generally there are eleven to nineteen sympathetic strings below the frets. These strings are not usually played directly but

instead vibrate according to the pitches played above them and their own tuning. Tuning pegs run up and down the neck of the instrument with the larger pegs existing behind the nut. Sitar strings are made of different metals, most often steel or copper.

Range

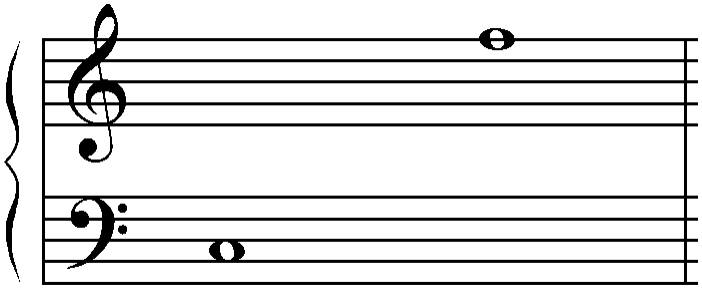
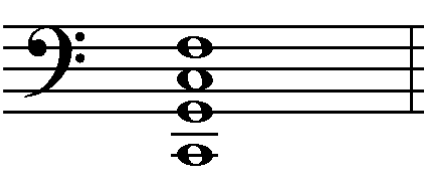
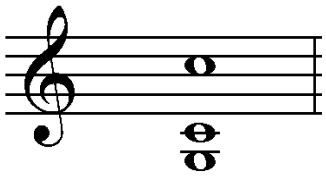


Fig. 134. General melodic range of a sitar pitched in C

Tuning



Tuning of melody strings



Tuning of drone (Chikari) strings

Fig. 135

Though there is no fixed pitch in which the sitar must be tuned, it usually lies between B and C#. If tuned to C, then the top strings will resemble the tuning illustrated above. Modern works may ask for specialized tunings. The frets on the sitar are also moveable and may have to be rearranged to accommodate pitches in a desired scale. The sitar has three groups of strings: the melody strings, Chikari or drone strings, and the sympathetic strings.

While melody strings of the sitar can be tuned differently depending on the music to be played, the standard tuning is C^2, G^2, C^3, and F^3. Two or three of the main strings act as drones. These Chikari strings, as they are termed, help reinforce the final pitch of the raga and provide rhythmic accompaniment. They are tuned in octaves unless a third string is used, which is tuned a perfect fourth below.[62]

Standard Indian Classical music requires the sympathetic strings be tuned to the pitches in the raga scale upon which the player will improvise. A raga is a scale that a performer will improvise upon and often has emotional significance or is to be performed at certain times of the day. The sympathetic strings reinforce the vibrations of the raga scale. Modern composers wishing to highlight pitches outside of a scale may indicate this via a written note to tune these strings to specific pitches.

Fig. 136. A view of the sitar's many strings

[62] Peter Van Gelder, interview by the author, telephone, 26 November 2002.

Pitch, Timbre, Dynamics

Much as on a guitar, the strings of a sitar are plucked or strummed to produce sound. Depressing a string onto a fret will change its pitch. While it seems like an ungainly instrument, the sitar is in fact quite agile, capable of fast runs, leaps, and arpeggiations. To facilitate movement on the string, performers lubricate their fingers with oil to slide along the strings for maximum speed and efficiency. The sitar, despite being a plucked instrument, has the ability to sustain sounds and create long sustained textures which are sometimes described as meditative. Because of the sympathetic strings and the physical composition of the sitar, the timbre is rich in harmonics and overtones.

The dynamic range of the sitar is not wide. While it is able to play a true pianissimo, it can barely achieve an orchestral forte and can be easily overpowered in the midst of an orchestral tutti. However, like the guitar, the sitar can increase its dynamic range with the use of microphones and loudspeakers.

Extended Techniques

Most of the techniques on the sitar have specific Indian names.[63]

1. Meend - A pitch bend. The player presses the string against the fret and pulls it laterally to sharpen the pitch, similar to a bend on the guitar.
2. Kan - Similar to the meend except the player bends the string first. After striking, the string is released. This produces emphasis on the second note, the first being perceived as an ornament.
3. Krintan - Using the left hand to produce standing tones. Similar to a left-hand pizzicato on the violin.
4. Sparsha - After a string has been struck, a quick movement on a higher fret can produce a higher note. This effect is similar to the "hammer on" technique of the guitar. When this action is done repeatedly it produces the effect known as Zamzama.
5. Ghaist - After playing a note, the performer slides a finger up or down along the string with no lateral deflection. Because of the sitar's frets, the sound is not a true glissando; rather, discrete pitches will be heard.
6. Andolit - A slight oscillation of pitch that eventually settles into the note. Accomplished by using a meend technique to produce a sort of vibrato.
7. Harmonics - Although uncommon, harmonics may be produced as on the violin or guitar. See the George Crumb example, fig. 137 and fig. 138.

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[63] Manfred M. Junius, *The Sitar: The Instrument and its Technique* (Wilhelmshaven, Germany: Heinrichshofen Press, 1974), 50-60.

Notation

While Indian classical music has precise theoretical principles, scales, and rhythmic patterns to be adhered to, the majority of it is improvised. Some compositions are scored in Indian notation, but these indicate only the main melody, and after playing it the performer is expected to improvise. Unless a sitarist is familiar with the Western notational system, it may be difficult to communicate the most exact details to the player.[64]

[64] Anupalma Bhagwat, interview by the author, Muncie, Indiana, 24 September 2002.

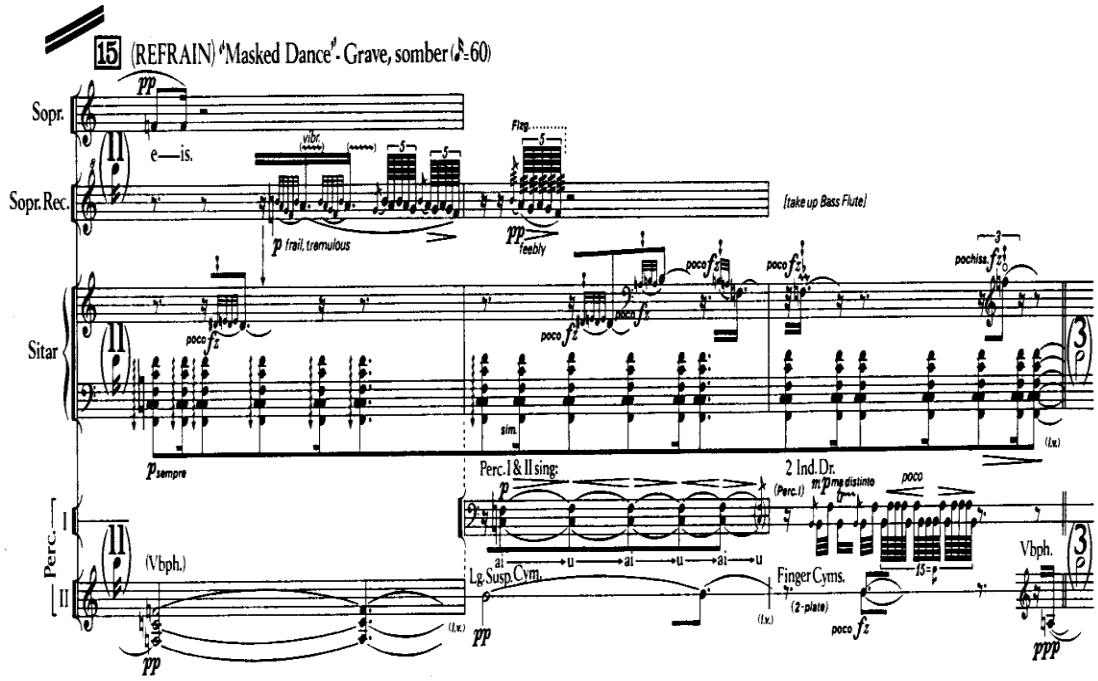

Fig. 137. An excerpt from *Lux Aeterna* by George Crumb. © 1972 by C.F. Peters Corporation. Used by permission. All rights reserved.

In the above example by George Crumb, the sitarist is asked to tune the strings to specific pitches. The player then uses all strings but one as drones. Note the arrows that indicate a strike with the mizrab and the ornaments that follow. Also note the use of the sitar's harmonics in the last note in the top line.

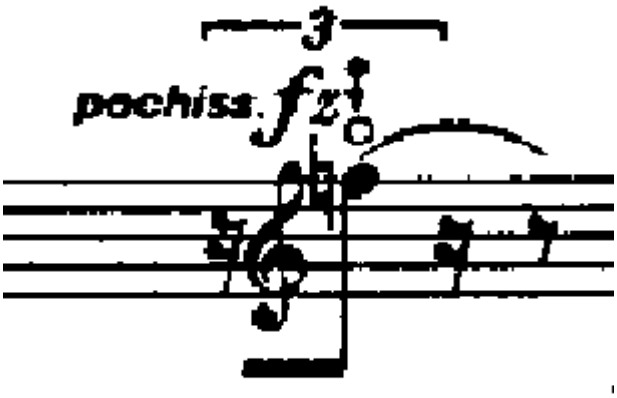

Fig. 138. A closer view of Crumb's notation of harmonics

History and Origins

The word *sitar* is derived from the Persian "Seh-Tar" meaning three strings: the number of strings on the original instrument. Thought to have been invented by Amir Khusrau in the thirteenth century, it was first used to accompany singers but later musicians began to develop a solo repertoire for the sitar. As the sitar became more of a solo instrument, more modifications were made, including more strings, a set of sympathetic strings, and sometimes another resonator at the top of the neck.[65]

The sitar has also made an occasional appearance in the world of popular music. George Harrison, guitarist from the Beatles, took sitar lessons from Ravi Shankar and featured the instrument in the song "Norwegian Wood." The Rolling Stones also used a sitar in the song "Paint it Black" and the band Yes used one in "It Can Happen." Most recently, the band No Doubt used a sitar in the song "Hey You."

[65] Manfred M. Junius, *The Sitar: The Instrument and its Technique* (Wilhelmshaven, Germany: Heinrichshofen Press, 1974), 17-18

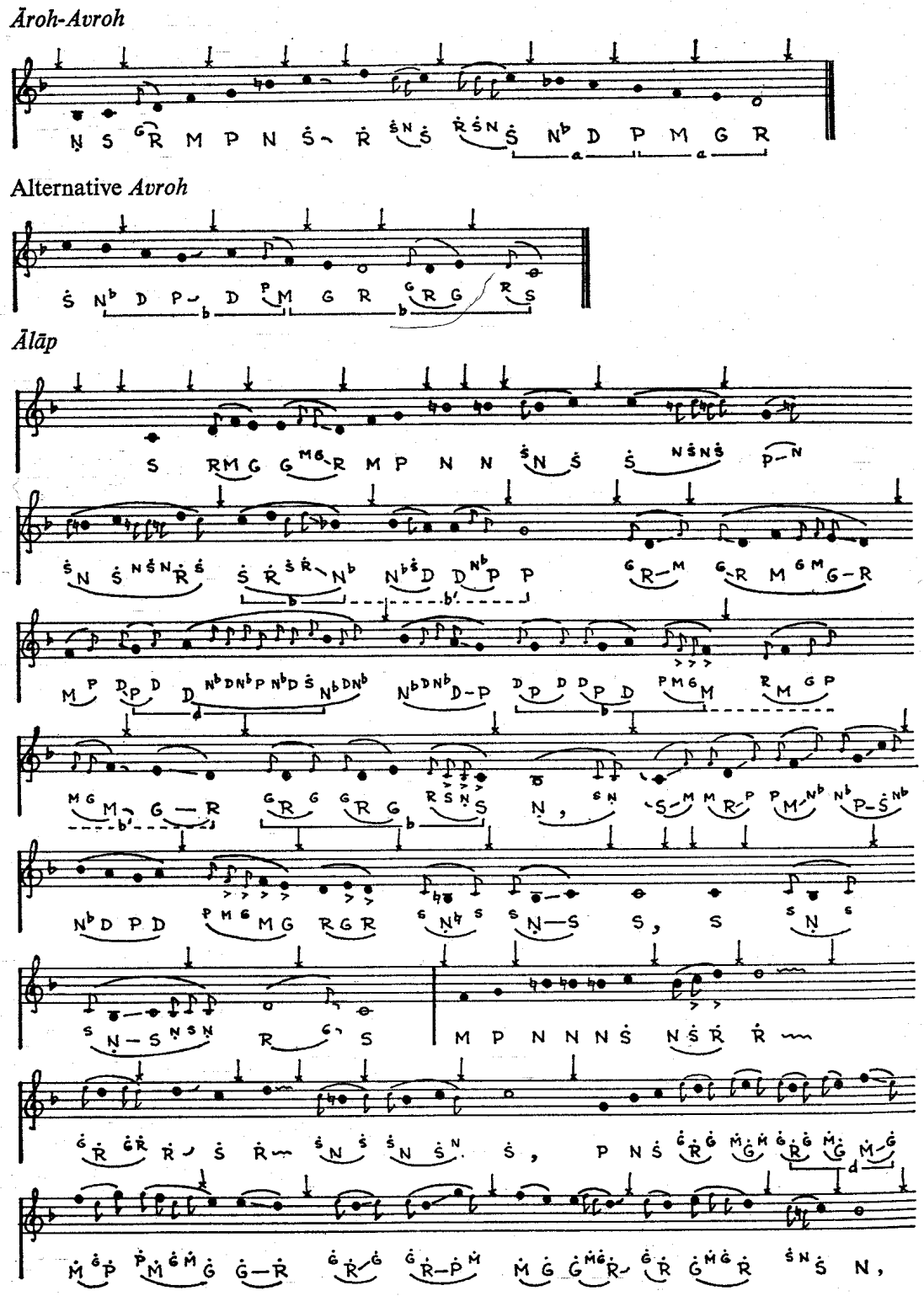

Fig. 139. A transcribed solo of Vilayat Kahn from N. A. Jairazbhoy, *The Rags of North Indian Music* (Middletown, Connecticut: Wesleyan University Press, 1971), 194.

CHAPTER 16

THEREMIN

Fig. 140. The author with the theremin

Physical Description

Created by Leon Theremin in 1920, the theremin is an electronic instrument. Although it has no standard shape and size, it is easily identified by its two distinct metal antennae. Usually they protrude from a box in which the circuitry is housed. One antenna sticks up vertically and the other horizontally. The vertical antenna is a straight, single piece while the side one is a loop. Because it is an electronic instrument, the theremin does require an amplifier and loudspeaker.

Range

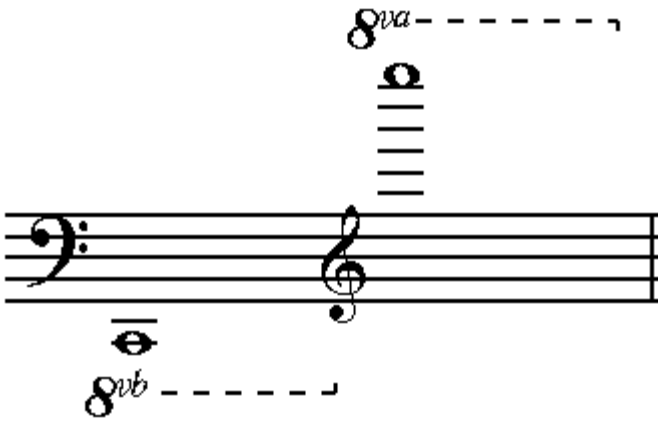

Fig. 141. Range of a seven octave T-vox Theremin

Depending on the model, the theremin has a range between four and seven octaves. The T-vox is a professional model and has a range from C^1 to E^8.

Tone Production and Technique

The theremin is one of the only instruments on which a player creates sound without touching it. The top antenna is used to control the pitch and the side one is used for volume. The pitch rises as the hand moves closer to the top antenna and gets louder as the other hand moves closer to the side looped antenna.

Since the theremin operates on these electro-magnetic waves and proximity of the hand, there is always a portamento between pitches unless the volume is shut off in between. The portamento gives it a vocal quality that may be enhanced with vibrato. This effect can be obtained by waving the pitch hand back and forth. This action also gives the performer control over the rate and depth of the vibrato. Additionally, a tremolo effect can be obtained by using the same technique over the volume antenna.

The theremin's sound is produced by the electronic principle of "heterodyning": when the frequency of the "pitch" oscillator is subtracted from the frequency of a fixed oscillator, the resultant frequency produced falls within the range of human hearing, and this is what we hear through a speaker as sound.[66]

Timbre and Controls

Because the theremin has a smooth portamento between pitches and the vibrato is so easily obtained, it has been said that it has a vocal quality. Although models tend to differ, most instruments have a dial that can give the performer some control over the timbre. Knobs adjust pitch and volume and some theremins offer controls to adjust the sensitivity of the antennae. Although Leon Theremin made some attempts to create a polyphonic instrument, the theremin remains monophonic.

Limitations

While the theremin has capabilities that other instruments do not possess, it does have some limitations. Since it does not have keys, valves, or mechanisms to produce pitches, and there are no visual aids, the performer must have an unusually fine sense of pitch. It is possible, however, to use an electronic tuner during practice to obtain visual feedback. The player can also tune to the accompaniment. The volume of the instrument

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[66] Albert Glinsky, *Theremin: Ether Music and Espionage* (Chicago and Urbana: University of Illinois Press, 2000), 24-25.

is limited by its speaker and amplifier which, depending on the instrument, can be changed to meet the needs of chamber music or performance with a large symphony orchestra.

Notation and Composing for Theremin

Lydia Kavina, one of today's premiere theremin virtuoso performers and a composer of many works for theremin, offers this advice on writing for theremin:

> The notation depends not on the instrument but on the composer's idea. So the theremin can play traditional music from the traditional scores, of course. For example, you can easily play a lot of classical repertoire and you do not need any adaptation in the notation at all. Because the note in the music does not mean a position of the finger on the string, or on the keyboard, or in the space. But it produces a sound which you can play or sing or hear. If you have ears for music and can read music so well that you can hear it in your mind, then you can play it on the theremin. The composer should sing the melody without words to imagine how the theremin can sound.
>
> But, of course, if the composer wants some new expression, he develops new notes, symbols, and sometimes new notation, particularly for the theremin, because of its great glissandi possibilities. There are some beautiful graphical scores for theremin.[67]

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[67] Lydia Kavina, interview by the author, September–October 2002.

Fig. 142. Lydia Kavina, age 9, with Leon Theremin

Photo reprinted with Lydia Kavina's permission

Other Instruments of the Theremin Family

Theremin had made improvements and alterations of his invention that resulted in other variations of the original. These included the theremin cello, the terpistone, the rhythmicon, and the electro-theremin. The theremin cello allowed a cellist to touch the finger board to control pitch while using a level to control volume. The great conductor Leopold Stokowski asked for a custom bass theremin and used it in the bass section of the orchestra.

The rhythmicon was a keyboard instrument that could convert harmonic data into rhythmic data. It was commissioned by American composer Henry Cowell in 1930 to perform complex rhythms that human beings were incapable of performing. The terpistone was a platform that responded to the movements of a dancer. The concept of

control was similar to the antennae of the theremin; if the dancer raised her arms, pitch would rise. Moving back and forth on the platform affected the volume.

The theremin cello was shaped like a cello with a plastic fingerboard that, when touched, would produce a tone. A lever on the side would control the volume. The electro-theremin was similar to the theremin but could produce discrete pitches. It was used on Brian Wilson and the Beach Boys' "Good Vibrations."

History and Origins

Leon Theremin invented his instrument in Russia, 1920. He sought to create an instrument that required no mechanical action or moving parts. Because Russia was in the beginning of its electrical age, he was invited to show his creation to Vladimir Lenin. Lenin was fascinated by the instrument and when he tried to play it, much to everyone's surprise, was able to play it well.

After many successful performances in Russia, Theremin traveled throughout Europe, amazing listeners with his invention. In 1927 he arrived in New York and performed a private demonstration for such guests as Arturo Toscanini and Sergei Rachmoninoff. Later, concerts were held at the Metropolitan Opera house and with the New York Philharmonic. Theremin had also accepted students, including Clara Rockmore, a violinist who became the premiere virtuoso theremin performer of all time.

In 1938, Leon Theremin was apprehended by the NKVD and sentenced to eight years in the Kolyma, a slave labor camp deep in Siberia. The charge was officially

recorded as "belonging to a fascist organization."[68] According to Andre Smirnov, director of the Theremin Center in New York, the KGB had been using him as an agent since the early 1920s and was dissatisfied with his performance. But Stalin needed scientists to work on special military projects. After several months in Kolyma, Leon Theremin was recalled to Moscow where he was put to work developing electronic technology for the Russian military, including radar and acoustics. After eight years he was freed, and in 1947 he was awarded the Stalin Prize of 100,000 rubles for designing a bugging device for the KGB. This ingenious technology was used to bug the Spaso house, residence of the US ambassadors for many years. He finally returned to the United States in 1991 and performed in a concert at Stanford University. He died in 1993.[69]

While several composers have written specifically for the theremin, it seems to thrive on transcriptions of classical works, often replacing a solo violin or voice part. The other area in which the theremin has found a niche is in film music, particularly that of science fiction, because of its ethereal, other-worldly sound.

Literature

Joseph Schillinger	(1929) *First Airfonic Suite* for theremin and orchestra
	(1929) *Mouvement electrique and pathetique* for theremin and piano

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[68] Albert Glinsky, *Theremin: Ether Music and Espionage* (Chicago and Urbana: University of Illinois Press, 2000), 215, 217.

[69] Joel Chadabe, *Electronic Sound: the Past and Promise of Electronic Music* (Upper Saddle River, N.J.: Prentice Hall, 1997), 8-11.

Friedrich Wilkens	(1933) *Dance in the Moon* for theremin and piano
Edgar Varese	(1934) *Ecuatorial* for theremin and orchestra
Percy Grainger	(1936) *Free Music* for four theremins
Bohuslav Martinu	(1944) *Fantasia for theremin, string quartet, oboe and piano*
Isidor Achron	(1945) *Improvisation for theremin and piano*
Miklos Rosza	(1945) *Spellbound Concerto* for theremin and orchestra
T. Nazarova-Methner	(1983) *Vietnam Album* for theremin and orchestra
Sergey Kosenko	(1987) *Remote Star* for theremin and tape
Valery Beluntsov	(1989) *La Fantasie d'Arbat tra i campi della Gubernia Voronez* for theremin and tape
	(1991) *Self Portrait* for theremin and organ
Olga Rayeva	(1990) *The Sketch* for theremin and clarinet
Malte Ruehman	(1993) *Die gefiederte Schlange* for theremin and piano
Jorge Campos	(1993) *Sequencia* for theremin, tape, and trumpet
Anatoly Kosselev	(1993) *Song on Ruins* for theremin and tape
Valery Belunsov	(1995) *Long Song* for theremin and radio baton
Jorge Antunes	(1995) *Mixolydia* for theremin and tape
Jorge Campos	(1996) *Glissandi* for 3 to 6 theremins
Valery Beluntsov	(1996) *Reccry 3* for theremin, cello and tape
Vladimir Komarov	(1996) *Voice of Theremin* for theremin and tape
Alexander Reichelson	(1996) *Six Translations from Villi Melnikov* for theremin and piano
Joseph Pehrson	(1997) *Whoo* for Theremin

Wolfgang Suppan	(1998) *Raum/Beschreibung 1, Klostenneuburg* for theremin and ensemble
Vladimir Nikolaev	(1999) *19 Peaks* for theremin and string quartet
Alexander Reichelson	(1999) *Rocochord*
	(1999) *The Round* for theremin and organ
Anthony Rovner	(1999) *The Moving in the Air* for theremin and clarinet
Howard Shore	(2000) *Ed Wood* Suite for theremin and orchestra
Christion Wulf	(2000) *Exercise for theremin, violin, C-bass and French horn*
Olga Neuwirth	(2000) *Baehlamms Fest* for theremin and orchestra.

Film Music

Miklos Rozsa	(1945) *Spellbound*
Bernard Herrmann	(1951) *The Day the Earth Stood Still*
Howard Shore	(1994) *Ed Wood*
Howard Shore	(1998) *eXistenZ*

Theater Music

Tom Waits	(1992) *Alice*
Fred von Hofe	(1993) *Othello*
Andreas Ammer, FM Einheit, and Ulrike Haage	(1996) *Odysseus 7*
Kiyoshi Furukawa	(1997) *Den ungeborenen Gotern*
Ralf Gothoni	(1998) *The Sun in Sand*
Olga Neuwirth	(1999) *Baehlamms Fest*

Compositions by Lydia Kavina

(1997) *The Seasons of the Year* a concerto-fantasy for theremin and orchestra

(2001) *Star Improvisation* for four theremins

(1997) *The Mirror* and *Transformations* for theremin, flute, and cello

(1998) *Valse* for theremin and string quartet

(1989) *Landscape* for four theremins

(1995) *The Monologue* for theremin solo

(1989) *Suite* for theremin and piano

(1994) *In Whims of the Wind* for theremin, voice and piano

(1992) *Swamp Music* for theremin and digital sampler

(1984) *The Statue of a Soldier* for theremin and piano

(1985) *Romance* for voice, theremin and piano

(1986) *Two Preludes* for theremin and piano

(1987) *Antique Russia* - fantasy for theremin, piano, viola, bassoon and chimes

(1990) *Chaconne* for theremin and synthesizer

(1990) *Requiem* for theremin and synthesizer

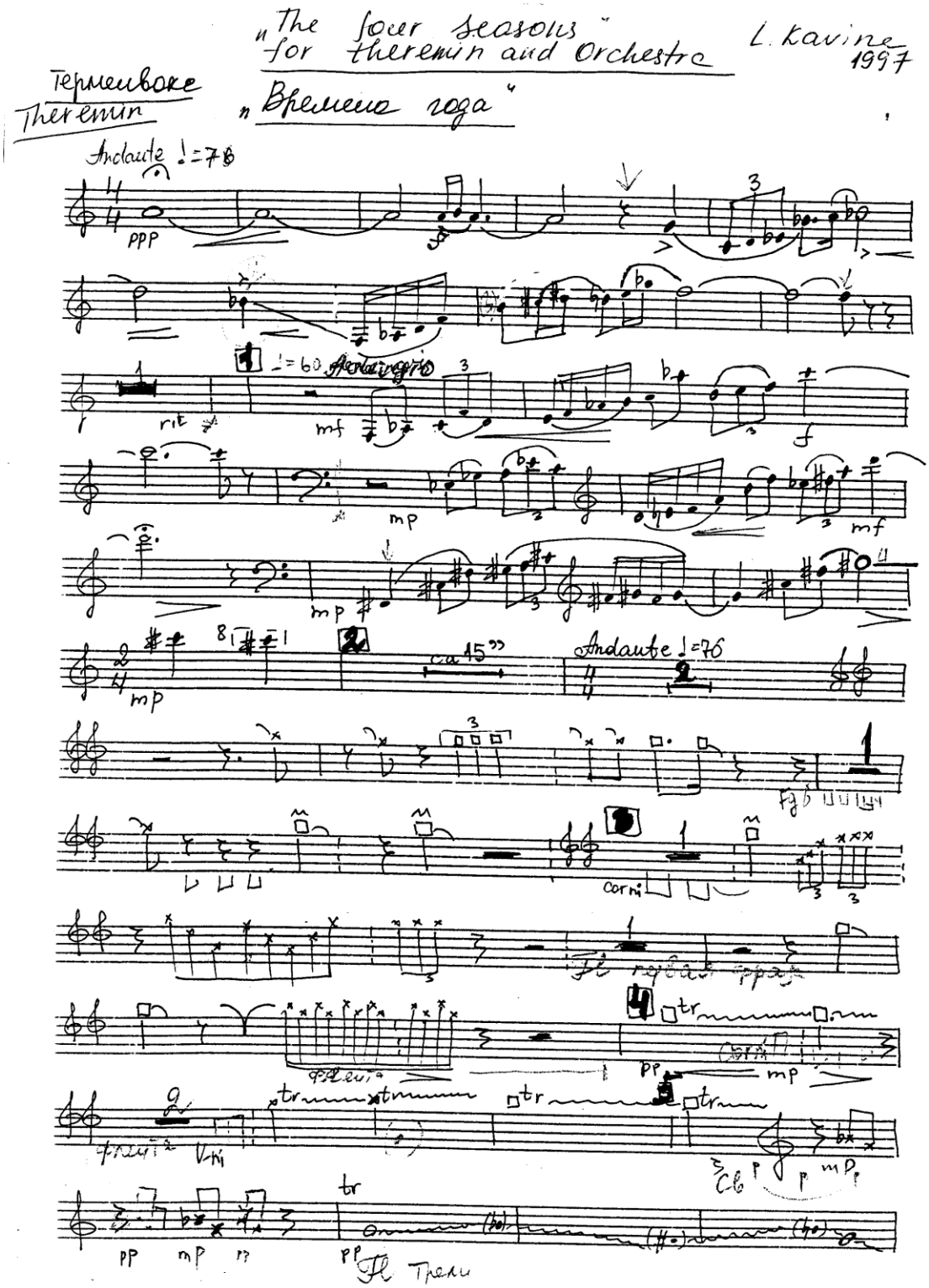

Fig. 143. *The Four Seasons* by Lydia Kavina. This score uses mostly traditional notation, but notice the square notes which tell to the performer to begin by touching the antenna.

Courtesy of Lydia Kavina

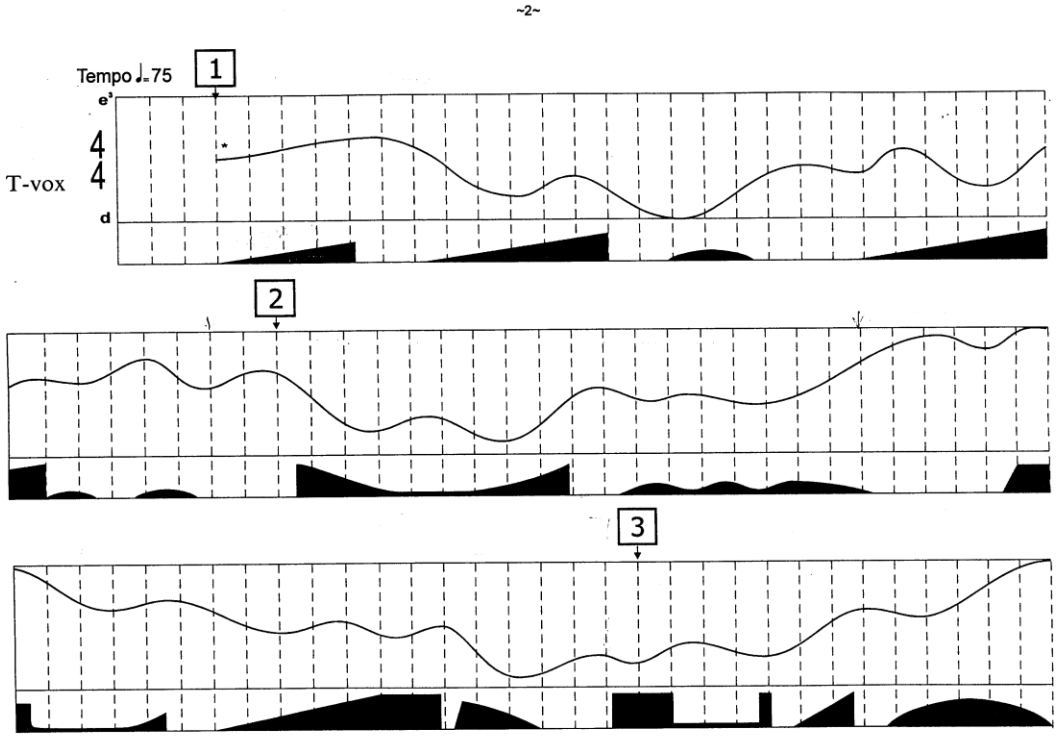

Fig. 144. Graphic theremin score of *19 Peaks* by Vladimir Nikolaev.

The curved line indicates pitch and the shaded graph on the bottom designates volume.
The pitches A and D are indicated by horizontal lines and a traditional time signature is given with vertical lines to indicate time.

Courtesy of Vladimir Nikolaev

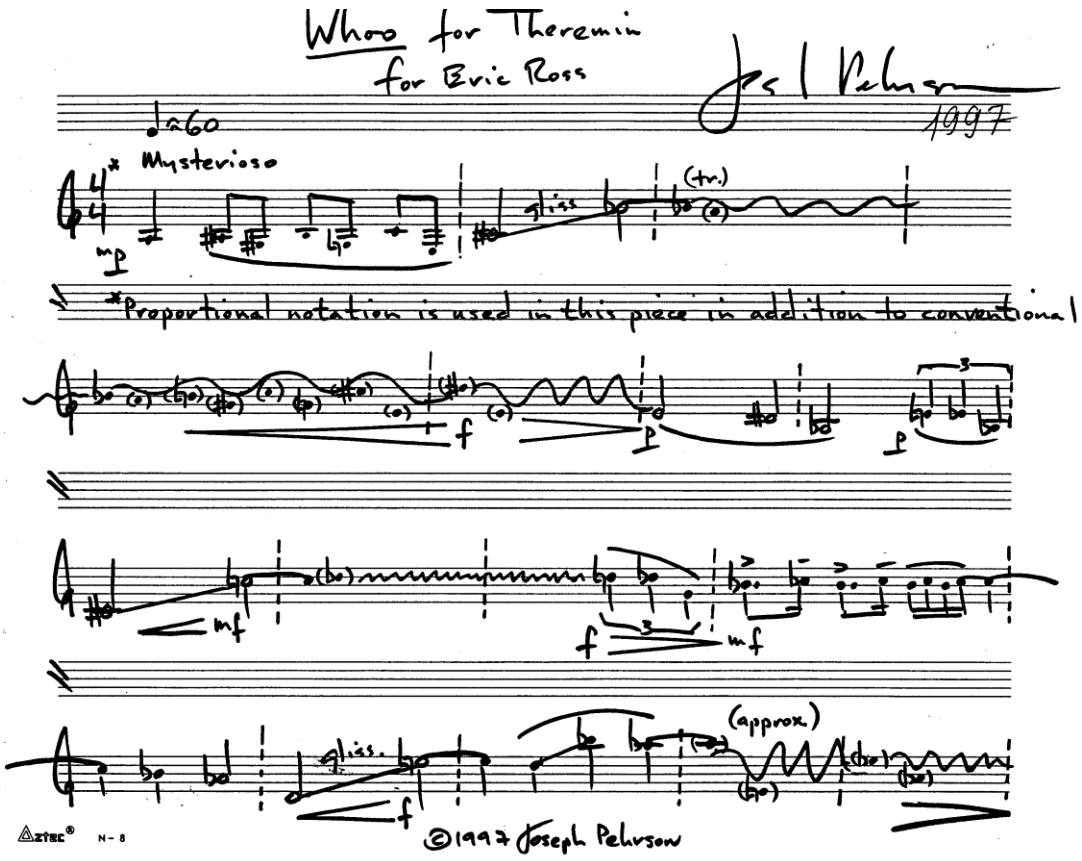

Fig. 145. *Whoo* (later renamed *Wuuuu*) by Joseph Pehrson

Note the combination of exact and free notations.
Courtesy of Joseph Pehrson

CHAPTER 17

UILLEAN PIPES

Fig. 146. A full set of uillean pipes

Physical Description

The uillean pipes (pronounced "ill-awn" and also called Irish pipes, elbow pipes, or union pipes) differ considerably from the great Highland bagpipes. Instead of a blowpipe, the performer uses a bellow to inflate the bag. The chanter has a double reed and provides the piper with several holes to cover for obtaining various pitches. The end of the chanter is an open hole and rests on the piper's leg to seal it closed. Three drones are attached to the bag but, unlike the Highland pipes, these drones are sometimes

equipped with regulators, which resemble large metal keys (see fig. 155). These regulators activate additional reeds that can, in combination with the drone pitches, create harmonies and rhythmic accompaniment. The drones are single reeds and the regulators are double reeds. A drone switch also activates or deactivates the drone pipes.

Fig. 147. The chanter

Fig. 148. Jim Smith, an uillean piper

Fig. 149. The chanter reed and the drone reeds

Fig. 150. A half set of uillean pipes

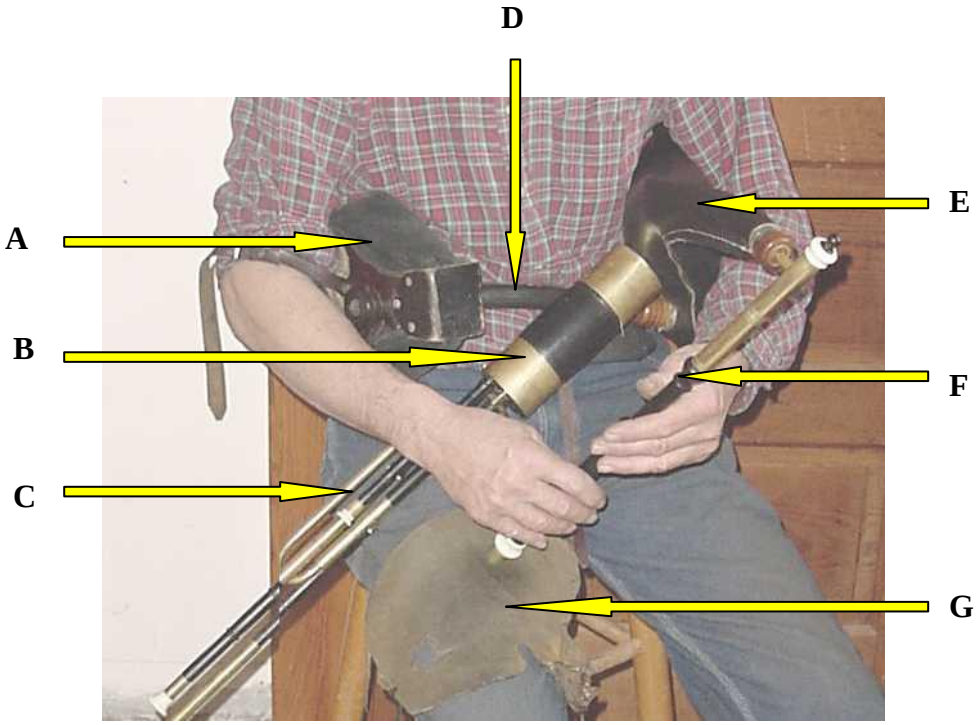

Fig. 151. A half set of uillean pipes

A - The bellows, controlled by the elbow.

B- The stock.

C- The drone pipes.

D - The blow pipe that connects the bellows to the bag.

E - The bag.

F- The chanter.

G - The leather pad that is sometimes used to rest the end of the chanter on and create a complete seal so that air does not escape.

Range

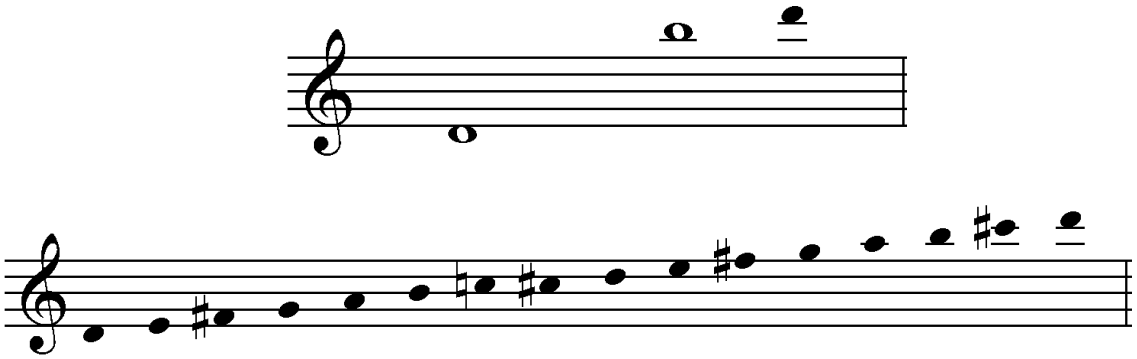

Fig. 152. Notes available on the chanter without the use of half-hole technique

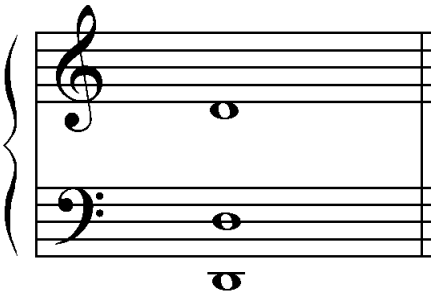

Fig. 153. Drone Pitches

The drones always sound the pitch D in octaves. There are three sets of regulators on a full set of pipes: a tenor, baritone, and bass. The tenor can obtain the notes C^5, B^4, A^4, G^4, and $F\#^4$; the baritone gets notes A^4, G^4, $F\#^4$, and D^4; the bass regulator gets notes C^3, B^2, A^2, and G^2.

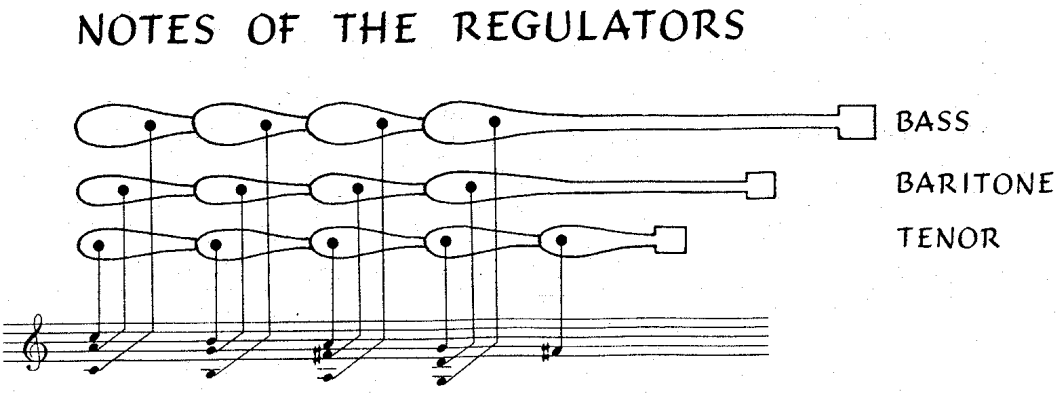

Fig. 154. Chart indicating regulator pitches from Wilbert Garvin's, *The Irish Bagpipe: Their Construction and Maintenance* (Belfast: Blackstaff Press, 2000), 35.

Fig. 155. The regulators

Tuning, Pitch, and Timbre

The uillean pipes use just intonation and therefore will sound slightly out of tune when mixed with instruments of equal temperament. But composers may favor these pipes for a number of reasons: dynamic level, range, and ability to alter drone pitches. Unlike the Highland pipes, the uillean pipes are not made for outdoor use and their dynamic level is considerably less than that of their Scottish cousin. Thus the piper can perform with instruments other than thundering drums. The uillean piper can play in ensembles with flutes, whistles, fiddles, and voice. Unfortunately, the dynamics of the instrument are also its limitation. The uillean pipes play only one dynamic level and any attempt to change the dynamic level will affect the intonation.[70]

The major limitation of the Scottish Highland bagpipes is their range and ability to play in multiple keys. Usually pitched in D, the Irish uillean pipes boast a two-octave range that is fully chromatic. This gives the instrument the ability to play in more than one key and makes it more compatible with modern symphony orchestras, particularly in the film genre. But while the pipes are chromatic, they are designed to play in specific

[70]Jim Smith, interview by the author, Shelbyville, Indiana, 25 November 2002.

keys. The pipes are pitched in D, the best key for the pipes. The pipes can sound any note listed under range in the beginning of this entry, but half-hole technique will allow a piper to obtain the chromatic intervals in between these pitches. Other common keys include G, b minor, and e minor. However, some chanters can be customized with keys to help facilitate production of chromatic pitches.[71]

Fig. 156. A keyed chanter

A practice set of pipes will not contain drones. A half set will have drones but no regulators. A three quarters set will include the tenor and baritone regulators, and a full set of pipes will include the bass regulator. The regulators are the keys on the drones that allow the piper to produce additional pitches and create harmony and accompaniment.

The tone of uillean pipes is much less strident than that of the Highland pipes. It has a rich, dark, haunting quality as opposed to the Scottish pipes' piercing fortissimo.

Technique

The fingering system on the chanter is similar to those of both the Scottish bagpipe chanter and the Irish flute. But because the pipes cannot rearticulate notes, they use a system of grace notes which closely resembles the ornamentation of the Irish flute. A note is re-articulated by means of a cut or a strike. A long note may be rearticulated

[71] Ibid.

several times by use of a crann or a roll. Rolls and cranns are combinations of cuts and strikes.[72] For more complete information on cuts, strikes, cranns, and rolls see fig. 160. The following are techniques often used by uillean pipers:

1. Pitch bending - Another extended technique is the ability to bend notes, which is much more characteristic of the uillean pipes than of the Highland pipes. An effect created by pitch bending loud tones is sometimes called a wail due to its wailing sound.
2. The bark - A distinct form of attack created by lifting the chanter off the leg.
3. Vibrato - By quickly and continuously shading an open hole, a sort of vibrato is created. Note that this is created with the fingers and has nothing to do with air pressure.

History and Origins

The uillean pipes are a descendent of the pastoral pipes, another bellows-blown instrument. The pastoral pipes originated in the British Islands and had two drones and a chanter. These pipes did not have the third drone or regulars that a set of full uillean pipes would have. The pastoral pipes also lacked the range available on today's pipes.

One mystery that surrounds the uillean pipes is the name. The term "uillean" is very close to the old Irish word for "elbow." Since the bellows is operated by the elbow, this seems logical. They are also called union pipes, however, which may mean that the stock of the instrument contains all of the drones and regulators, or it may additionally

[72] Ibid.

refer to some political movement of the time. Lastly, the term Irish pipes came about because the instrument is found in the folk music of Ireland. This also helps distinguish it from the Scottish Highland pipes[73]

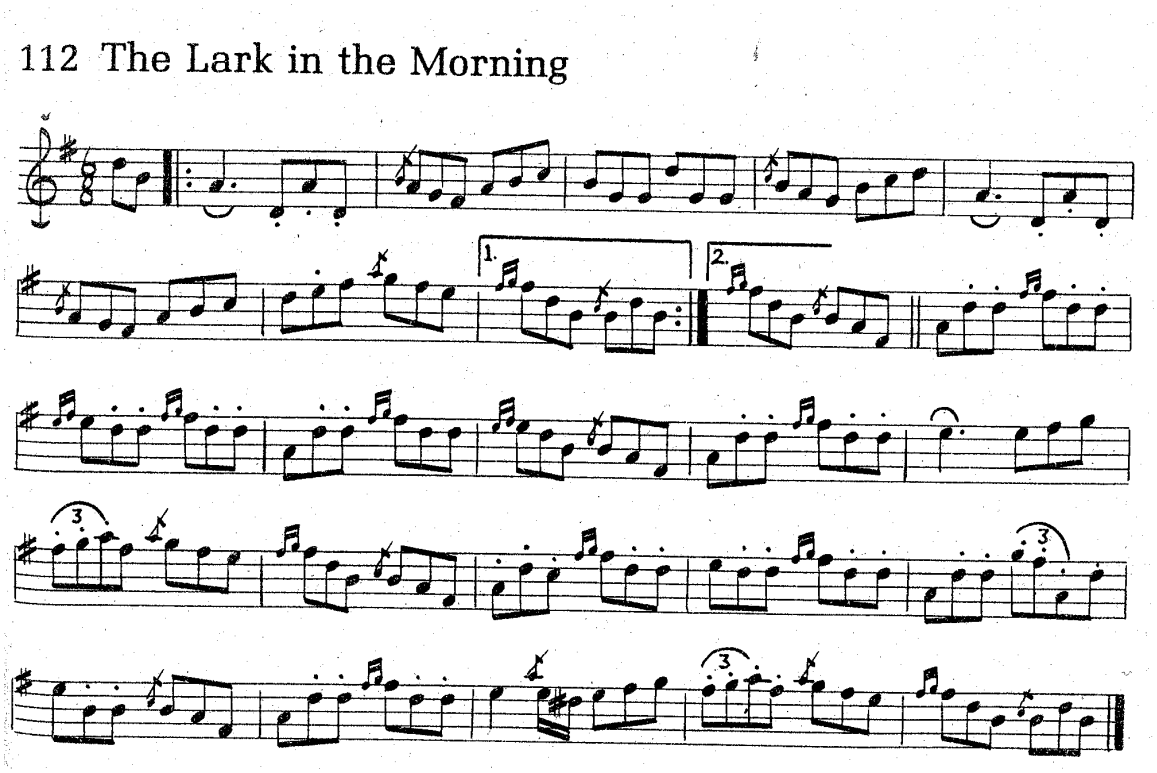

Fig. 157. A common folk tune often played by Irish piper from Pat Mitchell, *The Dance Music of Willie Clancy* (Dublin: Mercier Press, 1983), 87.

[73] Ibid.

Modern Literature

While uillean pipes will always have a place in traditional Irish music, they are most recently known for their appearance in several film scores. Such scores include:

James Horner	(1998) *Titanic*
	(1995) *Braveheart*
John Williams	(1992) *Far and Away*

From Shore to Shore, *The Long Journey Home*, and *Out of Ireland* are documentary films that also include examples of Irish pipes on the soundtrack. The following are symphonic works that utilize uillean pipes in the score.

Paul Geraci	(2000) *Celtic Trilogy*
Patrick Cassidy	(1996) *Famine Remembrance (The Famine Symphony)*
Bill Whelan	(1992) *The Seville Suite*
Shawn Davey	(1985) *Granuaile*
	(1983) *The Pilgrim*
	(1980) *The Brendan Voyage*

The following examples (figs. 158 and 159) of music for uillean pipes are from James Horner's manuscript for the film *Braveheart* entitled "Wallace is Caught." Note in this short excerpt how the pipes blend dynamically well with soft strings and harps. The range spans more than an octave making this piece impossible to play on a Highland bagpipe. The pipes have an expansive, sweeping quality while still retaining their melancholic yet expressive character. Also important is the key; notice how the key is perfectly suited to the pipes. The same example could not exist in a flat key.

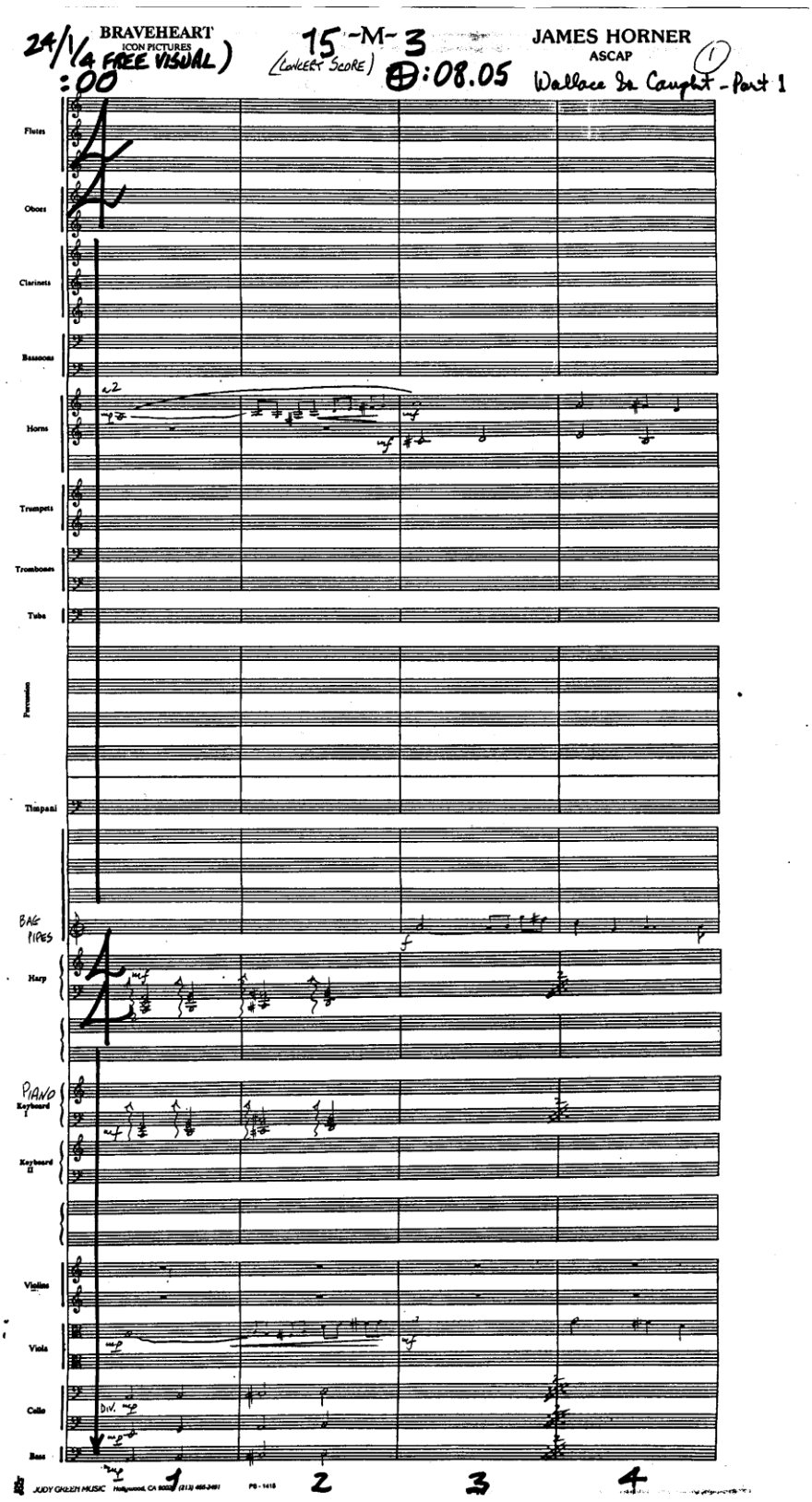

Fig. 158. James Horner's manuscript for the film *Braveheart* © 1995 Famous Music Corporation. Used by permission.

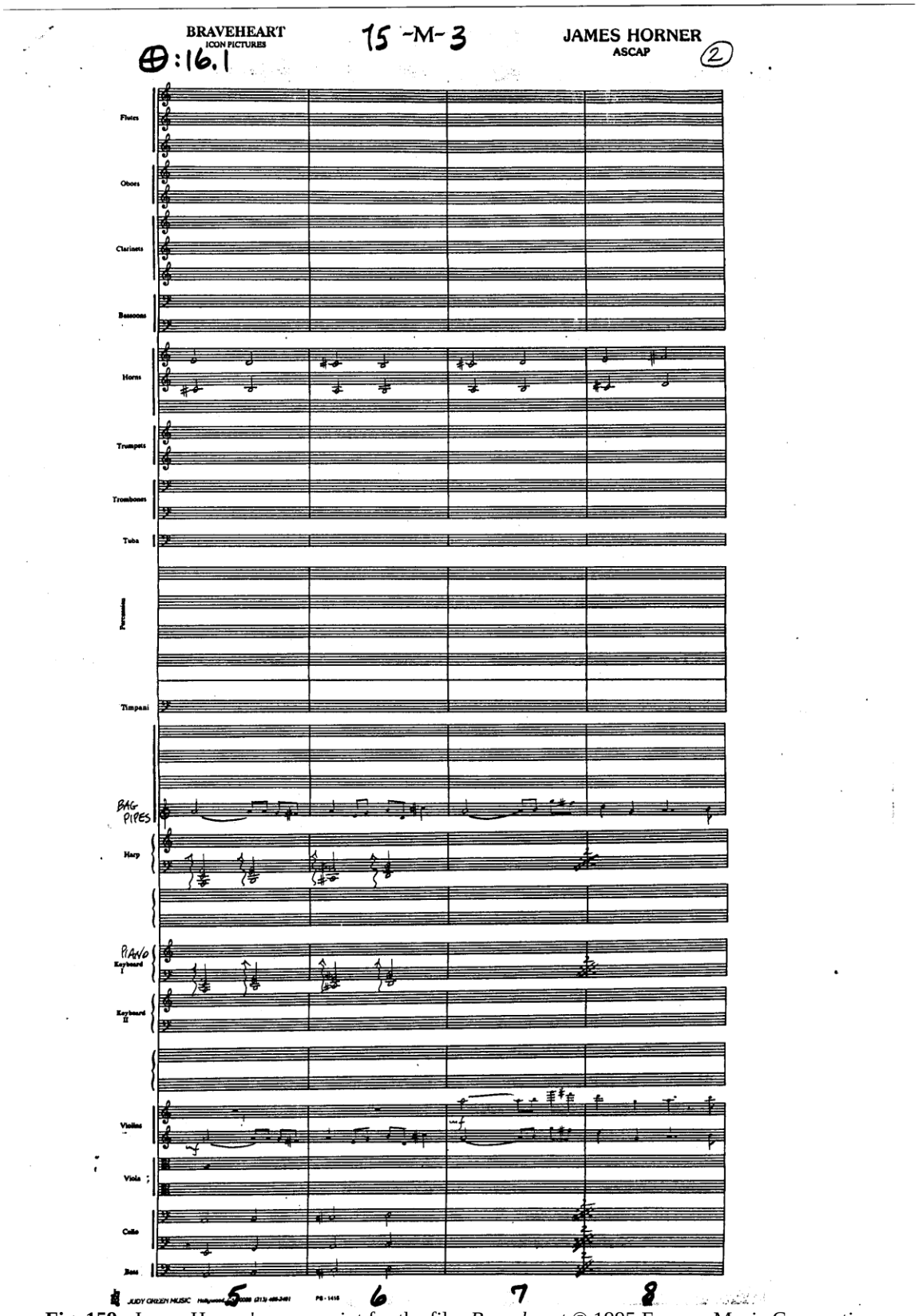

Fig. 159. James Horner's manuscript for the film *Braveheart* © 1995 Famous Music Corporation. Used by permission.

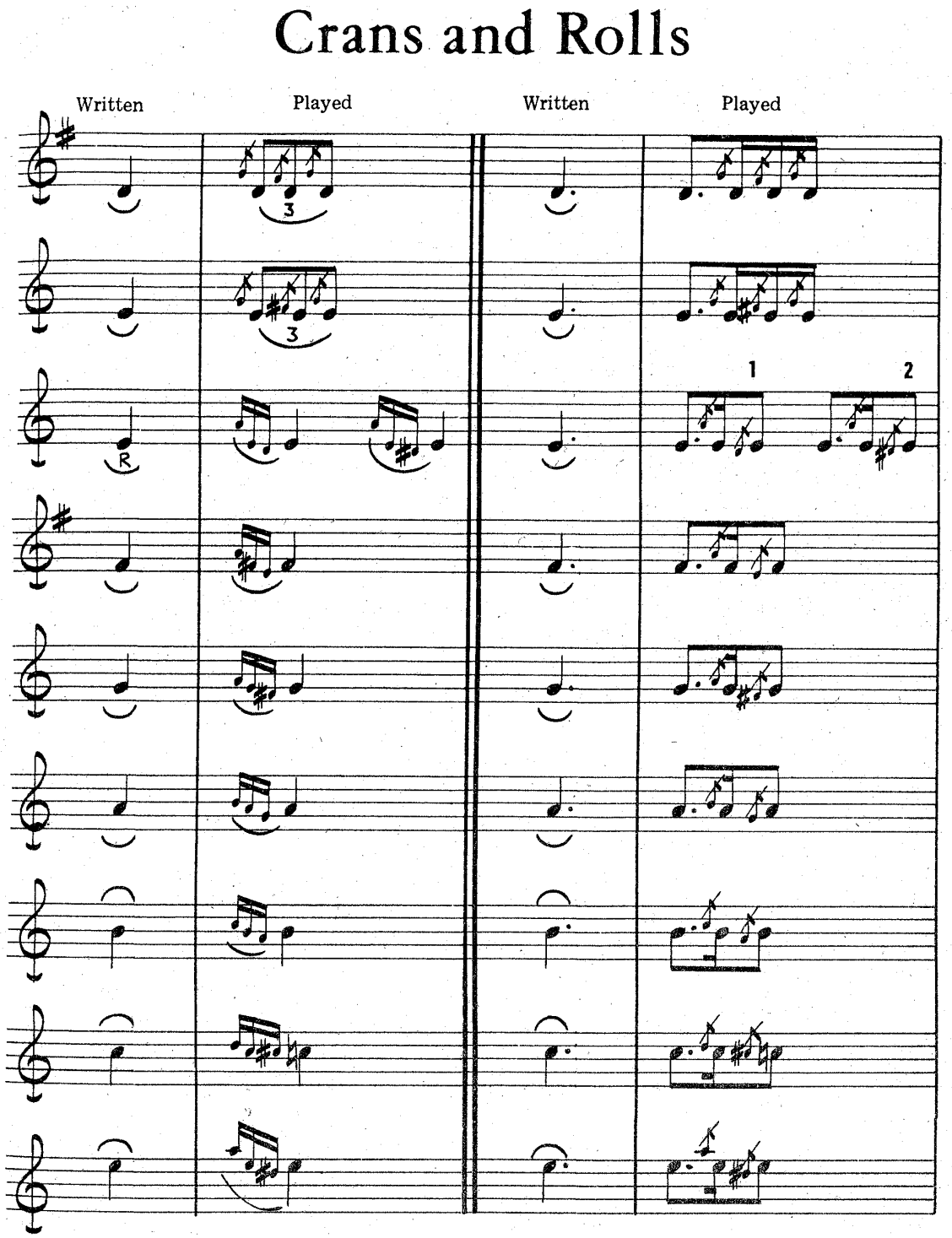

Fig. 160. Roll and crann chart from Pat Mitchell, *The Dance Music of Willie Clancy* (Dublin: Mercier Press, 1983), 19.

CHAPTER 18

CONCLUSION

A wealth of information is available about instrumentation and writing for nonstandard instruments, yet a need does exist for more. Much of the information about nonstandard instruments remains with the performers of these instruments. Therefore, the interviews in this study constitute important original research not found in any other source. While a significant amount of data relevant to this study is published in other sources, it has not been organized into a single, useable reference. Additional information is scattered among specialty instrument and cultural history texts. This information has been consolidated in this dissertation, supplemented by information drawn from the interviews, into a reference that it is readily available to composers and others wishing to study or write for nonstandard musical instruments.

The preparation of this document included selecting the instruments; interviewing qualified experts; organizing chapters and chapter format; finding text sources, musical examples, and photographs; and obtaining permission to publish the sources in the dissertation.

I selected the instruments in this study based on available resources and instruments that span a wide variety of cultures. A primary criterion was the

availability of musical examples by known composers. In order to produce a text that could aid a composer in writing for these instruments, I wanted to provide examples of how composers had already written for them successfully. A second criterion was the inclusion of instruments from a wide variety of cultures, providing the composer with a wider palette of colors from which to choose.

The process of arranging interviews included identifying qualified experts and contacting them directly. The interviews were conducted in several ways: personal interviews in the field, telephone, email, and postal mail. A complete interview schedule can be found in Table 1, and brief biographical data on each of the interviewees can be found in Appendix A.

Decisions regarding the document's organization included the order of the chapters and chapter format. Instrument chapters are ordered alphabetically for easy reference. Chapters are organized under several headings including "Physical Description," "Range," "Tuning," "Timbre," "Limitations," "Technique," "Literature," and "History and Origins." Some of these headings are common to all chapters, and other headings appear only when applicable.

Some of the information about the instruments was found in published texts. These sources include orchestration books, specialty instrument books, music books devoted to particular cultures, articles, and encyclopedias. I located musical examples in scores and music texts. Some of the scores were published by the composer or were copies of original manuscripts. Many of the self-published works came directly from the composers' or performers' personal libraries, and two of the musical examples are from my own compositions. I obtained the photographs from many different sources: photos I

took myself, photos digitally scanned from other texts, pictures on the web, and pictures taken for me.

The acquisition of copyright clearance was an important task. I obtained specific permission to use most musical examples and photographs. Others are used under the fair use clause of the copyright law. I contacted the publishers or copyright holders to obtain permission to use the musical examples. I contacted the publisher, photographer, webmaster, or copyright holder to obtain permission to use the photographs.

It is my hope that this dissertation will prompt further study of nonstandard musical instruments. Additional research may include adding to the number of entries, developing an annotated discography, creating a CD representing the instruments and musical examples, and writing texts devoted exclusively to single instruments.

Many instruments were omitted from this study because of a lack of available musical examples, experts, and written sources. This omission does not detract from their importance, and these instruments may be considered for further study. Such instruments may include: Jew's harp, fife, Native American duct flute, shamisen, washtub bass, steel drum, biwa, kazoo, and Appalachian dulcimer.

The scope of this study does not include a discography or a companion CD. Since many of the instruments do not traditionally employ Western notation, recordings can be an important resource. An annotated discography could provide source information for quality recordings. A CD with recordings of the instruments and musical examples would be a great asset as well. Composers who are unfamiliar with the instruments would benefit from aural examples.

Additional exhaustive studies may be completed on any single nonstandard instrument. To my knowledge, no complete texts are devoted exclusively to the glass harmonica or uillean pipes. There are very few exclusive texts for the other instruments and more may be welcomed.

APPENDIX A

Biographical Information of People Interviewed

Anupalma Bhagwat - Ms. Bhagwat learned to play the sitar in India at the age of nine. She holds a master's degree in music from Indira Kala Sangeet Vishwavidyalaya. Ms. Bhagwat has recorded two solo albums and has performed on radio and television. She is in demand as a performer of Indian classical music in the United States.

Henry Doktorski - Mr. Doktorski started learning the accordion in 1963. He has performed with many orchestras, including the Pittsburgh Symphony Orchestra, the Cleveland Chamber Symphony, and the Tanglewood Festival Orchestra. He is also an author of many articles on the accordion.

Michael Gould - Mr. Gould started learning the shakuhachi in 1982 in Kyoto, Japan, under the guidance of world-renowned masters Taniguchi Yoshinobu and Yokoyama Katsuya. One of a dozen non-native Japanese to obtain the rank of Grand Master, he currently is an instructor at Oberlin University and the University of Michigan.

John Gouwens - Mr. Gouwens is presently the instructor of carillon at Culver Academy and teaches carillon lessons at Ball State University. He has given recitals in Belgium, the Netherlands, and Germany. Mr. Gowens made two recordings of carillon music and has held numerous posts in the Guild of Carillonneurs in North America.

David Hudson - Mr. Hudson has been featured on many recordings including his own solo albums. In 1997 he toured with Yanni, performing in the United States, India, and China. Mr. Hudson also has his own line of custom didgeridoos that are available for purchase.

James Jones - Mr. Jones is both a performer and teacher in the San Antonio area. He has a large collection of didgeridoos and an extensive collection of recordings. He conducts workshops on how to build and play didgeridoos.

William Jones - Mr. Jones began playing Highland pipes in 1961. He is currently the pipe major in the Black Bexar Pipe Band and a highly regarded bagpipe instructor. Mr. Jones was a member of a bagpipe quartet that won the Texas state championship in 1989. Additionally, he has won individual competitions in Los Angeles and Houston.

Lydia Kavina - Ms. Kavina teaches at the Theremin Center at the Moscow State Tchaikovsky Conservatory in Russia. Her solo album *Music from the Ether* is the first album dedicated solely to original compositions for theremin. She is also an active composer and has written several works for theremin.

Kirby Koriath - Dr. Koriath is coordinator of graduate programs and professor of music at Ball State University. Additionally, he is in charge of the carillon at Ball State University. He earned his D.M.A. from the Eastman School of Music.

Russ Landau - Mr. Landau is a composer for film and television. In 1995, he and Paul Winter won a Grammy Award in the category of best new-age album for their work entitled *Prayer For The Wild Things*. He has written music for television shows such as "Survivor II: the Australian Outback" and "Seaquest DSV," and has scored films such as *Love and Action in Chicago* and *Telling You*.

Grey Larsen - Mr. Larsen has been featured on many recordings under a variety of record labels including a solo album entitled *The Gathering*. Mr. Larsen holds a degree from Oberlin Conservatory of Music and is the author of *The Essential Guide to Irish Flute and Tin Whistle*.

Anthony Maiello - Mr. Maiello learned to play accordion at an early age. He received both his bachelor's and master's degrees in music from Ithaca College. He is presently professor of music at George Mason University where he conducts instrumental ensembles.

Reiko Obata - Mrs. Obata obtained her koto teaching license with honors from the Seiha School of Japanese Music and her master's degree in music from San Diego State University. She also studied in Japan under the celebrated koto master Shinichi Yuize. Mrs. Obata is in demand as a performer and teacher in the Southern California area.

Kyoko Okomoto - Ms. Okamoto is the director of the Washington Toho Koto Society, which she founded in 1971. She is a graduate of the Kyoto University of Foreign Studies. She holds faculty appointments at the University of Maryland and George Mason University. She has recorded for film productions by the Smithsonian Institution and the National Symphony Orchestra.

Jim Smith - Mr. Smith has been an uillean piper since 1986. He frequently attends and performs at Irish music conventions across the country. He plays with the traditional Irish band Killoran and is active in Irish session playing in Indianapolis.

Jonathan Stock - Dr. Stock is a musicologist at the University of Sheffield, England. He is the author of four books and many articles. His studies focus primarily on Chinese music. Mr. Stock holds a Ph.D. in ethnomusicology from Queen's University of Belfast.

Peter Van Gelder - Mr. Van Gelder is an instructor of sitar at the Ali Akbar College of Music, an institution devoted to teaching Indian classical music. Mr. Van Gelder is an active performer and has performed on several recordings.

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