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An interactive software program to develop pianists' sight-reading ability

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AN INTERACTIVE SOFTWARE PROGRAM

TO DEVELOP PIANISTS' SIGHT-READING ABILITY

by

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CERTIFICATE OF APPROVAL

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D.M.A. ESSAY

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CHAPTER I

INTRODUCTION

Musical sight-reading, or sight-playing, is defined as "the ability to play music from a printed score or part for the first time without benefit of practice."[1] While this is the most strict definition of the term, also known as "prima vista" (at first sight), some use the term "sight-reading" even if some rehearsal has taken place. Andreas Lehmann and Reinhard Kopiez call sight-reading "the execution—vocal or instrumental—of longer stretches of non- or under-rehearsed music at an acceptable pace and with adequate expression,"[2] therefore adding requirements in terms of quality.

There are many books and a few electronic materials that claim to improve sight-reading ability. At the same time, there are many studies from the fields of psychology, neuroscience, and music education that offer insights into the various component skills required for successful sight-reading, supporting the notion that sight-reading is not a singular skill. However, do teaching materials keep abreast of this new information, and do they offer valid and up-to-date instruction? Based on the findings of the scientific literature and on the advice of music pedagogues, what is the most effective way to improve sight-reading? It is the author's intention to show how pedagogues can take advantage of current research and technology to enhance sight-reading instruction.

Sight-Reading through the Centuries

Prior to the twentieth century, sight-reading was an indispensable skill for musicians. C. P. E. Bach in his treatise *Essay on the True Art of Playing Keyboard Instruments* (1753 and 1762) states that the keyboardist "must be able to play everything

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[1] Thomas Wolf, "A Cognitive Model of Musical Sight-Reading," *Journal of Psycholinguistic Research* 5, no. 2 (1976): 143.

[2] Andreas C. Lehmann and Reinhard Kopiez, "Sight-reading," in *The Oxford Handbook of Music Psychology,* ed. S. Hallam, I. Cross, and M. Thaut (Oxford: Oxford University Press, 2009), 344.

at sight whether designed for his instrument or not."[3] Ensemble players, in particular,

had to constantly perform new music after only a few rehearsals, if any, because most

compositions were not performed more than a few times. Composers' fear of plagiarism

by orchestral musicians and uniform musical idioms are also cited as reasons why sight-

reading was prominent in performance situations.[4] While solo music was most often

performed by the composer himself, the rise of the solo performer as a separate entity

from that of composer toward the middle of the eighteenth century made sight-reading

important for solo musicians as well.[5] Performance traditions, however, started to change

yet again in the middle of the nineteenth century, diminishing the popularity of sight-

reading. Composer-performers like Mendelssohn and Clara Schumann initiated the

canonization of the repertoire through their well-rehearsed performances of pieces by

other composers.[6] Furthermore, virtuoso performers like Clara Schumann and Liszt

raised audience standards by performing from memory and developing the art of

interpretation in general. [7] Technological advances in the twentieth century decreased

further the need for sight-reading, since the phonograph and the radio provided

alternative ways of becoming familiar with a composition, something that previously was

often possible only through sight-reading.

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[3] Carl Philipp Emanuel Bach, *Essay on the True Art of Playing Keyboard Instruments,* trans. and ed. William J. Mitchell (New York: W. W. Norton, 1949), 27.

[4] Andreas C. Lehmann and Victoria H. McArthur, "Sight-Reading," in *The Science & Psychology of Music Performance: Creative Strategies for Teaching and Learning,* ed. Richard Parncutt and Gary McPherson (Oxford: Oxford University Press, 2002), 136.

[5] Sam Thompson and Andreas C. Lehmann, "Strategies for Sight-Reading and Improvising Music," in *Musical Excellence: Strategies and Techniques to Enhance Performance,* ed. Aaron Williamon (Oxford: Oxford University Press, 2004), 145.

[6] Lehmann and McArthur, 136

[7] Lehmann and Kopiez, 344-345.

Current Perspectives on Sight-Reading

Nonetheless, musicians and pedagogues today agree that sight-reading is still a very important skill for developing and professional musicians. Robert Spillman maintains that "in the world of music, one of the most basic, essential, sought-out, and appreciated … musical skills is the ability to sightread."[8] Similarly, Paul Harris and Richard Crozier state that "fluent sight-reading is arguably the most valuable skill for young musicians to acquire."[9] Sidney Lawrence writes that "the essential objective in piano teaching should be the training of skills … [of which] sightreading is the most useful."[10] Likewise, Ida Elkan says that sight-reading is "the crux of piano playing and musicianship,"[11] while Lehmann and Victoria McArthur state that it is "an indispensable part of any serious audition and subsequent training for musicians."[12] Furthermore, a survey of two hundred twenty one nationally certified teachers of the Music Teachers National Association (MTNA) revealed that eighty-six percent of the participants believed that sight-reading was the most important or highly important pianistic skill (the remainder rated it fairly important).[13] Similar views are encountered in the college setting. James Lyke asked general music teachers and class piano teachers throughout the United States to rate twenty keyboard musicianship items. Both groups rated sight-

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[8] Robert Spillman, *Sightreading at the Keyboard* (New York: Schirmer Books, 1990), 1.

[9] Paul Harris and Richard Crozier, *The Music Teacher's Companion: A Practical Guide* (London: Associated Board of the Royal Schools of Music, 2000), 45.

[10] Sidney J. Lawrence, *A Guide to Remedial Sightreading for the Piano Student: A Study in Corrective Teaching Techniques and Procedures* (New York: Workshop Music Teaching Publications, 1964), 103.

[11] Ida Elkan, *Piano Sightreading can be Taught* (New York: Music Sightreading Publications, 1948), 28.

[12] Lehmann and McArthur, 137.

[13] Dianne Hardy, "Teaching Sight-Reading at the Piano: Methodology and Significance." *Piano Pedagogy Forum* 1, no. 2 (1998). http://www.music.sc.edu/ea/keyboard/ppf/1.2/1.2.ppfke.html (accessed January 15, 2010).

reading as either first or second in importance.[14] Similarly, Jerry Lowder surveyed

university faculty members and practicing teachers (recent graduates) concerning the

relevance of seventeen keyboard skills taught in class piano programs. Faculty ranked

sight-reading as the second most important skill (after cadences), while public school

music teachers ranked it fourth.[15] Marilyn Kostka surveyed college music students

enrolled in class piano and reported that sight-reading was the second most desirable skill

after musicality.[16]

Sight-reading is considered to be a valuable skill for many reasons. At a basic

level, it facilitates learning new music quickly, which is particularly important for

chamber or orchestral musicians and accompanists. Music teachers, private or general

classroom teachers, need fluent sight-reading abilities in order to effectively demonstrate

musical examples. Learning new pieces accurately and quickly is also important for

student musicians, since less lesson time will need to be spent on correcting notes or

rhythms and more on musicality and interpretation. Furthermore, for amateur musicians

sight-reading is the most significant step towards musical independence, allowing them to

continue learning and enjoying music-making even after they stop taking lessons. Good

reading ability also keeps students in music lessons, since as Richard Chronister believes

"the failure to learn to sightplay is the single most prevalent reason for student

dropouts."[17] Above all, sight-reading improves overall musicianship and increases

confidence through familiarity with a variety of repertoire and a range of styles.

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[14] James B. Lyke, "An Investigation of Class Piano Programs in the Six State Universities of Illinois and Recommendations for their Improvement" (Ed.D. diss., University of Northern Colorado, 1968), quoted in Alice Watkins and Marie A. Hughes, "The Effect of an Accompanying Situation on the Improvement of Students' Sight Reading Skills," *Psychology of Music* 14 (1986): 97.

[15] Jerry E. Lowder, "Evaluation of Keyboard Skills Required in College Class Piano Programs," *Contributions to Music Education* 10 (1983): 35-36.

[16] Marilyn J. Kostka, "Effects of Self-Assessment and Successive Approximations on 'Knowing' and 'Valuing' Selected Keyboard Skills," *Journal of Research in Music Education* 45, no. 2 (1997): 278.

[17] Edward Darling, ed., *A Piano Teacher's Legacy: Selected Writings by Richard Chronister*

Even though sight-reading is recognized and valued as an important skill for amateur and professional musicians, surprisingly, it is not addressed very often or thoroughly in musical instruction. At the college level, many schools have proficiency exams that include sight-reading as part of class piano, but few programs have sight-reading requirements for piano majors. Similarly, the survey that reported that eighty-six percent of the MTNA teachers surveyed believed that sight-reading was the most important or highly important pianistic skill,[18] it also reported that only seven percent of those teachers actually taught it! Most teachers said the main reason for not including sight-reading in their lessons was that they do not know how to teach it. Others said that they did not teach sight-reading because it is not included in the method book series they use. Some did not believe that they need to teach it as a separate skill from repertoire acquisition, thinking that students would improve with more years of lessons. These findings are consistent with the notion shared until recently by many teachers, that sight-reading is a talent that cannot be taught.[19]

While another study that surveys teachers' attitudes and practices towards sight-reading is overdue, it is fair to say that teachers today have an array of instructional sight-reading material at their disposal. Many new sight-reading books have been published in the last twenty years and many older ones are still in print. In addition, many pedagogical sight-reading articles have appeared in educational journals. However, musicians today do not have to rely solely on the mostly speculative advice of their colleagues, since sight-reading has also attracted the interest of researchers not only in music education but also in cognitive psychology and even neuroscience. These studies

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(Kingston, NJ: Frances Clark Center for Keyboard Pedagogy, 2005), 245.

[18] See note 13 above.

[19] Ralph Harrel, "The Habit of Reading Slowly," *Clavier* 36, no. 5 (1997): 23; Kenneth Saxon, "The Science of Sight Reading," *American Music Teacher* 58, no. 6 (2009): 23. Harrel and Saxon report and dispute this notion.

deal with all aspects of sight-reading, such as how the brain processes music notation, how the eyes move when sight-reading, factors that affect sight-reading ability, and specific strategies to improve sight-reading ability.

Even though there are many didactic and supporting materials to aid music teachers in teaching sight-reading, there are very few materials utilizing a medium of instruction that is otherwise thriving in the educational music publishing scene. Several software programs have been developed to assist different aspects of musical training, but not many exist for sight-reading. A recent book titled *Experiencing Music Technology* describes music software programs and lists them according to their instructional content, such as beginning skills and aural skills/music theory.[20] Sight-reading is not included in the list, and no software programs that deal with sight-reading are described. Similarly, a survey of independent piano teachers reported that theory/note-reading and ear training are the most popular categories of computer-assisted instruction, followed by rhythm and history/music appreciation.[21] Sight-reading is not mentioned at all. The apparent lack of sight-reading software is somewhat puzzling, since the development of sight-reading computer programs has been recommended by researchers in music education.[22] More importantly, most of the pedagogical strategies to improve sight-reading ability that have been used by teachers or are suggested by the recent studies can be optimized with technology implementation. Some teachers, recognizing this, are using technology to train sight-reading, which was not specifically designed for it. This includes notational

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[20] David B. Williams and Peter R. Webster, *Experiencing Music Technology* (Belmont, CA: Cengage Learning, 2008), 409.

[21] May W. Tsao-Lim, "The Implementation of Technology into the Curricula of Selected Independent Piano Studios" (D.M.A. document, University of Oklahoma, 2006), 72.

[22] Robert J. Streckfuss, "The Effect of a Sight Reading Pacer Machine upon the Sight Reading Ability of College Wind instrumentalists" (D.M.A. diss., The Catholic University of America, 1984), 70; Donald A. Hodges, "The Acquisition of Music Reading Skills," in *Handbook of Research on Music Teaching and Learning: A Project of the Music Educators National Conference,* ed. Richard Colwell (New York: Schirmer Books, 1992), 469.

software and Musical Instrument Digital Interface (MIDI) playback devices.[23] Sara Hagen investigated the effect of such technology on the sight-reading ability of group piano students. She used the software program *Finale®* for play-along accompaniments, and *Harmony®* to create chord recognition and hand position drills to improve sight-reading ability. She reported that the computer-assisted instruction (CAI) was more effective than the traditional teaching method in improving note accuracy, with the *Finale®* group receiving the highest scores.[24]

Computer-Assisted Instruction (CAI) in Music

Not many studies have been done about software programs and sight-reading, correlating with the small number of sight-reading software programs available. Many studies, however, have investigated the effect of utilizing software programs to develop music fundamental and performance skills. The results of these studies are promising, since most of them find CAI instruction to be equal or superior to traditional instruction. Marianne Holland investigated the effect of a theory drill-and-practice software program on the reading skills of the grand staff with high school students enrolled in beginning keyboard classes. While there were no significant differences between the experimental and control groups in a written test, the experimental group scored higher in a performance test.[25] Jeffrey Jacobsen, in a study with non-music major college students, found that computer-assisted drill-and-practice was as effective as the traditional teaching

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[23] George Litterst, ed., "How do you Use Music Technology for Sight-Reading?" *Keyboard Companion* 14, no. 3 (2003): 48.

[24] Sara L. Hagen, "The Effects of Computer-Assisted Instruction and Cognitive Style on Sight Playing among University Group Piano Students" (Ph.D. diss., Florida State University, 2001), xiii.

[25] Marianne Holland, "The Effect of Computer Instruction on the Vertical/horizontal Music Reading Skills of the Grand Staff for Students Enrolled in Senior High School Beginning Keyboard Classes" (Ph.D. diss., University of South Carolina, 1987), 45-46.

method in the areas of note names, key signatures, and rhythm examples.[26] Cynthia Benson investigated the effects of using MIDI sequenced recording, video, multimedia computer program, or no computerized assistance (control group) on the performances of group piano college students. Although there were no significant differences among the treatment groups, the computer group (multimedia) scored higher on keyboard theory exercises and repertory pieces. Furthermore, students in this group improved the most in rhythm and note accuracy.[27]

Studies that investigated the implementation of technology in music instruction with children report similar results. Lois Hesser tested the effectiveness of CAI in reinforcing music reading skills in third grade elementary students. The participants were divided into three treatment groups: working with CAI in an untimed atmosphere, working with CAI in one scheduled thirty-minute period per week, and working with a traditional group reinforcement method. She concluded that CAI reinforcement was more effective than traditional group reinforcement methods. Furthermore, structured lab time was more effective for this age group than the unstructured student-controlled environment.[28] Troy Isaak found that CAI was as effective as a conventional approach in teaching basic note reading to elementary students in grades two through four. However, there were no significant differences between the use of an audio enhanced version of the software program and the use of the program without sound.[29] Darrell Bailey designed

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[26] Jeffrey R. Jacobsen, "Effectiveness of a Computer-Assisted Instruction Program in Music Fundamentals Applied to Instruction for Elementary Education Majors" (D.M.E. diss., University of Northern Colorado, 1986), 77-78.

[27] Cynthia Benson, "The Effects of Instructional Media on Group Piano Student Performance and Attitude," *Journal of Technology in Music Learning* 1, no. 2 (2002): 46.

[28] Lois A. Hesser, "Effectiveness of Computer Assisted Instruction in Developing Music Reading Skills at the Elementary Level" (Ed.D. diss., State University of New York at Albany, 1988), 98-99.

[29] Troy J. Isaak, "The Effectiveness of Computerized Drill and Practice and Bisensory Input in Teaching Music-Reading Skills to Elementary Students" (Ed.D. diss., University of Northern Colorado, 1988), iii-iv.

and developed a software program for four-, five- and six-year old children to help them learn pitch, rhythm and keyboard orientation skills. He reported that students who practiced with the software scored higher on achievement testing than the control group students, and that the implementation of technology was fully supported by the students and their parents.[30]

Purpose of the Study and Methodology

The purpose of this essay is to design an interactive software program that will train and improve pianists' sight-reading abilities, based on the latest findings in sight-reading research. The author reviews sight-reading studies from the fields of music education, psychology, and neuroscience. She then reviews and evaluates current sight-reading materials for piano in print and electronic format and assesses their pedagogical validity based on the findings of these studies. Finally, based on the same findings she designs the specifications of an electronic sight-reading trainer for pianists.

Need for the Study

As more and more people turn to the internet and to different software programs for learning, the evaluation of sight-reading material in electronic format becomes more important. To date, there is not a published assessment of electronic sight-reading materials for piano. Furthermore, while there are many software programs that train fundamental musical skills such as note-reading, rhythm, and aural training that are considered components of sight-reading, no software program exists that offers comprehensive training in sight-reading. This is unfortunate, since it appears that such a format of instruction would be the most advantageous to the effective teaching of this

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[30] Darrell L. Bailey, "The Effects of Computer-Based Instruction on Achievement of Four-, Five-, and Six-Year-Old Children in the Yamaha Music Education System Primary One Course" (Ed. D. diss., University of Illinois at Urbana-Champaign, 1989). 103-104.

complex and valuable skill. An electronic sight-reading trainer would allow students to improve independently and at their own pace, which would be ideal for self-study or as reinforcement between lessons.

Limitations of the Study

This essay limits its scope to the review of pedagogical sight-reading materials designed for pianists and published after 1990. Furthermore, this study is concerned only with designing the specifications of a sight-reading software program. The author, however, intends to pursue the development of the program in the near future with the assistance of a professional software engineer.

CHAPTER II

REVIEW OF LITERATURE

In the last thirty years there has been a renewed interest in the study of sight-reading in the fields of neuroscience, psychology and music education. Technological advances have allowed researchers to study perceptual, cognitive, and kinesthetic aspects of sight-reading, as well as to investigate characteristics of expert readers and components that correlate with a strong sight-reading ability. Additionally, a few empirical studies have tested the effectiveness of specific training techniques in improving sight-reading ability. In this chapter, findings from these studies are compared to what musicians, and in particular piano pedagogues, recommend in order to develop and improve this important skill.

Sight-Reading vs. Performance

While many great performers are great sight-readers, including Mozart, Czerny, Liszt and Mendelssohn,[31] there are also accounts of great performers who are weak sight-readers.[32] Research suggests that while a strong performance skill is necessary for successful sight-reading, it is not enough. Kopiez and Ji In Lee in a study done with fifty-two piano majors found that instrumental expertise is sufficient to excel at sight-reading only when the material is easy.[33] Charles Elliott reported that while performance jury scores were an important factor, they were not the best predictor of sight-reading ability in undergraduate wind players.[34] Gary McPherson, in a study done with high-

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[31] Andreas Lehmann and K. Anders Ericsson, "Performance Without Preparation: Structure and Acquisition of Expert Sight-Reading and Accompanying Performance," *Psychomusicology* 15 (1996): 3.

[32] Wolf, 143.

[33] Reinhard Kopiez and Ji In Lee, "Towards a General Model of Skills Involved in Sight Reading Music," *Music Education Research* 10, no. 1 (2008): 43.

[34] Charles Elliott, "The Relationships Among Instrumental Sight-Reading Ability and Seven Selected Predictor Variables," *Journal of Research in Music Education* 30, no. 1 (Spring 1982): 13.

school clarinet and trumpet students, concluded that at the beginning stages sight-reading ability is not strongly related to the ability to perform rehearsed music.[35] Eloise Kornicke reported that the number of pieces seventy-three pianists had previously performed (vs. sight-read) was not correlated with their sight-reading ability.[36]

Considering the different demands of the two skills, such discrepancies should be expected. When practicing for a performance, music students are taught to attend to every detail in the score, play all notes and rhythms, work at a slow and comfortable tempo, correct mistakes and repeat problematic sections, and use proper fingering. On the contrary, when sight-reading, one has to play as many notes as possible—leaving out some and guessing others, play at a tempo appropriate for the piece, never stop for mistakes but maintain the meter, and get to notes even by unconventional fingering.[37] Furthermore, sight-reading "requires that a sequence of movements be produced in response to a succession of visual stimuli presented in real-time."[38] Performance of rehearsed music, on the other hand, requires the reproduction of movements that have already been rehearsed repeatedly, and in the case of pianists, have been committed to memory. Sight-reading therefore relies primarily on short-term memory, while performing rehearsed repertoire relies primarily on long-term memory.[39]

Many educators maintain that "students learn to sightplay only through the experience of a lot of sight-playing."[40] Research confirms that a reliable predictor of

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[35] Gary E. McPherson, "Factors and Abilities Influencing Sightreading Skill in Music," *Journal of Research in Music Education* 42, no. 3 (Autumn 1994): 226.

[36] Eloise Kornicke, "An Exploratory Study of Individual Difference Variables in Piano Sight-Reading Achievement," *The Quarterly Journal of Music Teaching and Learning* 6, no. 1 (1995): 72.

[37] Lehmann and McArthur, 145; Wolf, 163-164.

[38] Thompson and Lehmann, 145.

[39] Wolf, 164.

[40] Darling, 245.

sight-reading ability is sight-reading experience. In a study done by Louise Banton, pianists who reported practicing sight-reading occasionally or often made significantly less melodic errors than pianists who practiced sight-reading rarely.[41] Kornicke found that the second best predictor of sight-reading ability (after aural imagery) was sight-reading experience, measured in terms of quantity, frequency, and range of experience (solo pieces, accompanying soloists, accompanying ensembles, etc).[42] Kopiez and Lee found that the single best predictor of sight-reading achievement was the number of accumulated hours of sight-reading practice up to the age of fifteen, therefore pointing to a critical time window for the acquisition of this skill.[43]

Many pedagogues recommend sight-reading duets or sight-reading in an accompanying or ensemble situation. As early as 1789, in his *School of Piano or Instruction in Piano Playing*, Daniel Gottlob Türk suggested that the teacher plays along with the student on another instrument, preferably the violin or flute, in order to reinforce fluent reading and a sense of constant pulse in the student.[44] Furthermore, he suggests that the teacher should not always duplicate the student's part but play a counter melody, sometimes with a different rhythm.[45] More recently, Leonhard Deutsch says that the best way to improve a student's sight-reading is "to join in his playing."[46] Lehmann and Anders Ericsson confirm the importance of accompanying experience in the development

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[41] Louise J. Banton, "The Role of Visual and Auditory Feedback During the Sight-Reading of Music," *Psychology of Music* 23 (1995): 12.

[42] Kornicke, 72.

[43] Kopiez, 55.

[44] Daniel Gottlob Türk, *School of Clavier Playing, or, Instructions in Playing the Clavier for Teachers & Students,* trans. Raymond H. Haggh (Lincoln: University of Nebraska Press, 1982), 26.

[45] Ibid., 96.

[46] Leonhard Deutsch, *Piano, Guided Sight-Reading: A New Approach to Piano Study,* 2nd ed. (Chicago: Nelson-Hall, 1977), 16.

of sight-reading. In a study done with sixteen expert pianists they reported that the

amount of accompanying experience and accompanying repertoire were the most

significant factors in sight-reading ability. The authors emphasize that mere quantity of

experience or repertoire is not enough if the material or situation is not increasingly

challenging as well.[47]

Empirical studies prove that sight-reading ability improves when playing non-solo

material. Alice Watkins and Marie Hughes found that students in a group piano class that

practiced sight-reading with a pre-recorded soloist improved their rhythmic accuracy

significantly more than the control group that played the accompaniments without the

soloist.[48] Christina Beeler found that sight-reading with a digital sequencer

accompaniment also improved rhythm.[49] Hagen reported that group piano students who

practiced sight-reading while a notational software program played along with them an

audio file of the same piece improved more in pitch accuracy than students who sight-

read without the software.[50]

Eye Movements when Sight-Reading

Pedagogues often draw parallels between learning to read musical notation and

learning to read text. Chronister suggests that the same emphasis that is placed on

teaching children to read words and sentences instantaneously from the beginning stages

should be given on teaching children to sight-read musical notation.[51] Lawrence states

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[47] Lehmann and Ericsson, 23-24.

[48] Watkins and Hughes, 103.

[49] Christina Jacobs Beeler, "The Effects of Interval Prestudy and a Cue for Rhythmic Continuity on Piano Sight Reading Achievement of Group Piano Students" (D.M.A. diss., University of Texas at Austin, 1995), iv.

[50] Hagen, 130.

[51] Darling, 244.

that just as one must first develop certain preparatory skills such as the alphabet and basic vocabulary before learning to read a new language, one must develop basic skills such as note and rhythm recognition before learning to sight-read.[52] Deutsch, on the other hand, states that musical notation is not like alphabetic writing but more like hieroglyphs and pictograms.[53] Sinichi Suzuki believes that literacy acquisition is similar in language and in music, and recommends that children learn to read musical notation in the same sequence that they learn to read their mother-tongue: hear – speak (play) – read.[54]

When reading musical notation, the eyes seem to move in a similar fashion to when reading text. Studies that monitored eye-movement show that the eyes do not move in a smooth and continuous way like it would seem, but rather they jump around. The jumps are called saccades and occur four to six times per second, while the pauses in between them are called fixations and occur at a rate of about five times per second.[55] Information seems to be perceived only during the fixations. These "snapshots" as John Sloboda describes them, are circles that lie in the fovea, the central field of our vision, and have about one inch diameter, which is how much can be in complete focus at any given time.[56] The brain puts together all of these pieces to create an illusion of a coherent image. Although most fixations expectedly target note heads, interestingly, many fixations target blank spaces. Note stems, bar-lines, phrasing, and the key signature are the other elements of the score that are fixated.[57] Another surprising aspect of how the

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[52] Lawrence, 48.

[53] Deutsch, 29.

[54] Sinichi Suzuki, *Nurtured by Love: A New Approach to Education,* transl. Waltraud Suzuki (New York: Exposition Press, 1969).

[55] Lehmann and McArthur, 137; Thompson and Lehmann, 146.

[56] John A. Sloboda, *The Musical Mind: The Cognitive Psychology of Music* (Oxford: Oxford University Press, 1985), 69.

[57] Frances E. Truitt, Charles Clifton, Alexander Pollatsek, and Keith Rayner, "The Perceptual Span and the Eye-Hand Span in Sight Reading Music," *Visual Cognition* 4, no. 2 (1997): 156; Elizabeth Gilman and

eyes move when reading, is that they not only move forward, from left to right, but sometimes backwards, from right to left, resulting in regressive saccades. While in text reading less-skilled readers use more regressive movements, in music reading it is the experts that look back more often.[58]

Actually, besides the fact that left-to-right visual perception occurs that uses fixations and saccades, reading music and reading text are quite different. This is confirmed by brain studies, which show that the processes of reading music and reading words activate parallel but distinct parts of the brain.[59] The differences are due to the different nature of the two notation systems. Letters are encoded according to their form and features. Notes are processed according to their position on the staff and to the relationship between them, and therefore require the participation of the superior parietal lobe which determines spatial sense.[60] Justine Sergent et al. utilized positron emission tomography (PET) imaging to show that sight-reading requires a neural network that spreads over all four cortical lobes of the cerebrum, in addition to the cerebellum. Specifically, this research team identified the regions of the brain that are activated when one reads, plays or listens to music. Interestingly, Sergent and her colleagues discovered that in addition to the areas activated for each of the three components, two other brain regions are activated when all three activities are combined together, as is the case when one sight-reads.[61]

Geoffrey Underwood, "Restricting the Field of View to Investigate the Perceptual Spans of Pianists," *Visual Cognition* 10, no. 2 (2003): 213.

[58] Thomas W. Goolsby, "Eye Movement in Music Reading: Effects of Reading Ability, Notational Complexity, and Encounters," *Music Perception* 12, no. 1 (1994): 93.

[59] J. E. Sergent, S. Terriah, and B. MacDonald, "Distributed Neural Network Underlying Musical Sight-Reading and Keyboard Performance," *Science* 257, no. 5066 (1992): 108.

[60] Danielle Schön, Jean Luc Anton, Muriel Roth, and Mireille Besson, "An fMRI Study of Music Sight-Reading," *NeuroReport* 13, no. 17 (2002): 2288; Sergent et al., 107.

[61] Sergent et al., 108. One area involved the superior parietal lobule of both hemispheres and the other the left premotor cortex and the left inferior frontal gyrus, immediately above Broca's area.

An obvious difference between reading text and reading musical notation is that a score with more than one staff requires vertical in addition to horizontal reading. Studies show that pianists move their eyes in a zigzag pattern in order to process two-staff notation, therefore reading each staff separately. The type and difficulty of the music further influence the specifics of the eye movements. When the music is homophonic the eyes move mostly vertically, fixating first on the top staff, then the bottom staff and then on the top staff of the next chord. When the music is contrapuntal, however, the eyes first move horizontally to take in a few notes of the top line, and then move down to the bottom line to take in a few notes of that line.[62] Weaver reported that fixations are longer when the music seems to be more difficult.

Another important factor that influences the specifics of eye movements is the skill of the sight-reader. Most studies report that expert music readers have briefer fixations than less skilled readers (Elizabeth Gilman and Geoffrey Underwood report no significant differences).[63] Results are inconclusive as to differences in the number of fixations used by more and less skilled readers. Thomas Goolsby found that experts use more fixations, while Gilman and Underwood report the opposite. Frances Truitt et al., on the other hand, found no significant differences in the number of fixations used by experts and novices.[64] Studies also show that skilled readers have a larger vertical span. Andrew Waters et al. reported that better sight-readers, when briefly presented with

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[62] H. E. Weaver, "A Survey of Visual Processes in Reading Differently Constructed Musical Selections," *Psychological Monographs* 55, no. 1 (1943): 27-28; Sophie Furneaux and Michael F. Land, "The Effects of Skill on the Eye-Hand Span during Musical Sight-Reading," *Proceedings: Biological Sciences* 266, no. 1436 (1999): 2437.

[63] Goolsby, "Eye Movement in Music Reading," 89; Truitt et al., 157; Andrew J. Waters, Geoffrey Underwood, and John M. Findlay, "Studying Expertise in Music Reading: Use of a Pattern-Matching Paradigm." *Perception & Psychophysics* 59, no. 4 (1997), 486; Gilman and Underwood, 212.

[64] Goolsby, "Eye Movement in Music Reading," 89; Gilman and Underwood, 217; Truitt et al.; 157.

chords notated on two staves, recalled more notes from both staves.[65] Leonora Young reported that successful readers scanned all notes in a chord from the top one to the bottom one, while unsuccessful readers tended to fixate only the central part of the chord in the middle of the two staves.[66]

It is interesting to note that while eye-movement studies consistently show that expert readers read chords from the top down, most piano educators recommend reading from the bottom up,[67] which seems to be the strategy used by intermediate readers (beginners read in an unsystematic way).[68] Lawrence dedicates a large part of his book on vertical reading since he believes that the reason for slow reading is the inability to read vertically. He demonstrates that students read words written vertically much slower than they read words written horizontally, but that can be improved with practicing vertical reading. While he does not specifically recommend reading notes from the bottom or the top, he spells all the words in his examples from the top down.[69] To expand the vertical span, Barbara Fast recommends introducing two-stave reading as early as possible, avoiding over-reliance on learning music hands separately, and working on instrumental and choral score reading.[70]

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[65] Andrew J. Waters, Ellen Townsend, and Geoffrey Underwood, "Expertise in Musical Sight Reading: A Study of Pianists," *British Journal of Psychology* 89, (1998): 134.

[66] Leonora Young, "A Study of Eye Movements and Eye-Hand Temporal Relationships of Successful and Unsuccessful Piano Sight-Readers While Piano Sight-Reading" (Ph.D. diss., Indiana University, 1971), 621.

[67] Darling, 245; Ellen Burmeister, *Keyboard Sight Reading* (Mountain View, CA: Mayfield Publishing Co., 1991), 112; Myra Boitos, "Scan the Page, Move the Eye: Suggestions for Teaching Students to Sight-Read," *Clavier* 37, no. 6 (1998): 9.

[68] Lehmann and Kopiez, 346.

[69] Lawrence, 32-33.

[70] Barbara Fast, "Building Blocks to Effective Sight Reading," *Piano Pedagogy Forum* 11, no. 1 (2008), http://www.music.sc.edu/ea/keyboard/PPF/PPFFast.html (accessed January 15, 2010).

Looking Ahead

Looking ahead is among the most common advice given for successful reading, first found in C.P.E. Bach's treatise *Essay on the True Art of Playing Keyboard Instruments* (1753 and 1762).[71] According to Ralph Harrel, learning to play one pattern while looking at another is the most often neglected step in sight-reading.[72]

Research confirms equivocally that experts look further ahead in the score than less skilled readers do. Sloboda first used the term "eye-hand span," adjusting it from the "eye-voice span" of text-reading studies, to measure the distance in the score between where the hands play and where the eyes fixate, or as Jaime Madell puts it "the distance between production and perception."[73] Sloboda, in an early study (1974) using one-staff simple tonal melodies, reports that good piano readers read six to seven notes ahead, while less skilled readers read three to four notes ahead.[74] Later studies confirm the general findings of Sloboda's study; however, they report significantly smaller eye-hand spans. Truitt et al. (also using one-staff melodies) report an eye-hand span of two beats for good readers and a little under one beat for poor readers, while Gilman and Underwood, using two-staff musical notation, report only one beat for good readers and three-quarters of a beat for poor readers.[75] This discrepancy is due to the fact that Sloboda, unlike the other researchers, did not track eye movements but instead estimated the eye-hand span by measuring the number of notes the pianists could play after the score was removed. As a result, Sloboda's estimate includes not only the eye-hand span

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[71] Bach, 174.

[72] Harrel, 23.

[73] John Sloboda, "The Eye-Hand Span—An Approach to the Study of Sight Reading," *Psychology of Music* 2, no. 2 (1974): 5; Jaime Madell, "Eye Movements and Music Reading: Where do we Look Next?" *Music Perception* 26, no. 2 (2008): 161.

[74] John Sloboda, "The Eye-Hand Span," 6.

[75] Truitt et al., 158; Gilman and Underwood, 227.

but also notes that the pianists did not see but predicted. It also includes the perceptual span, the visual field around a single fixation from where useful information can be extracted.[76] Even though only notation that lies within each fixation is in focus enough to be fully processed, the brain can still gather useful information from around the fixation point using parafoveal vision. According to studies done in text reading, this information facilitates sight-reading by guiding eye movements and by initiating the processing of notation that will be fixated later.[77] The perceptual span is more than two but less than four beats, and unlike the eye-hand span it is not affected by the skill of the sight-reader or by the complexity of the music.[78] Combining the eye -hand span and the perceptual span, one can conclude that good piano sight-readers reading two-staff musical notation extract information from up to four or five beats ahead.

Robert Streckfuss reported that instrumentalists who sight-read with the aid of a pacer machine, a device that moved steadily across the score covering up each beat as it was being played, improved significantly more than students who read the same exercises without the machine.[79] More recently, Tony Souter designed and tested a computer system that progressively erased a set number of the upcoming beats, thus forcing the pianist to always look ahead. He reported that this was an effective practice technique when reading four-part music.[80] Many teachers use a similar method of covering up with a card the measure currently played to encourage their students to look ahead.[81] While

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[76] Furneaux and Land, 2435.

[77] Gilman and Underwood, 202.

[78] Gilman and Underwood, 227; Truitt et al., 158. The reported eye-hand span is an average, while the perceptual span is measuring a maximum.

[79] Streckfuss, 67.

[80] Tony Souter, "Manipulating Working Memory to Improve Sight-Reading Skills," in *Proceedings of the Seventh International Conference on Music Perception and Cognition,* ed. C. Stevens, D. Burnham, G. McPherson, E. Schubert and J. Renwick (Adelaide, Australia: Causal Productions, 2002), 639-641.

[81] Spillman, 33-34; Harris and Crozier, 49.

the studies by Streckfuss and Souter show that this is an effective strategy in improving sight-reading ability, it should not be used heavily. As noted above, good readers look ahead, but they also return often to the point of performance to recheck information already taken in. Recommended techniques to practice looking ahead include playing parts of the piece (e.g. only downbeats) while keeping a steady pulse.[82] Some pedagogues say that telling the student to look ahead is enough,[83] but others recommend offering the students more specific suggestions.[84] Unless sight-readers know what to look for and can remember what they have previewed, however, asking them to look ahead is pointless.[85] Indeed, Goolsby reports that less skilled readers search around for information, while experts know what to look for.[86] Denes Agay says that we should tell our students what to look for, and suggests teaching them to seek out the natural divisions of the musical line (cadences, long notes, rests).[87] Kenneth Saxon, on the other hand, suggests that looking at one thing while playing another can be confusing, especially at the beginning, causing the reader to lose his/her place in the score. He also believes that forcing the eyes to look ahead is straining, so the eyes cannot respond optimally to the demands of reading.[88]

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[82] Sue Haug, "Sight Playing and Visual Perception: The Eyes have it," *American Music Teacher* 40, no. 3 (1990): 71.

[83] Harris and Crozier, 49.

[84] Denes Agay, "Sight Reading: The Basics, Step by Step," in *The Art of Teaching Piano: The Classic Guide and Reference Book for all Piano Teachers,* ed. Denes Agay and Hazel G. Skaggs (New York: Yorktown Music Press, 2004), 207-208.

[85] John Sloboda, "The Psychology of Music Reading," *Psychology of Music* 6, no. 2 (1978): 12.

[86] Thomas W. Goolsby, "Profiles of Processing: Eye Movements during Sightreading." *Music Perception* 12, no. 1 (1994): 97-124, quoted in Lehmann and McArthur, 139.

[87] Agay, 208.

[88] Kenneth Saxon, "Teaching Sight-Reading: Old Saws and New Tools for Effective Sight-Reading Skills," *Piano Pedagogy Forum* 7, no. 1 (2004). http://www.music.sc.edu/ea/keyboard/PPF/7.1/7.1.PPFke.html (accessed January 15, 2010).

Perceiving Patterns

Reading patterns and not individual notes is another piece of time-honored advice of music educators. Frances Clark says that students are slow readers often because they are "note readers" instead of "music readers."[89] Many pedagogues argue that children learn to read text by reading words or even whole sentences, and not by learning the alphabet which is a dated strategy.[90] Similarly, they advocate teaching music reading by teaching whole patterns and not individual notes. Edwin Gordon has an entire music learning theory based on carefully sequenced tonal and rhythmic pattern instruction.[91] Jane Tan states that "learning to play the piano is like learning a new language" and recommends applying the teach-drill-use approach used for building word vocabulary to musical patterns in order to improve reading fluency.[92] Ellen Burmeister states that "harmonic reading is possibly the single most important key to reading" and offers exercises so that "readers practice replacing reading the individual tones that make up the chord with seeing a harmony as a singly entity."[93] Commonly suggested strategies to encourage pattern perception are transposition exercises,[94] identifying and circling patterns in the score, drilling interval identification with flashcard-type drills, and playing only pitches without rhythm.[95] Lawrence suggests teaching students how chords sound,

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[89] Frances Clark, *Questions and Answers: Practical Advice for Piano Teachers,* (Northfield, IL: Instrumentalist Co., 1992), 65.

[90] Agay, 198.

[91] Edwin Gordon, *The Aural-Visual Experience of Music Literacy: Reading and Writing Music Notation* (Chicago: GIA Publications, 2004).

[92] Jane N. Tan, "Introducing the Language of Music," *Clavier* 32, no. 5 (1993): 19.

[93] Burmeister, vi.

[94] Haug, 71.

[95] Lehmann and McArthur, 147.

look and feel, then doing the same for two- and three-chord progressions.[96] Pattern

training is imperative in music because, unlike words in text, there is not a visually clear

separation of the patterns in the notation. Rather, the brain has to organize a string of

notes into recognizable and meaningful units.[97]

       Eye movement studies support the fact that good readers do not read note-by-note

but instead tend to read notes in groups or chunks. Mark Polanka found that good

readers, when compared to less skilled readers, have larger saccade lengths and thus

fixations that are further apart, and concluded that experts must read in larger units than

others.[98] Waters and Underwood found a similar effect of skill on saccadic length,

although the differences observed were not statistically significant.[99] Waters et al., in a

pattern-matching study where one-staff melodies were presented simultaneously, found

that experts needed fewer and shorter glances between the stimuli than the less skilled

readers did, and thus perceived larger units.[100] In another study, Waters et al. reported

similar findings when using dual-staved musical notation. Experts were faster at

comparing two-measure piano music, and recalled more correct notes when presented

briefly with chords notated on two staves.[101] Furthermore, the aforementioned finding by

Truitt et al. that fixations often occur on blank spaces between notes may suggest that

musicians read intervals rather than individual notes.[102] Evidence exists that a grouping

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[96] Lawrence, 45-46.

[97] Agay, 198.

[98] Mark Polanka, "Factors Affecting Eye Movements during the Reading of Short Melodies," *Psychology of Music* 23, no. 2 (1995): 182.

[99] Andrew J. Waters and Geoffrey Underwood, "Eye Movements in a Simple Music Reading Task: A Study of Expert and Novice Musicians," *Psychology of Music* 26, no. 1 (1998): 58.

[100] Waters et al., "Use of a Pattern-Matching Paradigm," 486.

[101] Waters et al., "A Study of Pianists," 137; Ibid., 134.

[102] Lehmann and Kopiez, 346.

or chunking strategy is also applied when reading rhythm. Veronica Kinsler and Roger Carpenter found that a simple rhythmic sequence (three quarter notes) that is embedded in a more rhythmically complex surrounding (with eighth-notes) is read with fewer fixations.[103]

Thomas Wolf's cognitive model of musical sight-reading, based on information-processing theories, illustrates the importance of chunking for successful sight-reading. Using George Miller's "magical number" of seven, he proposes a model of short-term memory with a capacity of seven slots.[104] He argues that expert readers group elements of notation together in meaningful chunks and therefore can store all the information necessary for correct performance in fewer slots. Because of chunking, expert readers can even have empty slots available that they can use to store information on measures that are coming up, or other kinds of information, such as phrasing and general musicality. Unskilled sight-readers who do not use chunking, on the other hand, need more than seven slots to store each individual bit of information and therefore cannot perform correctly. Sophie Furneaux and Michael Land, in a study that measured the eye-hand span in terms of number of notes but also in terms of time, suggest that experts are able to store more information using chunking.[105] They found that experts have a larger note-index than novices, but a similar time-index, which averages one second. The authors concluded that experts do not have the capacity to store information for longer time; instead, they have the capacity to fit more information into their buffers. In a study comparing the eye-movement profiles of a very good and a very poor sight-reader, Goolsby found that the poor sight-reader fixated on every note thus reading note-by-note,

[103] Veronica Kinsler and Roger H.Carpenter, "Saccadic Eye Movements while Reading Music," *Visual Research* 35, no. 10 (1995): 1447-1458, quoted in Madell, 167.

[104] Wolf, 161-162.

[105] Furneaux and Land, 2439.

while the good sight-reader seemed to chunk the information.[106] Support for a holistic

type of reading in music comes also from neuroscientists. Maria Stanzione et al. reported

the case of a music teacher, who after brain damage read text very slowly, exhibiting

letter-by-letter reading.[107] Her music reading also became laborious. The researchers

proposed that, analogous to the two types of processes in text-reading, there are two types

of processes in music-reading: an analytical, note-by-note or letter-by-letter route, and a

global, whole-measure or whole-word route. The brain damage incapacitated the global

route of this patient, making her reading very inefficient.

Confirmation of a global process in reading music comes from the phenomenon

known as "proofreader's error," a term borrowed from text reading. Misspelled words

are often hard to detect because one reads whole words and not letter-by-letter. This

phenomenon has also been demonstrated in music reading, most dramatically with the

"Goldovsky experiment."[108] Wolf relates how it took a poor reader, a student of Boris

Goldovsky, to detect a misprint in the Brahms Capriccio op. 76 no. 2 that occurs in many

standard editions. Goldovsky, amazed, asked skilled readers to detect the misprint,

allowing them to play the piece as many times and in whatever way they chose. None of

the twelve participants found the error under these conditions. Only when Goldovsky

pinpointed the specific measure or even chord many of them were able to locate the

misprint. The skilled readers did not notice the missing sharp on the Gs and played a C-

sharp major chord followed by another G-sharp anyway, presumably because they

processed all the notes of the first verticality as a group. The poor reader, in contrast,

read note-by-note, and therefore "correctly" read and played G-naturals.

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[106] Goolsby, "Profiles of Processing," 121.

[107] Maria Stanzione, Dario Grossi, and Luciano Roberto, "Note-by-Note Music Reading: A Musician with Letter-by-Letter Reading," *Music Perception, 1990, 7, 3, spring* 7, no. 3 (1990): 282.

[108] Wolf, 168-169.

Studies confirm the importance of pattern-reading in sight-reading. Waters et al. reported that the single best predictor of sight-reading ability in his study was pattern-recognition skills, especially rapid registration of groups of notes.[109] Joyce Gromko and Buford Cox also reported that visual perception of patterns is an important component skill of sight-reading.[110] Empirical studies show that training in pattern reading is an effective way to improve sight-reading performance. Kenneth Bean used a tachistoscopic device to display melodic, polyphonic, and harmonic patterns for a short time to pianists that had to play them after each stimulus disappeared. He reported an overall improvement in the sight-reading ability of the participants that practiced tachistoscope reading for twenty to thirty hours.[111] Patricia Grutzmacher improved the melodic sight-reading skills of beginning instrumental students by employing tonal pattern instruction through harmonization and vocalization activities; students who were taught to identify individual notes improved less (control group).[112] Lois Hahn used a "whole-music" approach to teach beginning string classes, focusing on tonal and rhythmic units rather than on recognition of individual notes.[113] She reported that the experimental group performed significantly better in reading both familiar and unfamiliar examples compared to the control group.

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[109] Waters et al., "A Study of Pianists," 146.

[110] Joyce Eastlund Gromko, "Predictors of Music Sight-Reading Ability in High School Wind Players," *Journal of Research in Music Education* 52, no. 1 (2004): 12; Buford E. Cox, "Factors Associated with Success in Sight Reading Four-Part Chordal Piano Music" (Ph.D. diss., Auburn University, 2000), 86.

[111] Kenneth L. Bean, "An Experimental Approach to the Reading of Music," *Psychological Monographs* no. 226 (1938): 78-79.

[112] Patricia A. Grutzmacher, "The Effect of Tonal Pattern Training on the Aural Perception, Reading Recognition, and Melodic Sight-Reading Achievement of First-Year Instrumental Music Students," *Journal of Research in Music Education* 35, no. 3 (1987): 177-178.

[113] Lois Blackburn Hahn, "Correlations between Reading Music and Reading Language, with Implications for Music Instruction" (D.M.A. diss., University of Arizona, 1985), 118.

Predicting

The proofreader's error suggests further that music reading is not only a matter of decoding the information that is on the page, but that the readers' previous experiences and expectations, as well as the context, come into play too. Such a top-down approach to reading musical notation is advocated by Kinsler and Carpenter, who propose a reading model that combines top-down and bottom-up processes.[114] In the "Goldovsky experiment" skilled readers favored a C-sharp major chord over a C-sharp – E-sharp – G sonority probably based on their knowledge of the composer's style and the context of that piece. It is interesting to note that one of the strategies suggested for effective proofreading of text is to read backwards, precisely to separate each individual word from the meaning of the sentence. Sloboda studied further the proofreader's error in music in a study where competent piano readers were asked to play unknown musical pieces that contained deliberate misprints.[115] Even though the pianists were instructed to play exactly what was written on the page, all of them corrected at least some of the misprints. Moreover, when asked to play the excerpts for a second time, the pianists corrected even more altered notes, in essence misreading more notes. Presumably, as they got familiar with the pieces, they were able to "skim" more, thus making more inferences, which in this case resulted in more mistakes.

Many other studies confirm that a top-down process is prevalent in music reading. Sloboda reported that the eye-hand span is not constant, but varies a great deal according to the type and structure of the music. Specifically, he reported that the eye-hand span of musicians is larger for tonally coherent music than it is for music that does not follow the

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[114] Kinsler and Carpenter, 1455.

[115] John A. Sloboda, "The Effect of Item Position on the Likelihood of Identification by Inference in Prose Reading and Music Reading," *Canadian Journal of Psychology* 30, (1976): 233-235.

rules of tonal progression.[116] Similarly, Waters and Underwood found that experts were better at comparing tonally simple patterns than tonally complex patterns, whilst less skilled readers performed equally on both.[117] The patterns were also categorized by visual complexity (based on changes in contour), but this condition did not seem to interact with performance. Sloboda confirmed that good readers do not merely rely on visual cues but are instead more sensitive to the musical structure. In a study where all visual marks that would indicate phrasing were removed from the score, including long notes that could imply phrase endings, the eye-hand span of good readers expanded and contracted in order to coincide with phrase boundaries.[118] Good readers were therefore able to predict the end of phrases not based on visual cues but based on some higher-order perception of the musical structure. Similarly, Polanka notated melodies that consisted of patterns of three or four notes as strings of pitches without rhythms, bar-lines or other visual markings. Eye-movement measurements revealed that readers did perceive the patterns, since they consistently used larger saccades for the melodies with three-note patterns than they did for the melodies with four-note patterns.[119]

Waters et al. found that prediction skills are an important factor in sight-reading ability probably because when successful, predictions can decrease the information-processing load.[120] Specifically, the authors demonstrated a priming effect in the visual domain, where skilled pianists were able to predict subsequent chords, making use of the harmonic context. Lehmann and Ericsson removed sections of a piece and asked pianists

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[116] John A. Sloboda, "Phrase Units as Determinants of Visual Processing in Music Reading," *British Journal of Psychology* 68, (1977): 121.

[117] Waters and Underwood, 52.

[118] Sloboda, "Phrase Units," 121.

[119] Polanka, 182.

[120] Waters et al., "A Study of Pianists," 147; Ibid., 126.

to sight-read, improvising the missing parts.[121] They reported that good sight-readers were able to infer more correct notes than less skilled readers. Furthermore, performance on a second attempt at filling in the blanks was statistically better than the first attempt, presumably because readers became familiar with the piece.

A way to cultivate expectations and predictions of what will follow is by developing auditory skills, the ability to hear the notation in one's head.[122] Kornicke reported that aural imagery was the strongest predictor of sight-reading ability.[123] Similarly, Waters et al. and Kopiez and Lee found that aural imagery was one of the best predictors of sight-reading achievement.[124] While auditory feedback is not necessary for successful sight-reading, at least in pianists,[125] it could be used for creating expectations.[126] Sight-singing and score study with or without listening to a recording is recommended to develop aural skills and gain familiarity with different musical styles.[127]

Rhythm Reading

Another aspect of sight-reading that is often neglected is rhythm-reading ability, even though studies show that it is very important in sight-reading. Elliott found that rhythm-reading ability was the single best predictor of wind instrumentalists' sight-reading scores.[128] Similarly, McPherson reported that 61 percent of all errors in sight-

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[121] Lehmann and Ericsson, 20-21.

[122] Waters et al., "A Study of Pianists," 126.

[123] Kornicke, 64.

[124] Waters et al., "A Study of Pianists," 147; Kopiez and Lee, 41.

[125] Banton, 14.

[126] Lehmann and Kopiez, 347.

[127] Sloboda, "The Psychology of Music Reading," 15; Harris and Crozier, 50; Thompson and Lehmann, 148; Haug, 71.

[128] Elliott, 13.

reading were rhythmical.[129] Gromko found that the sight-reading ability of high school wind players correlated highly with rhythmic audiation.[130] As noted above, empirical studies show that sight-reading in an accompanying situation helps rhythmic accuracy, at least in terms of continuity and pulse consistency.[131] Streckfuss suggests that the pacer machine was effective in his study partly because it provided a rhythmic aid for the students.[132] Deutsch maintains that students can learn to keep time when their teachers play along with them. He states, perhaps exaggerating, that "all the pupil has to do is to strike the notes simultaneously with his teacher. For this purpose no arithmetical explanation, no drill, and no counting is necessary."[133] Other educators suggest tapping exercises, establishing an internal pulse before beginning to play, and marking the beats in the score.[134]

Kinesthetic Skills

Another ubiquitous piece of advice when sight-reading is to keep the eyes on the score. The German pedagogue Friedrich Wilhelm Marpurg, in *Principles of Keyboard Playing* (1755), wrote that "the pupil should accustom himself to finding the keys quickly so that, when reading from the music, he is not continually obliged to glance down at the keyboard and then back [up] again."[135] When performing a well-rehearsed piece from

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[129] McPherson, 226.

[130] Gromko, 12.

[131] See notes 48 and 49 above.

[132] Streckfuss, 9.

[133] Deutsch, 33-34.

[134] Harris and Crozier, 46; Fast.

[135] Elizabeth L. Hays, "F. W. Marpurg's Anleitung Zum Clavierspielen: (Berlin, 1755) and Principes Du Clavecin (Berlin, 1756): Translation and Commentary" (Ph.D. diss., Stanford University, 1977), Intro-17.

score or from memory, pianists often look at the keyboard and their hands. In sight-reading, however, when the eyes look away from the score the opportunity for preview is lost especially since often pianists cannot find their place immediately. Studies confirm that good sight-readers spend less time looking at the keyboard than less-skilled readers,[136] and that when visual feedback is removed pianists make more mistakes.[137] Notably, Banton found that participants who reported rarely practicing sight-reading made significantly more melodic errors when unable to see the keyboard than participants who reported practicing sight-reading occasionally or often.

Pianists look down because they do not have a well-developed visual and kinesthetic imagery of the keyboard. Expert readers in Wolf's study stated that when sight-reading they see "the notes as the keys on the keyboard" and that they can "imagine that [they] are playing the piano even if the keyboard is not there."[138] Clark maintains that students "should learn to visualize the keyboard, to see it as clearly as they can see their bedroom in the dark."[139] To practice not looking down at the keyboard, both C.P.E. Bach and Türk recommend playing memorized pieces in the dark.[140] Modern-day pedagogues also recommend doing specific exercises with eyes closed, such as locating white keys (and later intervals) by silently pre-touching the black keys, practicing playing different intervals and remembering how each one feels, and playing scales, arpeggios and chord progressions.[141] Chronister says that most elementary-level students look

[136] Gilman and Underwood, 229.

[137] Banton, 14; Lehmann and Ericsson, 21.

[138] Wolf, 158-159.

[139] Clark, 64.

[140] Bach, 39; Türk, 28.

[141] Wilhelm Keilmann, *Introduction to Sight Reading at the Piano or Other Keyboard Instrument,* trans. Kurt Michaelis (New York: C.F. Peters, 1972), 5-9; Agay, 200; Faith Maydwell, *Sight Reading Skills: A Guide for Sight Reading Piano Music Accurately and Expressively,* rev. ed. (North Perth, WA: New Arts

down because they are unable to keep their five fingers in a five-finger position.[142] For

the same reason, others recommend playing many five-finger position pieces until

students do not feel the need to look down for verification.[143] Saxon, on the other hand,

claims that counting aloud prevents one from looking away from the score.[144] Sometimes

students look down because they lose contact with the keyboard and cannot feel where to

go next. Feeling pivot notes (finger substitutions) when shifting positions or using slides

and unorthodox finger crossings are recommended to maintain maximum contact with

the keys.[145]

　　　　Other times, however, pianists need to and should look away, such as when

playing large leaps or looking at another member of the ensemble to give or receive cues.

In these cases some recommend keeping the head steady and moving only the eyes,

which can be facilitated by holding the head slightly downward to allow a peripheral

vision of the keys.[146] Burmeister recommends training the eyes to look away and then

promptly return to their place by using duets that have each part printed on opposite

pages, and have the left hand play the bass of the *secondo* part and the right hand play the

melody of the *primo*.[147]

Press of Perth, 2007), 16-18; John Mokrejs, *Lessons in Sight Reading: At the Piano* (New York: Clayton F. Summy, 1909), 5-6; and Burmeister, 19, 86-87.

[142] Darling, 171.

[143] Agay, 201.

[144] Saxon, "The Science of Sight Reading," 23.

[145] Burmeister, 51-56; Maydwell, 19; Laura Beauchamp, "The 'Building Blocks' of Reading: Suggestions for Developing Sight Reading Skills in Beginning Level College Piano Classes," *Piano Pedagogy Forum* 2, no. 2 (1999). http://www.music.sc.edu/ea/keyboard/ppf/2.2/2.2.ppfgp.html (accessed January 15, 2010)

[146] Burmeister, 31.

[147] Ibid., 40.

Fingering

Some pedagogues draw attention to the importance of an intuitive approach to fingering for successful sight-reading. To develop this skill, Lawrence suggests that the students should be encouraged from early on to plan and write in the score their own fingering until they can gradually mentally finger.[148] Harris and Crozier recommend playing from the score patterns such as scales and arpeggios.[149] Burmeister includes exercises for finger substitution and slides. She also recommends practicing unorthodox crossings, such as a chromatic scale fingered with fifth finger on the white key and fourth on the black key.[150] Similarly, Wilhelm Keilmann recommends practicing using the thumb on black keys, even though uncomfortable.[151] These pedagogues recognize the need for fingering flexibility and adaptiveness when sight-reading, due to the limited ability to plan ahead. Unconventional fingering may be needed to find "escape routes."[152] Nonetheless, studies show that better sight-readers use more appropriate fingering on the first reading, and are able to further optimize their fingering choices in subsequent playings.[153]

Pre-playing Analysis

Many pedagogues recommend that sight-readers spend time scanning the score before playing to observe information that will help them. Some even provide a check

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[148] Lawrence, 47.

[149] Harris and Crozier, 49.

[150] Burmeister, 52-56.

[151] Wilhelm Keilmann, *Introduction to Sight Reading at the Piano or Other Keyboard Instrument,* vol. 2, trans. Kurt Michaelis (New York: C.F. Peters, 1978), 8-9.

[152] Burmeister, 51.

[153] Lehmann and McArthur, 142.

list of things to look at, that includes tempo, clefs, key signature, time signature, accidentals, fingering, motives, form, leaps, and dynamics.[154] To encourage students to take in and retain relevant information, Harris and Crozier recommend asking students to skim the score for thirty seconds and then take it away and ask them questions about the music.[155]

McPherson, in a study done with high-school wind players, confirmed that competent sight-readers scan the piece for relevant information and rehearse mentally difficult parts before they start playing, direct and maintain their attention throughout the performance, and monitor and evaluate their performance so they can correct errors.[156] Furthermore, he found that bad sight-readers did not remember important information about the piece, like time signature, key signature and dynamics, immediately before or after they performed.[157] Cox, however, found that pre-study analysis of chordal music did not correlate significantly with sight-reading ability in college-level pianists.[158]

Other

Sight-reading achievement is not only dependent on practice-related skills but also on skills that are partly related or completely unrelated to practice. Kopiez and Lee reported that the best combination of predictors is sight-reading expertise acquired up to the age of fifteen and inner hearing (as mentioned above), but also trilling speed and speed of information processing.[159] Specifically, they found that trilling speed with right-

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[154] Maydwell, 39; Keilmann, vol. 2, 27.

[155] Harris and Crozier, 52.

[156] McPherson, 229.

[157] McPherson, 227.

[158] Cox, 86.

[159] Kopiez and Lee, 55-57.

hand fingers three and four is a strong predictor of sight-reading ability. The authors argue that trilling speed, a measurement of psychomotor speed, is dependent on both task-specific training and genetically determined physiological effects. Speed of information processing, a measurement of mental speed, on the other hand, is assumed to be independent of practice. The authors suggest that mental speed, which is time-sensitive, is a strong predictor of sight-reading ability because of the real-time demands of sight-reading. Memory capacity and general intelligence, conversely, are not strong predictors because they do not have a time-restriction component.

Summary

Sight-reading is not a singular skill, but rather a collection of related component skills which are mostly practice-related. Studies show that expert readers differ from less-skilled readers in many aspects. Experts look further ahead but also return often to the point of performance, perceive larger units, have a larger vertical span, are more sensitive to the musical structure, make use of the context to form expectations, have a better aural imagery, are better at rhythm reading, spend less time looking at the keyboard, and use more appropriate fingering. A strong predictor of sight-reading ability is sight-reading and accompanying experience, in addition to trilling speed and speed of information processing (practice-independent).

For the most part, researchers' findings support the recommendations of music pedagogues. In a few instances, however, studies contradict common beliefs, or bring to light new information. Good sight-readers, for example, read ahead as pedagogues recommend, but studies report that the eye-hand span is much smaller than previously thought. Furthermore, most pedagogues recommend reading chords from bottom to top, but research reveals that good sight-readers read from top to bottom. Studies also indicate that there is a previously unknown critical window for the development of sight-reading ability, making the teaching of sight-reading from an early age imperative.

These unexpected findings show why keeping abreast with recent research is important for music teachers. Many pedagogues rely on teaching strategies passed down to them by their teachers. While such time-honored methods may yield satisfactory results, new instructional methods derived from recent discoveries could be more effective, more efficient, or work better for a particular group of students. Furthermore, it is equally important for pedagogues to know when studies corroborate the validity of their teaching methods. Such confirmation can give teachers encouragement and increased confidence, as well as provide evidence of effective teaching techniques for hard-to-convince students, parents, or administrators.

CHAPTER III

REVIEW OF SIGHT-READING MATERIALS

This chapter includes a review of the available sight-reading materials for pianists in print and electronic format that were published in 1990 or later. Graded sight-reading series are followed by textbooks for the adult student. Electronic materials include software programs for general piano instruction and ones developed specifically as sight-reading tools. Within each category, the materials are presented according to the author's assessment, progressing from the weakest to the strongest and most effective.

Print Materials

Selected Graded Sight-Reading Series

Some of these graded sight-reading series are published as supplementary material to specific piano method books, but all can be used independently. Only series that contain instruction in sight-reading beyond merely presenting the scores to be read are included.

A Line a Day Sight Reading

There are four volumes in this series that span from early to late elementary levels.[160] Each page contains a line titled "Daily Note Search," which contains random notes, intervals, or chords to be played with any fingers, and three four-measure phrases for sight-reading. The author recommends playing the "Daily Note Search" every day followed by one of the sight-reading phrases. In some cases, a fourth day is to be spent on playing all three four-measure phrases continuously to form a longer sight-reading exercise. Transposing the phrases is also recommended.

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[160] Jane S. Bastien, *A Line a Day Sight Reading,* 4 vols. (San Diego: Kjos West, 1990-1991).

At the beginning of each volume there is a list of things to do before playing, such as looking at the time signature and key signature, identifying problem spots, noticing dynamics, slurs or ties, finding the hand position, and setting the tempo by counting one measure aloud. The students are also asked to evaluate their sight-reading based on whether they played the right notes, played straight through with correct rhythm and steady pulse, counted aloud, and observed the slurs and dynamic markings. At the end of each volume there is a report that asks the teacher to rate the student in terms of note recognition, accuracy, technique, and practice habits. This table can help the teacher and the student pinpoint specific problematic areas.

The checklist for pre-playing analysis is valuable, as are the suggestions for self-evaluation after playing. However, these are general suggestions to apply to all pieces and therefore lack specificity. Furthermore, all the music is in the same style, without much variation in sound or character.

Piano Sight-Reading: A Fresh Approach

This series consists of three volumes that range from elementary to intermediate level.[161] It provides sight-reading tips at the beginning of each book. Book one, which stays exclusively in five-finger positions, includes suggestions such as looking at the time signature, tapping the rhythm, and looking for patterns. The tips get progressively more advanced, and include scanning the piece to observe its overall shape and plan for fingerings, looking at the chord shapes, looking ahead by as much as a measure if practical, and always playing musically and expressively. Book three contains some training in accompanying, and an entertaining section with pieces that parody known compositions to encourage style awareness.

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[161] John Kember, *Piano Sight-Reading: A Fresh Approach,* 3 vols. (Mainz: Schott, 2004-2006).

This is a series with a clear layout and music that progresses in a well thought-out manner. It is more appropriate for the older beginner or an adult student since the presentation is quite dry. The sight-reading tips are valuable and can instill good habits in students from the beginning levels. However, looking ahead by as much as a measure is probably not a practical advice, since recent studies have shown that even expert readers do not read more than one or two beats ahead. In addition, for a book that aims to help students teach themselves,[162] it is not interactive at all.

Let's Sightplay!

Let's Sightplay! is a series of four books that span from early elementary to early intermediate level.[163] The small pictures and characteristic titles of the pieces make this series best suited for children. Each book contains fourteen lessons with four exercises each. The first exercise is called "Dialogues" because the melody alternates between the hands. The second and third exercises are titled "Sightplaying Chimes." These one-line exercises contain whole-notes out of the five-finger position and are to be played with finger three and with the pedal down. These exercises drill matching of notes to the right keys on the keyboard. In addition, because they are written in whole notes and are to be played with the metronome, they encourage looking ahead and preparing. The fourth exercise is titled "Theme and Variations," which is meant to encourage finding similarities and differences in patterns, or "It's your move!" which contains pieces that require position changes.

At the beginning of each book there is a "Note to the Student" with a checklist, which includes suggestions like looking at the time signature and counting one measure before playing, checking for articulation and dynamics markings, identifying intervals

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[162] Ibid., 1: 4.

[163] Kathleen Massoud and Victoria McArthur, *Let's Sightplay!: Creative Solo Exercises to Develop Sightplaying,* 4 vols. (North Miami Beach: FJH Music Co., 1995-1997).

and note patterns that repeat, spotting tricky rhythms and position changes, and looking ahead. In addition, throughout the books there is one "sightplaying hint" for each exercise, which includes suggestions such as to tap the rhythm before playing, not to look at the hands, etc. To motivate the students the authors suggest giving the students points for accuracy based on how many repetitions it takes to play each passage right. At the end of each volume there is a progress report that asks the teacher to rate the student in terms of accuracy, continuity and practice habits. This table can help the teacher and the student identify problematic sub-skills.

The series' strongpoint is the music. It is interesting, written in a variety of styles and full of character. Furthermore, the specific hints provided for each piece supplement adequately the generic suggestions printed at the beginning of each volume. However, this series could benefit from some interactive activities, such as asking students to circle different elements in the score or fill-in blanks.

Four Star Sight Reading and Ear Tests

There are eleven volumes in this series, including an introductory level.[164] The series was originally designed to correlate with the piano examinations of The Royal Conservatory of Music (Canada). The authors aim at developing four skills and abilities in equal measure: visual learning skills, tactile sense, aural ability, and analytical skills. Each book contains ten sets of daily sight-reading and ear training exercises for practice at home, with an equal number of tests plus a final, to be administered by the teacher. In the early volumes, each day of sight-reading exercises includes melodic patterns mostly for one hand, a short piece, and a one-hand rhythmic pattern to be clapped or tapped. Ear training exercises include playing from memory rhythmic and melodic patterns, and playing and singing intervals. In the later volumes, sight reading exercises are mostly

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[164] Boris Berlin and Andrew Markow, *Four Star Sight Reading and Ear Tests: Daily Exercises for Piano Students,* 11 vols., ed. Scott McBride Smith (Mississauga, Ont.: F. Harris Music, 2002).

pieces taken from the standard repertoire and one-hand rhythmic patterns. Ear training exercises include the exercises found in the early volumes, in addition to playing and singing chords, and playing and identifying cadences.

All books include a list of the musical elements and patterns that will be covered in that particular volume. Additionally, the advanced volumes contain suggestions for practicing sight-reading and rhythm, and suggestions for practicing ear training. Suggestions for sight-reading and rhythm include looking at the key signature and time signature, rhythmic and melodic patterns, and opening and closing notes to determine the tonality, tapping the rhythm while counting, and not playing too fast. Furthermore, each sight-reading exercise throughout the books includes a hint, question, or activity, such as circling and marking particular elements in the score.

This is a very thorough series that is successful in training the students' visual, tactile, aural, and analytical skills. The strongest asset of this series is its parallel inclusion of ear training exercises. Furthermore, the music is attractive, written by standard composers. The musical style is varied, however the emphasis is on music from the classic and romantic eras. For this reason, and because of the dry, yet clear, layout, this series is best suited for older students. A disadvantage of this method is its insistence in the early volumes that players name the notes of one of the hands when playing. While it is important that students can recognize notes, knowing their names is not necessary for playing them and can discourage students from reading intervallically, in addition to slowing them down. Another drawback is that all rhythmic exercises are for one hand.

Right@Sight

     Right@Sight is a series of eight volumes that correlate to the grades of the Associated Board of the Royal Schools of Music syllabus.[165] In each of the pieces the students are reminded to follow the acronym TRaK, which stands for Time signature, Rhythm, and Key signature, therefore drawing attention to these fundamental elements. Each piece comes with additional hints regarding form, technique, fingering, and interpretation. Sight-singing is also recommended for aural awareness. The layout of the page is quite clear; questions are printed on the left side, while information and suggestions on the right side. At the back of the book there are pieces without any specific hints for independent study. For these pieces, students are encouraged to take a few seconds to scan the score following TRaK, look ahead, keep counting and keep going. A glossary of musical terms and symbols is also included.

     This is a very well thought-out series. The use of the acronym will help students remember to look for the most important elements in a piece. The additional hints are generally very thorough and often cover advanced concepts. This series is more suitable for the older beginner or adult student, since the presentation is clear but dry. Additionally, the use of British terms like crotchet and minim may confuse some students.

Improve your Sight-reading!

     There are nine books in this series, a pre-grade one and levels one through eight that correspond to the grades of the Associated Board of the Royal Schools of Music syllabus.[166] Each book has eight to nine stages or chapters, and starting from level two each stage deals with a new concept, like a rhythmic pattern or a key. Each stage

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[165] Thomas A. Johnson, Caroline Evans, and Paul Terry. *Right@Sight,* 8 vols. (London: Peters, 2001).

[166] Paul Harris, *Improve Your Sight-Reading!, Piano,* 9 vols. (London: Faber, 2008).

includes four types of material: rhythmic exercises, melodic exercises, prepared pieces, and pieces titled "Going Solo."

The rhythmic exercises are written for both hands, even though in the early volumes one hand taps the pulse. In addition to practicing these with both hands tapping, the author suggests practicing with various combinations of tapping the pulse with either foot, clapping, playing one note, or improvising a melody to the given rhythm. He also recommends counting one measure out loud and one silently before beginning. The melodic exercises use mostly the rhythmic patterns of the rhythmic exercises. In the preface the author recommends understanding the rhythm and counting before beginning to play them; looking at the shape of the tune, locating the highest and lowest notes and deciding what fingering to start on (even though the opening fingerings are provided at least in the first books); playing the first note and trying to mentally hear the piece through. The prepared pieces come alongside with six questions or suggestions, which deal with counting, finding the key, locating repeated patterns, hearing the music in the head, and playing with character. The questions are generally the same in every book. The pieces titled "Going Solo" have no clues provided, and in the preface the students are encouraged to take about thirty seconds to understand the piece before playing. The last page of each volume includes a checklist of things to do before and while playing, like keep feeling the pulse, ignore mistakes, look ahead at least to the next note, keep the hands in position on the keyboard, and play musically.

This is a very organized and clean-looking series. It is equally accessible to children and adults, though younger students may be more drawn to other books that include pictures and characteristic titles. The rhythmic exercises are one of the assets of the series, and having one hand tapping the pulse will certainly reinforce internalization of the pulse. The suggestions included at the preface and the ones that accompany the prepared pieces are very valuable and can instill in students a good, methodical routine. However, the questions for the prepared pieces could benefit from more variety, since at

some point they become generic. Furthermore, while the chapter on leaps contains

effective suggestions such as finding different notes or playing pieces without looking at

the keyboard, this is a topic that should have been addressed earlier than level eight.

Another weakness of this series is the lack of any duets. Despite its shortcomings, this

series provides high-quality methodical instruction in an interactive manner, and can

reinforce good habits that are of prime importance in successful sight-reading.

Sight Reading and Rhythm Every Day

This series includes ten books in six levels, with each of levels one through four

containing two volumes.[167] Each book is divided into ten to twelve units that cover a

new concept. The units have reading materials for five days of independent practice and

a lesson day, which includes a student-teacher duet.

The early levels include melodic exercises and rhythmic exercises with

independent rhythms for each hand, or rhythmic patterns with lyrics to be spoken. In

addition, the later levels include rhythm, pattern, chord, or interval flashes, which are

short patterns to look at briefly and play by memory. The authors also suggest

harmonization and transposition exercises. There is a big variety in activities, which

include circling all instances of a specific interval, writing in the time signature, adding

bar lines, singing, playing silently on the top of the keys. The preface to the later

volumes contains a list of general tips for sight-reading. Recommendations include

playing at a tempo one can keep steady without stopping, keeping the eyes on the score,

playing musically, using a metronome, and not worrying about mistakes.

This series offers a thorough instruction in sight-reading, presented in a

systematic, yet interesting manner. The large variety of activities will keep students

engaged and excited. The inclusion of duets and the flashes are definite assets, as are fun

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[167] Helen Marlais and Kevin R. Olson, *Sight Reading & Rhythm Every Day,* 10 vols. (Fort Lauderdale: FJH Music Company, 2005-2008).

activities like rhythm exercises that require snapping and stomping. Though the material

and presentation make it suitable for both children and adults, the content of the lyrics

reveals that the targeted audience is children. However, the suggested metronome

markings are sometimes puzzling, since an eighth-note pulse is given for exercises with a

time signature of 3/4.[168] Overall, this is a highly interactive series that successfully

attempts to develop eye, ear, and hand coordination in a fun and engaging way.

<div align="center">Sight-Reading Textbooks for Adults</div>

Sight Reading Skills

Faith Maydwell's book targets adult students that want to improve their sight-

reading skills, or piano teachers that need new ideas and resources.[169] It assumes

knowledge of the grand-staff notes. The book does not include any music for sight-

reading. Instead, the author recommends using Bartók's *Mikrokosmos* vols. 1-4. In the

first few pages the author recommends a proper posture at the piano and sight-reading

only when rested and focused. She also encourages the readers to play with evenness,

accuracy and expression even if that means playing slowly. The main part of the book

deals with three areas: guided reading, keyboard orientation, and reading the signs.

Guided reading is a concept taken from Deutsch, where he recommends that the teacher

plays along the same music as the student.[170] To establish a sense of keyboard

orientation, which will enable playing without having to look at the keyboard, she

recommends exercises like playing scales and triads with eyes closed, octave

displacement of passages, playing chords with pivot notes and then without. For reading

the signs, the ability to recognize the material in the score, she includes exercises for

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[168] Ibid, 10: 11, 12, 26, 27.

[169] Maydwell (see note 141 above).

[170] Deutsch, 16.

parallel, contrary, and random motion between the two hands, blocked intervals, triads, and four-note chords. She also addresses ledger lines, clef changes, accidentals, and being able to reproduce various metronome markings. For rhythm training she recommends clapping and counting aloud, and practicing keeping a steady pulse when going from even eighth-notes to triplets, to sixteenth-notes to quintuplets, and vice versa. To encourage chunking, "the process of organising material into blocks of information rather than individual units"[171] she recommends singing and transposing. The book concludes with a checklist of things to observe before playing and a graded list of suggested sight-reading material.

Maydwell's book makes an easy and interesting read, enhanced by the quotes that are scattered throughout the book from historical or other sources. The exercises for training a kinesthetic sense are perhaps the most helpful. In general, however, this book does not have much depth.

Keyboard Sight Reading

Burmeister's book targets college-level keyboard players and can be used as a textbook for a reading class, or as supplementary to group or private piano study.[172] It assumes intermediate level playing ability. The book is organized around what the author thinks the culprits of weak sight-reading are: lack of physical agility, inability to make instantaneous decisions, lack of flexibility, tense muscles, and a lack of definite, continuous rhythm. The first chapter, titled "Flexibility," deals with improvisation and transposition. The second chapter, titled "Eyes and Breathing" encourages the use of "soft eyes," avoiding focusing intently or staring at one note or chord. Instead "the eyes should rest only fleetingly at any one thing, floating lightly from harmony to harmony or

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[171] Maydwell, 36.

[172] Burmeister (see note 67 above).

from pattern to pattern,"[173] therefore enabling peripheral vision. To practice that, she

includes musical examples with different symbols like a triangle and an *X* printed at the

four corners and at the center of the page, and recommends reading the music while

keeping some or all of these symbols in the peripheral vision. She also notes that vision

and sight-reading in general can be hindered by held breath, and recommends breathing

exercises such as playing scales while inhaling on the ascent and exhaling on the descent.

Next, she encourage readers to have the "courage, confidence and conviction" to

leapfrog, to play one thing while reading another. She inserts arrows in musical

examples to show the reader exactly when and where to look ahead, usually three to four

notes. Her ideas on not looking down and fingering have been described in chapter two.

For leaps she encourages a play-move-place procedure, getting to the note before it is

time to play it. She also recommends diminishing the leap in chords by feeling the

distance from the top note of the first chord to the bottom note of the second chord (when

ascending). For fluent harmonic reading she recommends thinking whole chords and not

individual note names, reading from bottom to top, and letting the eyes rest in the middle

of the measure between the staves.

Burmeister's book includes a wide spectrum of aspects that relate to sight-

reading. She offers some helpful ideas for breathing, establishing a kinesthetic feel for

the keyboard, and fingering. However, her suggestions on eye movements are

questionable, particularly her advice to let the eyes rest in the middle of each measure in

the blank space between the staves. Studies have shown that it is the unsuccessful

readers that tend to hover in the middle of the two staves, while expert readers have more

vertical movements, fixating methodically on all parts of a chord from top to bottom.[174]

In addition, while her advice to look ahead is certainly valid, recent studies show that the

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[173] Ibid., 20.

[174] See notes 65 and 66 above.

eye-hand span is much smaller than previously thought, only one to two beats for expert readers.[175]

Sightreading at the Keyboard

Spillman's book can be used as a textbook for a college-level group piano class.[176] The first two chapters are theoretical in content. Chapter one discusses the importance of good sight-reading ability for musicians and common causes of difficulties in sight-reading, which can be divided in three categories: obscure musical language, high technical requirements, and unclear layout on the page. In chapter two the author describes at length the process of reading prose and poetry, and illustrates the importance of top-down processes and expectations in particular. He then parallels that with reading musical notation, and concludes that "the more you know, the more you learn."[177] Chapter three gets into more practical matters, dealing with establishing rhythmic and harmonic security. The author recommends having one student play a piece that he/she knows well, while another student plays only particular features of the music, like only downbeats, all tonic bass notes, or all occurrences of a particular melodic contour. He also includes exercises to instill a sense of prioritizing when reading, emphasizing rhythm or harmonic background at the expense of small details. Chapter four includes exercises to build topographical awareness, like finding notes and chords on the keyboard with eyes closed, and shifting octaves in a piece at random places when signaled by a helper. He also addresses notes with ledger lines, line changes, and page turns. For looking ahead he recommends sight-reading with a helper who covers up the measure when you get to each downbeat. In chapter five the author deals with reading contrapuntal music.

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[175] See note 75 above.

[176] Spillman (see note 8 above).

[177] Ibid., 14.

He recommends focusing on one line of the music, putting it at the foreground, and leaving the other line(s) to peripheral vision (background). In chapter six he recommends improvising different styles of music by composer, era, or genre. In chapter seven he discusses transposing by ear, interval, key signature, or by using C clefs. Chapter eight deals with different types of score reading, and chapter nine with advanced rhythmic and notation problems, such as mixed rhythms and meter, and musical notation without bar lines. The volume concludes with ninety-eight examples of music to sight-read and a list of suggested music for further study, arranged according to what each piece can drill.

This book includes many practical and creative exercises. The list of music for further sight-reading is very helpful especially because it is organized by concept. The inclusion of unusual topics such as page layout and page turns makes this book more interesting. The fact that many exercises require a partner, however, makes this book less functional.

Electronic Materials

Piano-Learning Software Programs

Piano-learning software programs are mostly in CD-ROM format. They include comprehensive instruction in piano similar to piano method books but marketed for self-study instruction. Here, they are evaluated only on their inclusion of sight-reading exercises and their adaptability as potential sight-reading trainers.

Rocket Piano

Even though this is sold as a software program, it is nothing more than the electronic version of three hard copy books that are also available.[178] Many pieces have

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[178] Ruth Searle, *Rocket Piano.* (Christchurch, New Zealand: Rock Star Recipes, 2004). Available from http://www.rocketpiano.com/.

audio tracks that provide accompaniments, while others have jam tracks to simulate playing along with a band. However, this program is not compatible with a MIDI keyboard and therefore cannot give feedback on performances, nor does it have a recording station. Even though the author states that the Advanced book (third) will help build skills that "will equip you for… sight-reading,"[179] there are no sight-reading exercises in any of the three books.

The e-books come with bonus software games. "Jayde Musica" drills note-names while "Chordinator" drills chord names. In "Keycelerator" one matches notated chords to their keyboard configuration.

Teach Yourself to Play Piano

This program does not include any sight-reading exercises.[180] All pieces have MIDI play-along recordings with four tracks: piano, accompaniment, rhythm and metronome. Each track is optional, which enables the user to choose whether to have the solo part doubled or not. When using the play-along feature, the measure currently played by the MIDI file has a pink border, which can help following along. In addition, the user can control the speed of the MIDI files. The software is not compatible with a MIDI keyboard, so it cannot give any feedback. However, the user can record his/her performance (with an additional purchase of a microphone), and compare it against the track provided. This program comes with games, such as a flashcard-type game that requires matching of staff notes or chords to the correct keys on a keyboard, and an arcade-type game where the user has to fill in correct beats in a 4/4 measure.

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[179] Ruth Searle, "Learn How to Play Piano with the Rocketpiano Piano Lessons," Rock Star Recipes, http://www.rocketpiano.com/.

[180] Lindsey C. Harnsberger, *Teach Yourself to Play Piano,* deluxe ed. CD-ROM (Van Nuys, CA: Alfred Pub. Co., 2002).

This program includes fun pieces with entertaining MIDI accompaniments. However, its inability to give feedback or import new pieces limits its functionality as a potential sight-reading tool.

EMedia Piano and Keyboard Method

The elementary level is divided in twelve chapters with a total of 316 lessons.[181] Only chapter three contains sight-reading exercises, titled "Sight-reading with Twisted Melodies" (lessons 80-86). There are six main melodies, and each melody has additional versions where the order of the measures has been randomly scrambled. It includes tips for before and while sight-reading, like looking ahead, keeping eyes on the score, not stopping, etc. Because these melodies are part of chapter three they are all in middle-C five-finger position. Connection to a MIDI keyboard allows for instant feedback on the user's performance. Specifically, the program first gives a percentage score of the performance, and then marks in the score all the wrong notes with further explanation of the mistake, such as "held too short." The user also has the option to listen to a correct version of each piece, and record his/her performance for comparison. In pieces with MIDI accompaniments, the program tracks along the user's playing by highlighting the notes that are to be played. The solo part is included in the MIDI file, and unfortunately hearing only the accompaniment does not seem to be an option. For pieces without accompaniment (including the sight-reading melodies) the program does not visually follow along the user's playing by highlighting the current beat. However, it knows when to "turn the page" even if the performance included wrong rhythms or tempo inconsistencies.

Although this program contains only six melodies with their variations explicitly for sight-reading, its extended feedback capabilities make it an excellent tool for

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[181] *EMedia Piano and Keyboard Method,* CD-ROM (Seattle: EMedia Corp., 2009).

independent sight-reading. While importing other pieces is not possible, the program includes about one hundred pieces that could be used as sight-reading material. The pedagogical value of the program is undermined, however, by an outdated emphasis on a middle-C approach.

<u>*Piano Suite Premier*</u>

This software, to be used with a properly connected MIDI keyboard, includes many pieces arranged in five levels, however it does not have any exercises labeled for sight-reading.[182] There are three learning methods to choose from. "Wait for the Note" is concerned exclusively with pitch accuracy, and the program will not continue until the correct key is played. "Rhythm" is only concerned with rhythm. First, the user can hear how the rhythm is supposed to sound and then try it. In this mode, even if the user hits a single key in each hand, the program outputs the proper melody. "Notes and Timing" assesses both correct notes and rhythms. Finally, in "Record and Evaluate" the user can hear and see notated his/her performance, presented against the original score. Audio files of all the pieces are also provided. The user has control over many features, like the number of measures (one to three) the metronome will count through before beginning to play, the tempo of the MIDI files, and the number of beats in advance (one to three) the next page will be displayed.

Piano Suite also includes games, in addition to the drills in the "Theory Thinker" that require matching of notes to the right keys or vice versa. One of the games is an adaptation of the classic card game "Concentration" for improving memory skills. The player has to match staff notes to note names in the early levels, and staff notes to keyboard images in the intermediate levels.

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[182] *Piano Suite Premier,* CD-ROM (Bridgewater: Adventus Inc., 2002).

Even though this software does not have any exercises specifically for sight-reading, its many capabilities can make it function as a sight-reading tool. In addition to the large number of pieces that are included in the piano lessons and in the "Theory Thinker," one can import any MIDI file or even write a piece in the "Composer's Corner." In addition, setting the automatic page turner to the two or three beats option can instill a habit of looking ahead, at least at the end of each line. The immediate feedback capabilities make it ideal for practicing sight-reading independently. The only drawback of this software is the absence of accompaniment tracks that would make playing more enjoyable and reinforce rhythmic continuity.

<div align="center">Sight-Reading Programs</div>

Software programs developed specifically as sight-reading tools can be downloaded for a fee or for free, while some simpler ones run entirely online without any need for installation. The programs chosen for this review are the ones that include "sight-reading" in their name or otherwise advertize themselves as sight-reading tools.

Sight Reading Challenge

This is a flashcard-type program that one can download for a fee.[183] The title of the webpage reads "learn to sight read music with musical flashcards on your PC."[184] The flashcards display single notes with a three-octave range without including any sharps or flats. Each flashcard is accompanied by the corresponding sound of the note in the user's choice of instrument. Unlike other programs, this function is not optional. The user can press the correct key in a properly connected MIDI keyboard, or click the names

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[183] *Sight Reading Challenge* (Cambridge: Wieser Software, 1998). Available from http://www.wieser-software.com/lmusic/index.shtml.

[184] Wieser Software, "Learn to Sight Read Music with Musical Flashcards on Your PC," http://www.wieser-software.com/lmusic/index.shtml.

of the notes on the screen, with the option to use English letter names, Southern European syllables (Do, Re, Mi), or even Korean and Indian syllables. If the wrong key or button is pressed the program displays the correct answer, which can also be given away with the press of the space bar. After all the notes are presented, the program shows the amount of time it took and the number of incorrect answers.

Piano Music Sight-Reading Practice

This is a program that operates completely online.[185] There is no need to download anything and it is free. It claims that "a few minutes a day with this training exercise will greatly improve your piano music sight reading skills."[186] This is basically an electronic flashcard program that displays single notes and the user has to match them to the keys of a virtual keyboard or to an appropriately connected MIDI keyboard (test version). One can control different parameters like the key signature, inclusion of accidentals, maximum number of ledger lines, and whether each note will be accompanied by its sound.

Alfred's Interactive Musician

This program includes three sections: pitch training, sight-reading, and rhythm.[187] Pitch training is mostly aural training that aims at developing perfect pitch. The rhythm section includes reading and dictation exercises. The sight-reading section includes twelve-measure exercises (two measures appearing at a time) that the user must play on a connected MIDI keyboard or on the on-screen keyboard within a limited time. These

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[185] *Piano Music Sight-Reading Practice,* freeware (Tegus Corporation). Available from http://www.sightreadingpractice.com.

[186] Tegus Corporation, "Sight Reading Practice – Piano Music Sight-Reading Practice," http://www.sightreadingpractice.com.

[187] Morton Manus, *Alfred's Interactive Musician,* CD-ROM (Van Nuys, CA: Alfred Pub. Co., 2004).

exercises deal only with pitch, and rhythm is not evaluated. If a wrong note is played, the program will not go on until the right key is depressed.

This program can be used when a student needs separate training in rhythm and pitches. The aural training exercises can also enhance sight-reading ability. However, the section labeled for sight-reading deals only with the fundamental skill of matching notes to keys.

Jalmus

Jalmus is a software program that is free to download,[188] which claims to help "musicians, especially pianists, to improve their sight-reading."[189] It has two sections, note reading and rhythm reading.

Note reading requires matching of staff notes (on treble clef, bass clef, or grand staff) to the keyboard, earning extra time for every correct answer, and losing time for every wrong answer. It drills single notes, intervals or chords. For each mode the user can control how many different stimuli will be included, e.g. in the interval mode the user can select to be drilled only on thirds and fifths.

Answers can be given by playing on a properly connected MIDI keyboard, by clicking on a virtual keyboard, or by clicking on the letter names that appear at the top of the screen. For intervals and chords, each key must be played separately in an arpeggiated fashion. Using the virtual keyboard can get irritating, since any time the mouse passes over any key it sounds out, so when getting from one key to the next there is always a glissando-like sound. Furthermore, each stimulus is accompanied by its corresponding sound, which can help students' aural skills but hinder their reading skills. However, this function can be disabled.

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[188] Richard Christophe, *Jalmus,* freeware (2006). Available from http://www.jalmus.net/?lang=en.

[189] Richard Christophe, "Jalmus – Free Sight-Reading Software," http://www.jalmus.net/?lang=en.

Rhythm reading allows the user to look at nine measures of rhythm and tap or clap along with the program. The note currently played turns red. The user can choose a general tempo (*largo* to *presto*) and which note values to include: whole notes, half notes, quarter notes, eighth notes, and the corresponding rests.

This is a good program for drilling fundamentals, such as notes, intervals and chords. It is easy to use and control according to each user's needs. The rhythm section is particularly valuable, even though one can only play along with the program and no feedback is given at the end. Another limitation of this section is that all examples seem to be in 4/4.

Sightreading Genie

This is a free electronic database of 101 four-measure phrases organized in four levels that range from elementary to intermediate levels.[190] After choosing an exercise the user has the option of printing it, as well as listening to a MIDI file of the exercise to compare with his/her performance. Even though this program goes beyond flashcard-type drilling, many of the examples are awkwardly written. Furthermore, the four-measure phrases often sound incomplete, which will not provide much gratification to the player.

Practice Sight Reading

This free site[191] concentrates on rhythm reading because "rhythm is the most important part of sight reading."[192] The software generates random measures of rhythm

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[190] *Sightreading Genie,* freeware (Canberra: PracticeSpot Pty). Available from http://www.practicespot.com/sightreading.phtml.

[191] Jesse Clark, *Practice Sight Reading,* freeware (Fluteinfo.com, 2009). Available from http://www.practicesightreading.com/.

[192] Jesse Clark, "Become Better at Sight Reading with Practice Sight Reading.com," Fluteinfo.com, http://www.practicesightreading.com/.

after the user selects the time signature (simple, compound and mixed meters are available), the number of measures, and the level (one through five). All the examples are monophonic. A MIDI file is provided to either play along, or for comparison. The user can choose the instrumentation of the audio file and can adjust the tempo.

This site is useful for rhythm-reading practice especially because, unlike some other programs, it includes more difficult rhythmic motives. However it is of limited use for pianists because all examples are written for one line. Furthermore, the examples lack musical flow and truly seem to be randomly generated.

KeyPiano.com

The KeyPiano.com website, which claims that it is "the key to sight reading piano sheet music,"[193] offers different programs that can be purchased and downloaded separately. The *Name it*-series has four sections, drilling notes, keys, intervals, and chords respectively.[194] "Name it-Notes" has twelve levels that correspond to the twelve keys. Correct register is not important when clicking on the virtual keyboard. "Name it-Intervals" has fourteen levels. In the first level, only the numeric value of the interval is needed for a correct answer and not its quality. The next twelve levels correspond to the twelve keys, and here the user has to choose also the quality of the intervals, which range from minor second to perfect octave. The last level can display intervals of any key signature. In every level the user can select which intervals to be drilled, and can choose to see the intervals visualized on the keyboard in addition to the staff notation. In "Name it-Keys" a key signature is displayed and the user has to answer a different question in each of the five levels. In levels one and two the user must decide what major or minor key, respectively, this key signature belongs to. In levels three and four the user must

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[193] Posto 5, "KeyPiano.com, the Key to Sight Reading Piano Sheet Music!," http://www.keypiano.com/.

[194] *Name it - Keys, Notes, Intervals and Chords* (KeyPiano.com/ Posto 5, 2006). Available from http://www.keypiano.com/.

enter the roots of the primary or secondary chords, respectively, of the implied key. Level five displays a key signature and a scale degree (written in roman numerals) and the user has to press the key that corresponds to that scale degree in the implied key. "Name it-Chords" drills up to thirteen types of chords (including such advanced chords as sus2 and sus4) in twelve levels that correspond to the twelve keys. The user can choose to see the chords notated in an arpeggiated fashion. As in the interval section, there is the option of a keyboard visualizer. The user must choose the correct answer from four given options.

The *Play it*-series is used in conjunction with a connected MIDI keyboard.[195] "Play it-Notes" has twelve levels for each of the twelve keys. Unlike "Name it-Notes," correct register does matter. "Play it-Intervals" also has twelve levels for each key. Intervals are presented harmonically or melodically, but the user must press both keys simultaneously even for melodic intervals. "Play it-Chords" has ninety-six levels, eight for each key. Unlike "Name it-Chords," where the user can choose manually which chords to be included in the drills, here the chords are divided in eight predetermined levels. Chords can be displayed blocked or arpeggiated, but again they must be played blocked in both cases.

In all of the sections the user has 150 seconds to answer as many questions as possible, earning five points for each correct answer. In case of a wrong answer the program will not go on until the right answer is given. This is another flashcard-type program. However, its advanced material particularly in chords and keys make it stand out from the rest.

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[195] *Play it - Notes, Intervals and Chords* (KeyPiano.com/ Posto 5, 2006). Available from http://www.keypiano.com/.

Etude Sight Reader

     Etude Sight Reader is a software program that works with a properly connected MIDI keyboard, but only on PCs (Windows).[196] It is developed specifically as a sight-reading trainer. It comes with many exercises and one can create new lesson files as well, but the process seems to be quite involved. The existing material is divided in different stages according to difficulty. The program has two games, the note mode and the phrase mode. The note mode presents single notes that the user must play correctly on the keyboard in a limited time. The phrase mode presents phrases that the user plays while the program records the performance. At the press of a button the performance is played back, while the notation indicates in green and red color the correct and wrong notes respectively, while blue horizontal lines mark errors in rhythm or duration. It has a metronome that the user can choose to turn off. The user can also control the speed of the metronome, but in order to graduate to the next level the pieces must not be played slower than the suggested tempo. Two horizontal bars above the staff act as measure markers, showing the current and next measure respectively.

     Etude Sight Reader has much potential as a sight-reading trainer. Its instant feedback that clearly marks the wrong notes and rhythms make it ideal for independent study. However, this is not a user-friendly program and it will take some time to get comfortable with it. One of its drawbacks is that, while it has the capability to play the correct version of the phrases, this option is only enabled when the user passes a level, which happens only when the performance was correct in the first place. Perhaps the biggest disadvantage of this program is the music files provided, which tend to be unimaginative and sterile in character, mere studies as the program's name implies.

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[196] Kobus Botha, *Etude Sight Reader* (Cape Town: Etude Software, 2006). Available from http://www.etudesoftware.com/.

Other

Home Concert Xtreme

  Home Concert Xtreme is a practice and performance tool, but it is versatile enough to work as a sight-reading tool as well.[197] The software comes with a few sample MIDI files, but any standard MIDI file can be imported. The user plays along with the accompaniment tracks in three modes: "Learn," "Jam," and "Perform." The "Learn" mode aims at teaching the right pitches and rhythms, so the program will stop for any mistakes and it will not continue until the right note is played.   In the "Jam" mode the audio will keep going regardless of what the soloist is doing, while in the "Perform" mode it will adjust the tempo and dynamics to match the user's playing, and it will follow along even if entire measures are skipped. The program automatically records the user's performance for playback. In all three modes and in playback, the current measure is highlighted in grey color. An optional keyboard visualizer shows the keys currently played. In playback the screen displays the notation without marking any wrong notes, but the keyboard visualizer displays the keys that were played inaccurately in different color. The user can also hear a recording of the imported MIDI file itself that combines both the solo and the accompaniment tracks for comparison or playing along purposes.

  The "Jam" mode of this program can be used as a sight-reading tool, since the non-flexible accompaniment will force the user to keep a steady tempo and not stop for mistakes. The biggest assets of this program are the ability to import any standard MIDI file hassle-free, and being able to play with imaginative accompaniments that not only will make sight-reading more fun, but will also aid in rhythmic continuity. The playback function also allows the user to hear his/her performance and compare it to the original version. However, indicating the mistakes only in the keyboard visualizer and not in the notation is a drawback. The visualizer works in real time so the indicated wrong keys

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[197] *Home Concert Xtreme,* CD-ROM (Rehoboth, MA: TimeWarp Technologies, 2006).

disappear quickly. Furthermore, it is not clear if the mistakes were in pitch or in rhythm.

Because of its limited feedback capabilities, this program is less suited for self-study and

more appropriate for use with a teacher.

Summary

There is an abundance of sight-reading material for piano created in the last two

decades. Some of the graded sight-reading series are pedagogically sound with appealing

music and suggestions or questions that create an interactive learning environment.

These series address most topics found to be important in successful sight-reading, such

as identifying and reading patterns, looking ahead, rhythm reading, fingering, and pre-

playing analysis. In addition some encourage aural awareness, while a few of them

provide duets. The three textbooks for adult keyboardists also cover these sub-skills, in

addition to more advanced issues, like page layout and score reading. The small number

of such textbooks that are available is perhaps indicative of the rarity of sight-reading

instruction at the college level. An important skill that is not addressed in any of the print

material is that of anticipating and predicting. However, even though students are not

directly encouraged to predict, some of the materials help build skills necessary for

predicting, such as knowledge of harmony and aural awareness.

It is interesting to note that only one of the piano-learning software includes sight-

reading instruction. At least some of them, however, can be used as sight-reading tools,

taking advantage of their instant feedback capabilities. Most of the programs that claim

to improve sight-reading, on the other hand, drill only fundamental skills such as

matching of notated notes, or at best intervals and chords, to the correct keys on the

keyboard. While such skills are necessary for sight-reading, this flashcard-type drilling

can hardly qualify as sight-reading practice. Other programs provide melodic or rhythmic

phrases to be sight-read but no clear means of feedback other than providing MIDI files

of how the phrases should sound. Only one program offers exercises to be sight-read

with instant and precise evaluation of each performance. Unfortunately, its user interface design is poor and the music uninspiring.

It is clear that while the technology exists to create a program that offers comprehensive, interactive, and independent practice in sight-reading, such a program does not seem to be available.

CHAPTER IV

THE PROPOSED SOFTWARE PROGRAM

While many sight-reading books offer sound instruction in sight-reading, the electronic materials that are available fall far behind expectations. This is unfortunate, since, in the author's opinion, an electronic format is the most advantageous to the effective teaching of sight-reading. Firstly, a software program that uses animation has the ability to manipulate the score and the user's attention in ways that are not possible with a hard copy. Secondly, a well-designed software program can provide maximum interaction and immediate feedback which again is not possible with a book unless supervised constantly by a teacher. An electronic sight-reading trainer, therefore, is ideal for independent yet guided study, a mode of learning that has become very popular with adults. Alternatively, practice with such a program can be assigned by piano teachers for daily homework to save valuable lesson time.

In this chapter, the specifications of the program are outlined in detail. The actual development of the program is not in the scope of this essay since that would require advanced software engineering skills not possessed by the author. Nonetheless, she intends to pursue the development of the program in the near future with the assistance of a professional software engineer.

General Description of the Program

The proposed program develops most practice-dependent component skills that have been discussed in the second chapter as crucial factors in successful sight-reading. The exercises are grouped in six sections (Table 1), with each section corresponding to a component skill. "Playing with Eyes Closed" and "Noticing and Retaining Information" develop kinesthetic and analytical skills respectively, while "Keep it Going" involves ensemble playing for cultivating rhythmic continuity. Though studies show that an

Table 1. The six sections and individual exercises of the program.

_____

1. Pattern Training

    a. Play patterns from memory

    b. Identify and mark patterns

2. Predicting

    a. Complete phrases with missing notes

    b. Complete pieces with missing patterns

3. Playing with Eyes Closed

4. Looking Ahead

    a. Play a piece alternating with an audio file

    b. Play the same piece with the phrases rearranged

    c. Disappearing score

    d. Look-ahead mode

    e. Play only downbeats

5. Noticing and Retaining Information

    a. Answer questions about the piece before playing

    b. Answer questions about the piece without the score present

    c. Answer questions about the piece in the middle of playing

6. Keep it Going

    a. Play pieces for piano and another instrument

    b. Play piano duets

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intuitive approach to fingering plays a role in successful sight-reading, [198] no exercises are included here for the development of this skill. This omission is due to technological limitations, since there is no way for the software program to know the fingering the users use, therefore compromising its feedback capability.

The instant feedback capability is one of the most important advantages of an electronic sight-reading trainer over a sight-reading book. This program, following the user's attempt at each exercise (unless otherwise noted in the subsequent description), will display the original score with any notes played incorrectly printed in red color (see Figure 5). Furthermore, each performance will be recorded and played back for self-evaluation and comparison with a pre-recorded performance. Users will also have the option to use a virtual metronome with adjustable speed, and will be encouraged to try each exercise again for an opportunity to improve their performance. To fully take advantage of its feedback and recording capabilities, the user must use the program with a properly connected MIDI keyboard. In addition to the specific pieces that will be included in the program, users will be able to import other pieces in MIDI format to use for general sight-reading practice, taking advantage of some of the built-in feedback and looking-ahead features.

<div align="center">Icons Used in the Program</div>

The following icons are used throughout the program to access and control the various capabilities of the program.
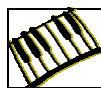
 Play & Record: This button is to be used when the user is ready to start playing. A virtual metronome will count off two measures (minus any upbeats) and record the input from the MIDI keyboard.

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[198] See note 153 above.

Metronome: The virtual metronome with adjustable speed can be switched on or off. When disabled, it will only beat for the two measures prior to the performance.

Pre-recorded audio: Listen to a pre-recorded MIDI or acoustic performance of the piece.

User Profile: Listen to the user's performance recorded through the *Play & Record* button. The user will be able to select the icon for this function from a list for a personalized touch.

Detailed Description of Each Section/Exercise

<u>Perceiving Patterns</u>

Studies show that the ability to perceive large units of notation in respect to pitch and rhythm is a defining characteristic of expert readers and a predictor of high sight-reading skills.[199] Furthermore, pattern training has been shown to improve sight-reading ability.[200] Because the reading of rhythm is processed by a different visual stream than that of pitch, [201] practicing pitch reading and rhythm reading separately is as important as practicing these two elements in an integrated manner. In the first two exercises that follow, the user will have the opportunity to focus on patterns that contain only rhythm or pitch information, before encountering patterns that contain both elements.

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[199] See notes 98-103 and 109-110 above.

[200] See notes 111-113 above.

[201] Lauren Stewart, "A Neurocognitive Approach to Music Reading," *Annals of the New York Academy of Sciences* 1060 (2005): 384.

In "Play patterns from memory" (exercise 1a), similar to Bean's tachistoscopic training,[202] short patterns will be displayed for a few seconds and users will have to play them after they disappear. Users will be able to listen to a pre-recorded version of the pattern and compare it to their own performance (Figure 1, 2, 3). Patterns will be for one or both hands, and can include harmonic patterns such as chord progressions. At a first stage, patterns will be either melodic or rhythmic, allowing the user to concentrate only on one aspect. Later, patterns will involve both pitch and rhythm. The purpose of this exercise is to familiarize users with patterns commonly found in music, so they are able to recognize them in their pieces. Furthermore, because the patterns will be presented only for a few seconds, users will be encouraged to process and memorize large chunks of information quickly. Sloboda suggests that such an exercise can help with sight-reading by developing auditory skills,[203] while Brenda Wristen recommends it for encouraging effective patterns of eye movements.[204] While some sight-reading books include a similar flashcard-type activity, for example *Sight Reading and Rhythm Every Day*,[205] none of the software programs do. This electronic format of the exercise is advantageous compared to the print format, since in the absence of a teacher it ensures that students are not tempted to cheat or give up when they cannot remember all the details of the pattern. The electronic format also allows for play-back and comparison with a correct performance of the pattern.

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[202] See note 111 above.

[203] Sloboda, "The Psychology of Music Reading," 15.

[204] Brenda Wristen, "Cognition and Motor Execution in Piano Sight-Reading: A Review of Literature," *Update - Applications of Research in Music Education* 24, no. 1 (2005): 49.

[205] See page 44 above.
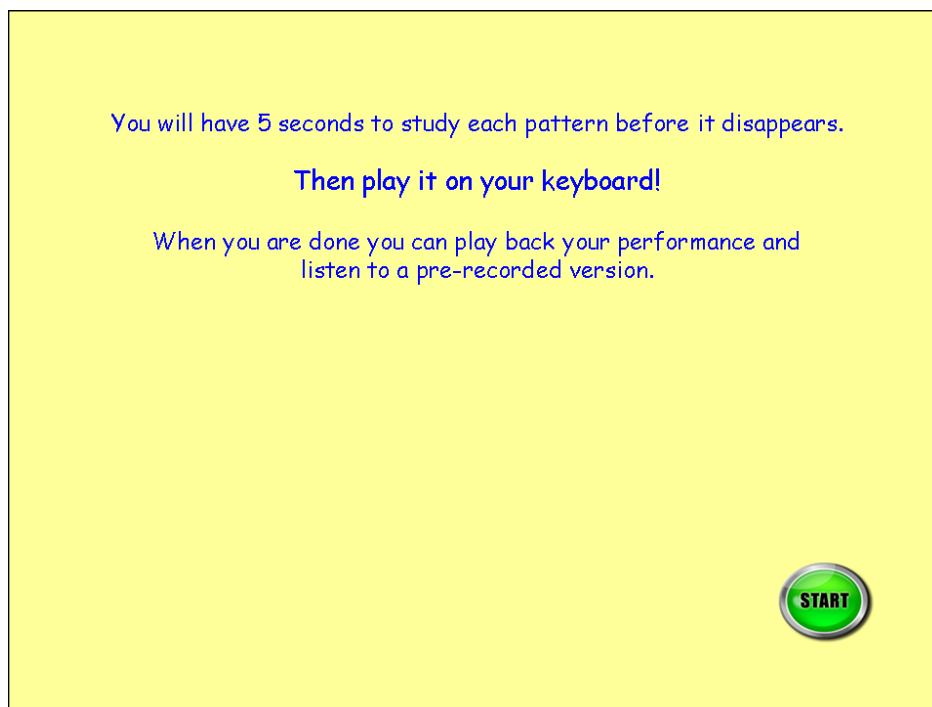
Figure 1. Instructions for exercise 1a.

Figure 2. The pattern (here a rhythmic pattern for both hands) will be displayed for five seconds, automatically progressing to a blank screen where the user's performance will be recorded (not included).
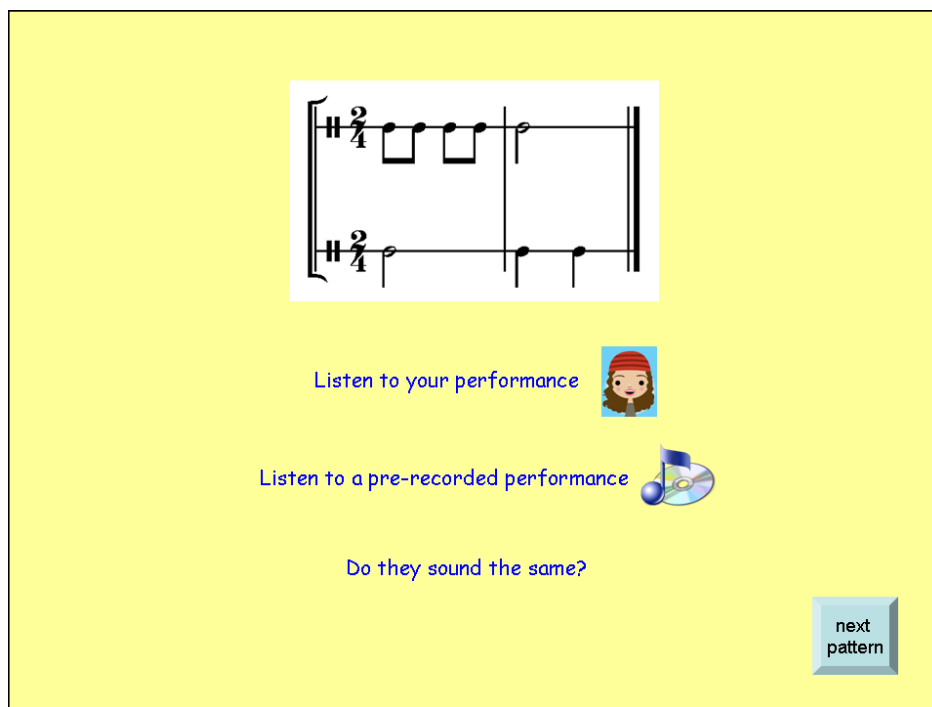
Figure 3. After the user finishes playing he/she can listen to a pre-recorded performance and compare it to his/her own while looking at the original pattern.

In "Identify and mark patterns" (exercise 1b) users will have to identify melodic or rhythmic patterns in a short piece and then play it. This is an exercise suggested by many pedagogues[206] and found in most interactive sight-reading books, such as *Improve your Sight-reading!* and *Sight Reading and Rhythm Every Day,*[207] but not in any of the software programs. Here, users will be asked to find and mark all occurrences of a specific pattern by clicking on the first and last note of each occurrence. If correct, brackets will appear around the pattern, thus providing instant feedback and assisting in the subsequent performance of the piece by visually marking the score (Figure 4, 5).[208]

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[206] Lehmann and McArthur, 147.

[207] See pages 43-44 above.

[208] All of the musical works used in the figures are in the public domain. They have been edited in order to create short and self-contained musical examples.

Figure 4. Initial screen for exercise 1b. Each pattern is marked with different color brackets. Here, the user has already selected the first pattern (thus highlighted) and is now clicking on the first note of its repetition, causing the appearance of an opening bracket in the same color.

Figure 5. Feedback for exercise 1b. The program displays the original notation in black color and any notes played incorrectly in red (gray). The user can listen to a pre-recorded performance of the piece and to his/her own performance. He/she is then encouraged to play the piece again.

The ability to identify and process patterns quickly is a prerequisite for being successful with most of the other exercises. Users, therefore, will be required to complete "Pattern Training" before being allowed to proceed to the exercises of the other sections. The following sections, however, can be tackled concurrently.

<div align="center">Predicting</div>

Through the two exercises of the first section users will attain a pattern vocabulary that will facilitate prediction skills by helping to build up suitable expectations. The next two exercises will directly encourage and cultivate the users' predicting skills by eliminating notes in the score.[209] As seen in the previous chapters, predicting is crucial in successful sight-reading.[210] Surprisingly, it is a skill that is not addressed at all in the existing materials for training sight-reading, in print or electronic format. "Complete phrases with missing notes" (exercise 2a) will prompt students to complete patterns by playing missing notes. To successfully complete this fill-in-the-blank activity, users will have to consider the whole pattern, therefore promoting chunking behavior. Furthermore, users will apply their experience from the previous exercises in reading, playing, and identifying patterns to make educated guesses. Even if the material is taken from actual pieces, this is not an exercise in guessing exactly what the composer wrote, but rather an exercise in finding convincing solutions that could work in the specific musical context. As feedback, the program will display and play the users' solution and the original version. Furthermore, users will be encouraged to evaluate whether their performance sounded convincing, and to speculate why the composer wrote it the way he/she did (Figure 6, 7).

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[209] Suggested by Sloboda in "The Psychology of Music Reading," 15. Also used as an experiment by Lehmann and Ericsson (see note 121).

[210] See note 120 above.

Figure 6. Initial screen for exercise 2a. The metronome function is shown in its disabled form.

Figure 7. Feedback screen for exercise 2a.
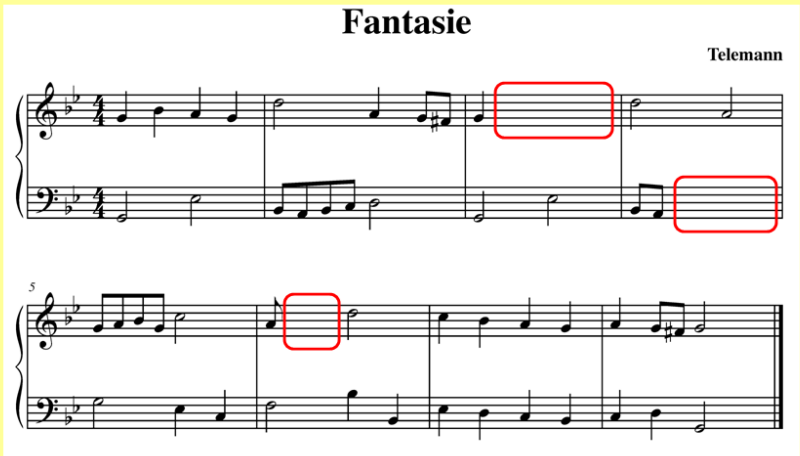
In "Complete pieces with missing patterns" (exercise 2b) users will have to play and complete pieces with missing notes. At a first stage, the material will be compositions that include repetitions of one or more patterns, with some instances of those patterns removed. At a later stage, the eliminated notes will be more random. The users will draw on their experience in identifying patterns and anticipating in order to complete successfully this exercise. Feedback will be in the same form as in the previous exercise (Figure 8, 9).

Figure 8. Initial screen for exercise 2b.

Figure 9. Feedback screen for exercise 2b.

Playing with Eyes Closed

This section will develop kinesthetic skills in order to diminish the need to look at the keyboard. Studies confirm that good sight-readers spend less time looking at the keyboard than less-skilled readers.[211] In this exercise users will be asked to locate keys or intervals with their eyes closed, by silently pre-touching the black keys. At a later stage, users will have to play phrases, directed either by note names or by intervals (play a third higher, then a fourth lower, etc.). Instructions and feedback will be given orally ("correct!" or "try again") so that students will not need to look at the screen, keeping their eyes closed at all times (Figure 10). While some sight-reading books deal with developing kinesthetic skills, none have this type of exercise; nor do any of the software programs. The oral delivery of instructions in this program makes this exercise possible in the absence of a teacher.

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[211] See note 136 above.
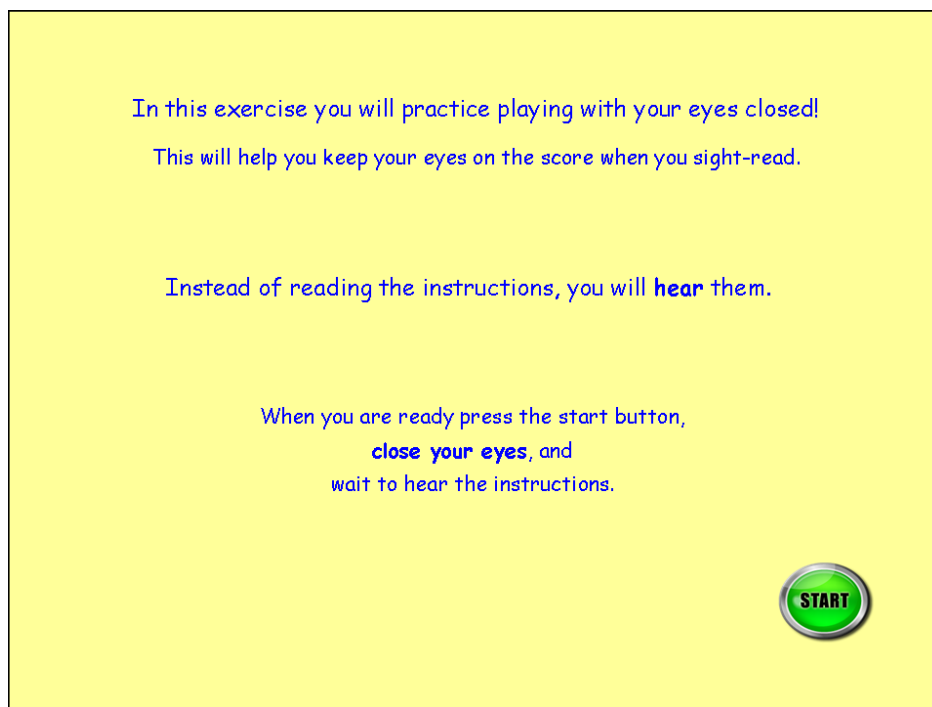
Figure 10. Instructions for exercise 3. When the user presses the "start" button, he/she will hear through the speakers the specific instructions, for example, "play D above middle-C, now a fifth higher, now a fourth lower, a third higher, a second lower."

Looking Ahead

Studies show that expert readers look further ahead in the score than less skilled readers do.[212] Furthermore, studies show that using technology to force readers to look ahead improves sight-reading ability.[213] However, caution should be used when insisting that students look ahead. Eye movements, including looking or not looking ahead, can be a symptom or a result of reading problems and not the cause. In other words, pianists can be good readers not because they look ahead, but instead they may be able to look ahead because they are good readers. Furthermore, sight-readers often cannot look ahead because they do not know what to look for. The previous exercises in identifying, reading, and predicting patterns are invaluable in this respect.

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[212] See notes 74 and 75 above.
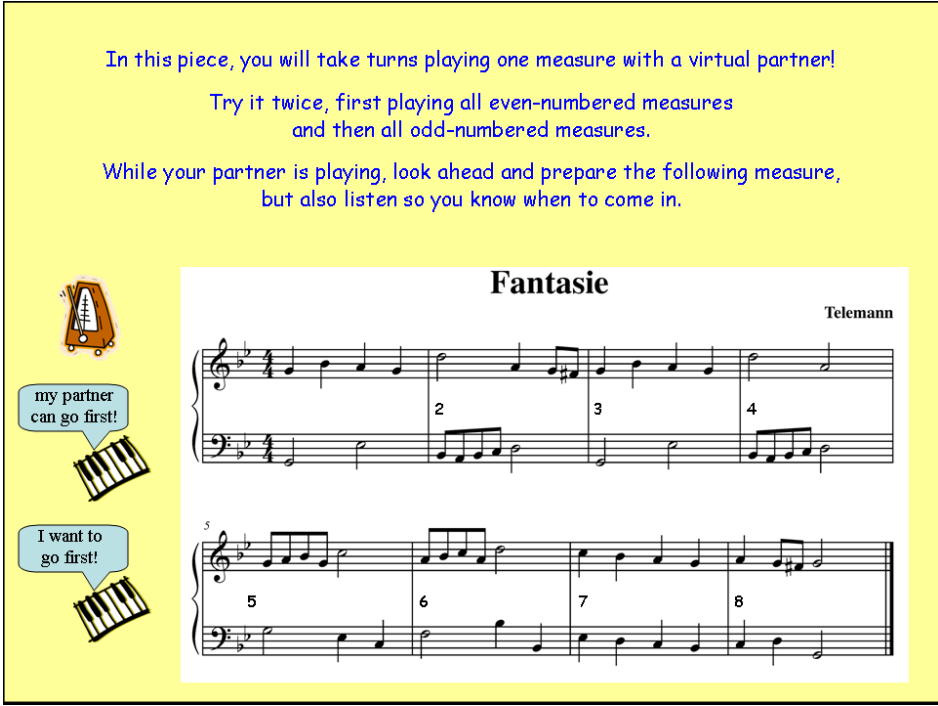
[213] See notes 79 and 80 above.

An exercise that can encourage users to take in large chunks of notation, look ahead and prepare is to have the reader alternate with a MIDI audio file playing a piece (exercise 4a).[214] For example, the first measure will be played by the user, the second measure will be played by the program, the third measure will be played by the user, etc. While the MIDI file is playing, the user will be encouraged to listen but also look ahead and prepare the measure that he/she is about to play next. After playing the piece twice in this format (once playing all even-numbered measures and once playing all odd-numbered measures) the user will have to play the piece as it is written (Figure 11, 12). In the absence of a teacher, this type of exercise is possible only with the assistance of technology. None of the programs reviewed, however, include such practicing.

Figure 11. Initial screen for exercise 4a.

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[214] Martha Baker-Jordan, *Practical Piano Pedagogy: The Definitive Text for Piano Teachers and Pedagogy Students* (Miami: Warner Bros., 2004), 230. She suggests implementing this exercise using a sequencer.

Figure 12. After playing the piece alternating with an audio file, the user will play the piece as it is written.

Another exercise, suggested by Chronister, is to rearrange the phrases of a piece the users have already played and ask them to play it without any preparation time (exercise 4b). With this drill users will not be practicing sight-reading in the strict meaning of the word, but they will be practicing sight-reading skills.[215] Users will already be familiar with the specific piece so they will be able to play in tempo, which facilitates reading groups and not individual notes. Furthermore, to find out which phrase comes next they must look ahead, which again they will be able to do because they are familiar with the piece (Figure 13). The purpose of this exercise, therefore, is to give the users the opportunity to look ahead and read patterns while playing in tempo, so they can then use this experience when reading unfamiliar music. The fact that users can play the original piece to begin with does not make this type of activity any less valuable or

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[215] Darling, 242.

irrelevant to sight-reading. After all, sight-reading is not reading something completely unknown, but rather "playing the notes, rhythms, dynamics that you know, but in a context you have not played before."[216]

This exercise could be carried out using a hard copy of the score. That, however, would entail photocopying, cutting up the phrases, and randomly arranging the pieces of paper. A software program, on the other hand, can do that effortlessly. *EMedia Piano and Keyboard Method* is the only program that includes a similar exercise.[217]

Figure 13. Initial screen for exercise 4b, deliberately using the same piece as in exercise 4a.

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[216] Ibid., 243.

[217] See page 51 above.

        "Disappearing score" (exercise 4c) is reminiscent of Sloboda's experimental

method of measuring the eye-hand span.[218] Users will be warned that at random points

the score will disappear for a few seconds but they must keep playing. This will not only

encourage users to look ahead, but will also prompt them to guess and improvise if they

do not remember what was coming up (Figure 14). None of the sight-reading materials

reviewed, in print or electronic format, include an exercise of this kind. A teacher can of

course cover up a measure or take away the score while the student is playing, but the

software program can do it in a less disruptive and distracting way, in addition to making

this type of practice possible in the absence of a teacher.

Figure 14. Initial screen for exercise 4c.

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[218] See page 19 (note 73) above.

Streckfuss's pacer machine and Souter's *Sightreader* that force readers to look ahead by eliminating from view the current and a number of the upcoming beats, are effective practicing techniques for improving sight-reading ability.[219] However, neither of these tools allows readers to look back to the point of performance like expert readers like to do. In the proposed program, the "Look-ahead mode" (exercise 4d) will encourage users to look ahead, but at the same time allow them to return back to the point of performance since none of the notes will be eliminated. Instead, the notes that are one, two, or three beats ahead of the point of performance will be highlighted, therefore directing the readers' attention forward. A less prominent scroller will follow along the users' playing, marking the current point of performance (Figure 15). Another variation of this mode will encourage rapid eye movements in addition to looking ahead (exercise 4e). The users will be asked to play only the downbeats of each measure at each consecutive beat. To facilitate jumping ahead, the downbeat of each following measure will be highlighted (Figure 16).

Because of the required animation, this exercise is only possible in an electronic format. While some programs implement a scroller that follows the current point of performance, like *eMedia Piano and Keyboard Method* and *Home Concert Xtreme*,[220] none of them attempt to draw the users' attention to what is coming up in the score. *Etude Sight Reader* does mark both the current and next measures through two horizontal bars above the staff, but the placement of the markers is not optimal for drawing attention to the actual notes. [221]

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[219] See notes 79 and 80 above.

[220] See pages 51 and 60 above.

[221] See page 59 above.

Figure 15. Initial screen for exercise 4d, here set for two beats ahead, shown as the user plays the first beat.

Figure 16. Initial screen for exercise 4e, shown as the user plays the first downbeat.

Noticing and Retaining Information

Most pedagogues recommend taking time before starting to play to look at the score and try to make sense of it. In one exercise, users will be presented with a piece that is accompanied by general questions, such as finding the key signature, dynamics, and opening fingering (exercise 5a). Questions can also be more specific, such as finding all instances of a particular pattern or noticing similarities and differences between measures. Users will be urged to correctly answer the questions as quickly as possible, and a timer will display how long it takes them to complete the task (Figure 17, 18). This type of exercise is found in many sight-reading books, but not in any software programs. Instant feedback in the absence of a teacher is again a big advantage of technology implementation.

In this exercise you will have to answer correctly 4 questions about a piece.
Try to do it as quickly as possible. A timer will tell you how long it took you.
When you are done, play the piece!

START
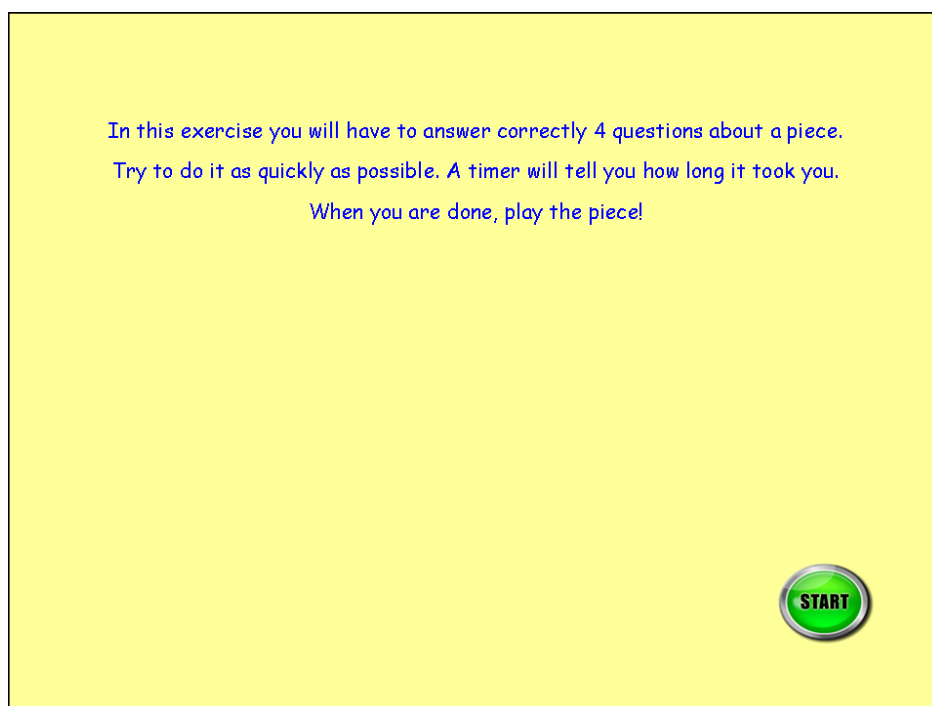
Figure 17.   Instructions for exercise 5a.

Figure 18. Four multiple-choice questions pertaining to the piece are displayed. The user selects one of the possible answers and gets immediate feedback. The timer at the top right will stop when all questions are answered correctly. The user can then play and record the piece.

A second exercise will not only test whether users notice important information about the piece but also whether they retain the information (exercise 5b). As noted in the second chapter, weak sight-readers do not remember important information about the piece immediately before or after they perform.[222] A piece will be displayed for a limited time and then disappear from the screen, at which point the user will have to answer general questions about that piece (Figure 19, 20, 21). Alternatively, the user will be given some time to look through the piece and start playing (exercise 5c). At a random point, the score will disappear and the player will have to answer questions about the piece (Figure 22, 23). These exercises, not found in any of the books or software programs, will encourage users to maintain their focus throughout the performance.

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[222] See note 157 above.

Figure 19. The initial screen for exercise 5b which will automatically progress to the following screen after thirty seconds.

Figure 20. Multiple-choice questions about the piece previously displayed. The user selects one out of three possible answers and gets immediate feedback.

Figure 21. After answering all multiple questions correctly, the user can play the piece.

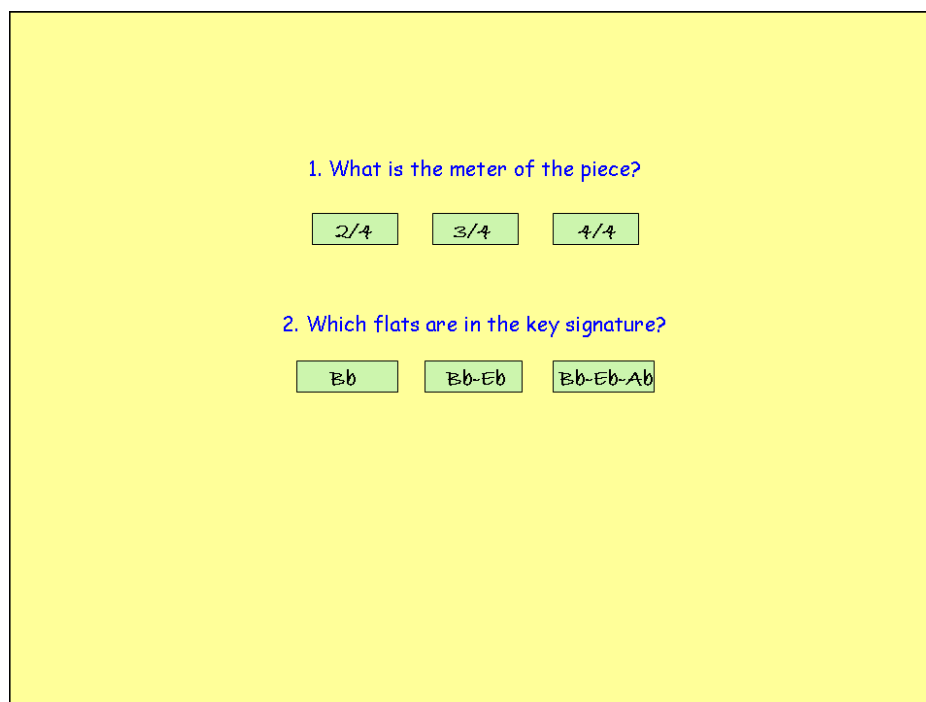Figure 22. Initial screen for exercise 5c.

Figure 23. At a random point while the user is playing the piece the score will disappear and this screen will be displayed. When the user answers the questions the previous screen will return and the user can resume playing.

Keep it Going

A common sight-reading problem is losing rhythmic continuity by stopping or stuttering. Many pedagogues advocate sight-reading as part of an ensemble to force the students to continue playing. Studies show that accompanying experience is a significant factor and predictor of sight-reading ability.[223] Furthermore, empirical studies have proven that playing an accompaniment while listening to the solo part or playing a solo part while listening to an accompaniment improves sight-reading ability.[224] In the proposed program, users will play piano duets (exercise 6a) or pieces for piano and another instrument (exercise 6b), while listening to the other part. The music will be displayed in an open score format, encouraging users to expand their vertical eye span and follow along another part while playing (Figure 24, 25, 26, 27).

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[223] See notes 42 and 47 above.
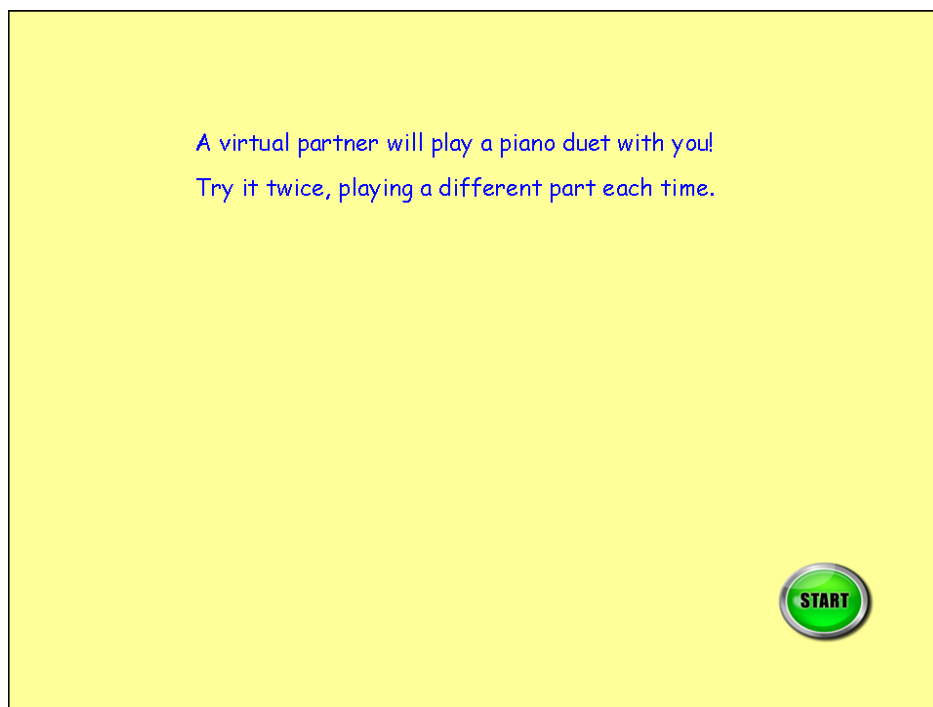
[224] See notes 48 and 49 above.

Figure 24. Instructions for exercise 6a.

Figure 25.   A piano duet. The user is encouraged to play it twice, once playing the *primo* and once playing the *secondo*.
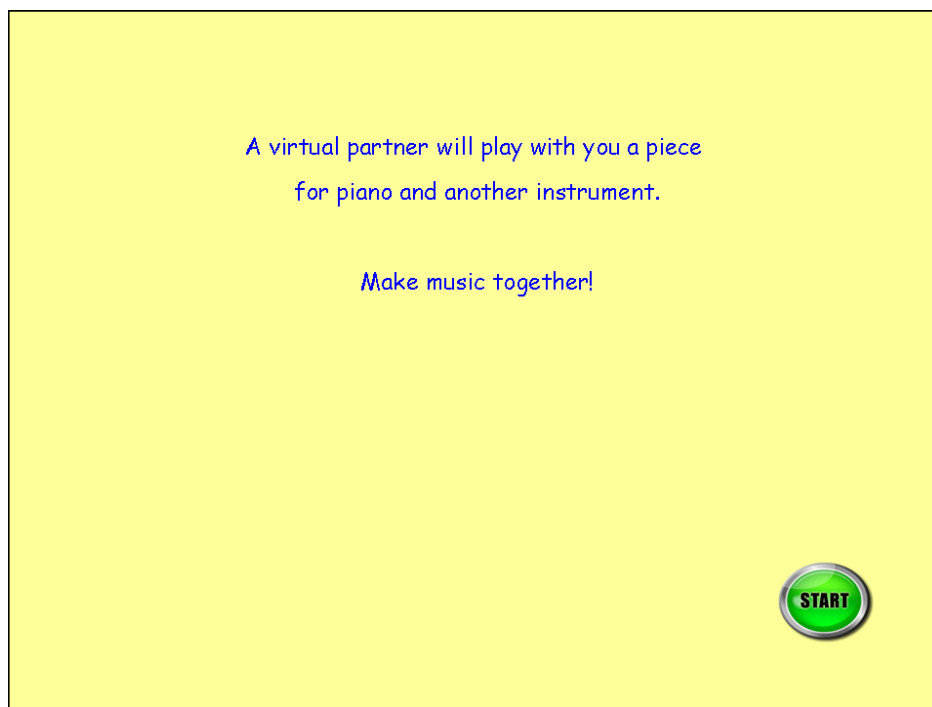
Figure 26. Instructions for exercise 6b.

Figure 27. A piece for piano and another instrument.

CHAPTER V

CONCLUSION

In the last thirty years many researchers in the fields of psychology, neuroscience, and music education have turned their attention to musical sight-reading. Their studies deal with perceptual, cognitive, and kinesthetic aspects of this skill. A general finding of these studies is that sight-reading is not a singular skill, but rather a collection of related component skills which are mostly practice-related. These skills are: looking ahead, reading patterns, predicting, rhythm-reading, kinesthetic, intuitive fingering, and analytical skills. Sight-reading experience and accompanying experience are factors that further affect sight-reading ability.

Some of these studies' pedagogical implications can be realized most optimally in an electronic format. Computers have the ability to manipulate and enhance a music score on a screen in real time, which is not possible with a hard copy. Furthermore, an electronic sight-reading trainer can have instant feedback capabilities, making it ideal for independent study or for reinforcement between piano lessons. Unfortunately, most of the existing electronic materials that claim to improve sight-reading deal only with fundamental skills. While the technology exists to create a software program that offers comprehensive, interactive, and independent practice in sight-reading, such a program is not available.

The program proposed in this essay aspires to fill this gap in sight-reading instruction. Some of the features of the program are instant and specific feedback capabilities, recording of users' performances for comparison with pre-recorded audio versions of the musical material, and animation techniques. These features are applied in a framework of sound pedagogy in order to develop effectively each of the component sight-reading skills.

The next step following this project will be to develop the program. This will require gathering and creating appropriate musical material and organizing it in a

systematic manner, similar to creating a graded sight-reading book. The assistance of a professional software engineer will be then needed to create the program.   An experiment will be carried out to test the effectiveness of the program in improving the sight-reading ability of pianists. If the results are positive, the program will be produced for commercial publication. The author intends to follow these steps.

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