The Role of Computer Programs in the Process of Creating Modern Educational Literature in Music Education

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Abstract: This article is devoted to the history of preparation of musical works for publication and the creation of contemporary literature using computer programs.

Keywords: innovative technology, computer literacy, information technology, computer programs, performance skills, musical knowledge.

Introduction

Anyone who has anything to do with music these days understands the value of a printed sheet. This value is measured not only in the cost of ink and paper. But even if we say that the notes are a reflection or fixation of the composer's intention, their importance is still overlooked. The need for music printing can also be seen in its complex journey from manual copying to computer typesetting systems and offset printing. For centuries, masters from different countries have worked to make printed musical text beautiful and convenient to convey not only precise performance instructions, but also the overall aesthetic intent of the composer.

In this respect, musical notation offers more freedom than conventional notation: aesthetic perception is affected by many components of the musical text, their relative position, the spaces between them ("air"), the distribution of musical material across lines and pages, and the score, performance instructions reveals in detail.

Music publishing dates back to a time when notation took a form close to what we know today, for which it was natural to combine several horizontal layers of the musical fabric (parts, instruments, voices, backgrounds) into a single flow. special patterns of vertical and horizontal construction. Before the first notes were printed, a system of written representation of time relationships in music had already been formed. All subsequent evolutions in musical notation have not changed these two essential features of musical notation: the addition of horizontal lines and temporal ratios. This difference between musical notation and text writing placed very high demands on music printing, which were successfully met at various stages of the development of science and technology.

For the culture of music publishing, which has been gradually developing over the centuries, new opportunities are opening today based on the use of computer technologies and the transition from traditional to new ways of working in music publishing. Realization of these possibilities requires serious scientific-conceptual and information-technological developments. However, doubts may arise: can the music publishing industry remain at the high level achieved by old ("manual") technologies? Can notes not lose the "liveness" that is imparted to them with the engraver's breath? And the use of computer methods will allow us to find a qualitatively new stage of development of music printing, new applications of sheet music in the field of musical performance and education, expand the scope of paper music publishing and make it virtual?

With the development of computer technology and high technology in recent decades, more and more types of information can be stored and processed electronically. And this is not only a respect for time, but also a meaningful need due to the growing need for this information, the speed of access to it, the reliability of storage, the flexibility of changing and updating it. to the possibility of automated search and analysis of this data.

Today, computers are widely used to store and process large amounts of traditional data, such as text, monochrome and color static and animated images, drawings, diagrams, sound tracks, output units, and control programs for electric musical instruments. The computer is entrusted with managing processes based on the analysis of these data in various areas of human activity.

Based on consumer requirements, equipment manufacturers are striving to increase the speed and reliability of this equipment, and are also looking for opportunities to increase the volume of recorded data. In this sense, they are far ahead of software developers for this hardware, who stopped being critical of their work and relied on the speed of the hardware and the size of its address space, hiding the flaws of the software. Such an attitude leads to inefficient use of technology and, with the increase in the volume of information, it leads to a serious slowdown in all processes related to its processing.

Therefore, the format chosen for its presentation on electronic media plays a major role in increasing the speed of information processing. A lot of speed can be achieved through development.

1. These fears are not unfounded. As PC and desktop publishing became more common, many non-professional publications such as books and sheet music appeared. The apparent technological simplicity becomes a temptation for people who are unprepared, lack publishing experience, don't know or appreciate tradition - and they turn to improvisation, increasing the number of bad publications. At the same time, many of those who mastered publishing skills and had experience in preparing books and sheet music could not master new technologies, their knowledge was no longer in demand. A format for storing certain data, focusing on some special cases of this data. However, this method leads to a sharp decrease in efficiency and sometimes even failure when working with other special cases. Thus, format development requires a compromise between implementing the universal principles of data generation and the specific circumstances of that data. This requires in-depth study of the information being developed by specialists in this field of information.

Notation (broadly understood as all notational systems, including notation, oral, digital, etc. - with which the author puts down his musical work on paper) is a field in which notation is used. The computer opens up a wide range of possibilities. First, a significant part of the hard physical work of a music engraver (stamper, copyist) can be transferred to the computer, requiring instead the work of an experienced music editor with computer skills. Secondly, it will be possible to create a database accessible via the Internet for electronic storage of texts of musical works. Thirdly, a computer with access to the specified data bank will help in conducting research with the texts of musical works and in their analysis.

Today, commercial projects related to the sale of notes via the Internet are becoming widespread. As a rule, they are made using the PDF electronic document format. However, this format can only be used in such projects if users purchase sheet music images. As musicology software became widely used, there was a need to distribute the music text available to run such programs, and the PDF format could not meet that need. In addition, the presentation of any information in a graphical form requires a much larger amount of memory and therefore more data transfer time than its "content" presentation. For example, one letter of the alphabet is encoded using one byte (in Unicode - two). However, if you transmit its graphic representation describing the coordinates

of all the points (or vectors) contained in it, it will occupy several kilobytes. The same can be said about musical notation: the representation of a single note in MIDI format takes several bytes.

2. Of course, the acquisition of computer technology is the second necessary condition for the successful development of such a format. its graphic description size is also measured in kilobytes. Voice always plays a crucial role in data transmission over the network.

The specified prospects are possible due to solving a number of problems in the development of computer programs and creating an integrated computer environment for the musician based on them. One of these tasks is to create programs for writing and arranging music (we call such programs notation programs). In recent years, many companies and individuals have been working in this direction. However, attempts to solve this problem outside of the rest of the complex lead to the creation of an integrated environment, because when developing a format for storing musical notation data, it is usually not intended to use this data for purposes other than visualization. Moreover, the idea that musical notes can only be manipulated as a simple set of straight and curved lines is deeply flawed: each symbol in musical notation carries a multilevel semantic load and is connected to other symbols by many spoken and unspoken laws. the main part is based on music and is illustrated by these characters.

3. Thus, the problem of creating an integrated computer environment for the musician should be clearly approached by developing a format for storing sheet music data that takes into account the musical load of all its components and allows the use of this information on all musical instruments. not just in any of the above areas. Such a format should not be limited to currently available notation systems, allowing for the use of all musical graphic concepts and associated notations associated with the development of the art of music. Such concepts should be introduced with as much flexibility as possible and used with equal ease.

The advantages and disadvantages of specific projects are discussed in the following chapters, respectively.

4. A promotional article describes the "advantages" of Music Publisher notation software: "In fact, the program knows very little about music (just like a word processor knows little English)." On the one hand, this "ignorance" of the program gives a person more freedom when writing complex modern music, because a computer controlled by such a program does not try to adapt the musical text to standards that do not correspond to a certain style. . On the other hand, it completely deprives us of the advantages of a computer that we have the right to expect from it - that is, to automatically perform routine tasks for us and follow all the formal rules necessary to write music on paper. as it already exists. Therefore, we are not only talking about creating a data storage format, but also about developing a musical notation data description language designed for interaction between software components of an integrated environment. This work does not set the task of fully developing such a language, because its construction is inextricably linked with the creation of all the components of the integrated environment discussed above. However, by studying existing musical notation encoding formats, it is now possible to identify their advantages and disadvantages and, on that basis, create new concepts for computer representation of notation.

The bibliographic material of this dissertation includes traditionally published literature, as well as information and articles posted on the Internet or distributed in various digital media. It can be divided into four groups:

1. historical-theoretical works on sheet music and music printing (including manuals for editors, proofreaders, engravers, stampers and copyists of music texts);
2. research on the use of computers by musicians (including music software manuals and reference books);

3. descriptions of note formats;
4. descriptions of computer programs and data formats that are not related to music, but provide useful solutions for the development of music data formats and programs, as well as literature on publishing.

An important part of the literature of the first group consists of works devoted to the development of local and world musical notation before and after the emergence of music publishing, among which I.A. Barsova's "Essays on History" should be mentioned. sheet music and W. Apel's polyphonic musical notation, which help reveal the origins of today's traditions in sheet music.

Among the works that have an idea about the development of music publishing, it is possible to highlight the "Essay on the history of music publishing" by the hereditary Russian music publisher B.P. Jurgenson and his article "How sheet music is printed", as well as the beginning of music publishing in Russia, the Russian printed music of the 18th century by B. J. Volman. can be seen in a number of works.

5. In the bibliography (Appendix E) all sources are listed in alphabetical order (first Russian, then foreign) in a single list, Russian music publications of the early 19th-20th centuries, "Triton" music publishing house.

As for the current state of music publishing in the era of computer technology, it is described in sufficient detail in local guides to the graphic design of musical texts.

A lot of useful information for setting up a computer music graphics system can be found in the correspondence of famous composers with well-known music publishers, such as Tchaikovsky and Jurgenson or Scriabin and Belyaev. The latter is especially interesting, because Belyaev in his publishing activity focused entirely on the aesthetic and general musical value of the publication, no matter how useless it may be, rather than from a commercial point of view.

An important source of material for working on the dissertation was the archive of the composer P. B. Ryazanov, who worked as an editor at the Triton music publishing house in the 1920s and 30s. Six storage units in his archive are devoted to "writing and editing techniques" - the subject of these notes. However, in their essence, they are the result of an analysis of many domestic and foreign notation publications, from which examples of the use of various objects of notation are copied. This collection was at one time instrumental in Ryazanov's work as an editor at Triton, and today it helps to find ways to formalize sheet music.

C. Kohoutek in his book "Composition technique in 20th century music" and G. Suponeva in "Problems of notation in 20th century music" think about the search for innovation in the field of notation. , as well as a number of Moscow authors in the Ars Notandi collection. Notation in a changing world, an exploration of past, present and future notation challenges.

The second group of sources includes user manuals provided by software manufacturers, non-software literature that contains purely useful information about the purpose of certain tools and program modules, practical recommendations and descriptions of the operation of programs. . . This aspect of the debate is even mentioned in one of S. Lebedev's publications "Final for Windows. A Practical Guide with Reflections". In addition to this book, which has passed through two editions, a number of other works can be named that reflect (to a lesser extent) the question of the compatibility of programs with musical requirements. This is a series of books by the father and son Petelins Personal Orchestra and on PC, Sound Studio on ShK, Personal Orchestra on PC, as well as the reference 600 sound and music programs compiled by the Moscow systematizer P. Zhivaikin, the reference V. Belunkov Musical possibilities of the computer and K. Eremenko's two-volume book From the Ice Age to the Age of Electronics.

A third group of sources consists almost entirely of English-language technical documents on developments by amateur authors, as well as entire communities seeking to achieve consistency and standardization in the sharing of music files. All these documents are posted on the Internet, where they are constantly updated and expanded.

Traditionally, several articles describing the structure of the MIDI format with varying degrees of specificity have been published, one of which has been translated into Russian (C. Petzold, Anatomy of MIDI

6. A topic close to the problems of this dissertation is mentioned in the theses of S. Lebedev Musurgia Universalis - a computer workstation for a musicologist.

When searching the literature on this topic, you should keep in mind that the methods of formalizing and encoding music graphics are trade secrets of notation software companies. If we talk about theoretical studies in this area, they do not exist at the moment. Therefore, only the above-mentioned documents and existing programs have a set of computer files known as PDK (.Plug-in Developers Kit), in which plug-in software developers provide technical descriptions of their data structures and the functions that work with them. for developers who want to create additional modules for these programs. References to these PDKs are also available on the aforementioned web page.

The very genre of these definitions means that they lack any theoretical basis, which calls for some caution in their use.

7. The importance of G.A. Smirnov's note-taking book using the Braille system should be emphasized. Although musical text is not directly related to computer notation, it contains valuable material for the work, as it describes the formalization and encoding of musical text in Braille, which is nothing more than a sequence of six-bit numerical values. formatted as various configurations of six dots within fixed-size rectangles. Information about each such rectangle can be stored in computer memory, occupying only one byte (two more bits in each byte are reserved for additional functions). So another completely open format for writing musical notes that we need to learn and describe it in the form of a mentioned book.

The fourth group of sources allows you to find similarities with music data among other data stored on the computer. With this, in some cases there is no need to invent anything, but you can use ready-made solutions. One of the most popular books on this issue is G. Born's "Formats" reference book

This mainly explains the illogical construction of existing formats from a musical point of view, their lack of flexibility and development.

8. An alternative source of information for researching existing methods of notation encoding is to study the files created by various notation programs in conjunction with practical work on these programs. data. Books on publishing software are also helpful. These books not only contain descriptions of the respective programs, but also provide additional information about the printing rules and the logic behind the internal workings of these programs. The famous typographer J. Tshihold's articles on the aesthetic image of the book are of great importance.

Today, experts from many countries are addressing the topic of notation, which can be seen in the many materials on this topic on the Internet. However, the authors of these materials are mainly programmers and cannot always imagine the full range of issues related to the encoding of certain elements and the general aesthetics of music publishing when transferred to a computer. As for musicians, they have the right to expect a new tool that can satisfy their needs in music publishing, copying, storage and analysis of music texts.

Thus, the relevance of the topic of this dissertation is determined by the general direction of the interests of modern musicians, as well as by the current needs of music publishers and companies creating software for musicians. Throughout the history of notation and music printing, there has always been a desire to use the latest advances in science and technology, so today it seems natural and necessary for the computer to enter the musician's daily life. Although recent research in the field of computer representation of musical notes by companies and scientists is often placed in a competitive environment and responds more to commercial interests than scientific and aesthetic, this research must continue and it is important to give it a scientific character, not just a narrowly understood one.

The main goal of the dissertation is the theoretical justification of the basic concepts of the computer language that formalize the description of the objects of musical notes. To achieve this goal, the following tasks were set:

9. TgX is a layout program that is a text description language interpreter. Notational extensions of this language are also known.
1. Observing the formation, development, and change of notation types;
2. To study the pre-computer principles of music printing, determined by the situation during the emergence and subsequent co-evolution of notation;
3. To review the principles of notation programs in terms of meeting the modern needs of music publishing;
4. To determine the specific advantages and disadvantages of existing formats for storing music notes;
5. Promote new practical concepts related to the methods of storing sheet music data, algorithms for working with them, as well as user interface elements designed to control the processes of preparing sheet music on a computer.

The scientific novelty of this work is that computer representation of sheet music became a subject of special theoretical research for the first time within the framework of an academic music educational institution. Musical notation is studied from its inception to the present day, and various stylistic trends in modern music reflected in musical notation are examined. For the first time, standard typographical concepts such as line, paragraph, and section are applied to a music publication, as well as new units such as vertical and vocal notation, which allow musicologists' marks to be stored alongside the text. use of music and computer music library information for educational purposes.

For the first time, instead of copying all the material for each part, it is proposed to use a single data stream for orchestral scores and parts with additional instructions for each part. For the first time, the memory allocation concepts found in modern high-level programming languages are applied to musical score data.

In 1984, one dissertation was defended at Indiana University, USA, on the topic related to the problems of this work. This is a computer generated sheet music by Donald Bird. Some of its rules were used to create the NIFF and SMDL formats and are discussed in this work.

Methodological foundations of research. The work is based on the basic requirements of modern music graphics, as they are presented in traditional music publications, as well as on the author's practical experience of preparing original layouts of new works of composers in music publishing. Theoretical researches on the fundamental problems of the study of sheet music became a guide in the search for methods of analysis, as they are presented in the works of domestic and foreign musicologists. The methodological basis for the development of a new language was the concepts of Backus-Naur and Donovan.

The practical importance of the thesis is that its results can significantly expand the scope of the use of computers by musicians, as they lead to the practical implementation of a universal computer workstation for a musician (musicologist, composer, etc.). finds its place in education and scientific research and creative activity. In addition, the analytical sections of the dissertation may be of interest to the employees of music publishers and motivate them to adopt new methods of music publishing.

Summary

Notation is constantly being improved. Some of its forms are used in one or two works and are forgotten. Some stay and are adopted by other musicians. The task of a music publisher is to ensure that musical opuses do not remain in only one copy of the author's manuscript. They should be open to learning and doing. Thanks to the use of modern information technologies, access to data banks and electronic libraries, where literary works, scientific researches and other information are stored, is becoming easier. However, among them, the introduction of sheet music is hindered by the lack of a universal format for storing music recordings in digital form. This work is intended in part to fill this gap and to propose ways of formalizing musical notation that help to solve this problem.

Thanks to the research carried out in this work, new ways of solving the traditional problems of musical notation have been opened, the use of modern compositional methods and the freedom in its recording have been expanded.

During the research, the main advantages and disadvantages of the software offered on the market today, designed for working with music notation graphics, as well as for working with music notation data storage formats, were identified. Analyzing these advantages and disadvantages allows us to formulate a number of new concepts not previously used in popular sheet music programs, which help to simplify, speed up and make meaningful the input, storage and processing of musical texts. computer. With this, the principles of a new notation program and a notation data description language were formed, which can be used in the development of a universal computer workstation for the musician (composer, musicologist, editor, student, etc.).

For the first time, new data structures were proposed for a writing program, such as vertical and paragraph patterns, rhythmic patterns, and patterns of mandatory elements at the beginning and end of lines. In addition, the concept of typographic style is not yet widely used in music software. For the first time, it is proposed to include musicological symbols in a music file along with the physical structure of the piece.

The prospects for the application of the results of this research seem very attractive, as they allow the creation of electronic music libraries, which is a very important issue in the context of the growing importance of the Internet. The field of music publishing is expanding: not only traditional paper music publications with high typesetting quality can be published, but also the market for electronic publications, which has a very promising future, can be developed. Commercial structures on the Internet are growing. Composers will be able to use the computer more flexibly to record their musical intentions using notation. A computer equipped with a new sheet music software allows a composer to create an electronic manuscript of his work at home.

One of the most important applications of a musician's computer workstation built using the concepts proposed in this work is professional education. By working with electronic music libraries, the student will be able to obtain a score for any work studied in the classroom. The computer allows you to listen to any part of the score while viewing the text on the screen at the same time. The teacher will be able to add their own marks to the electronic score file, making it easier to identify the thematic material of the work, analyze the form, study its harmonic, polyphonic structure and any other aspects.

The history of music graphics over the centuries seems very interesting in relation to the use of computers. As stated by G.I.Suponeva in her work "Problems of notation in music of the 20th century": "Replacing approximate methods of notation. a fixed note has arrived." The clearer the record, the easier it is to formalize that record for entry into the computer. There are examples of such precise logging that only a technician can reproduce, but for a human its instructions are redundant. However, then the sign took a step away from accuracy. Collecting the sheet music of many contemporary composers, the performer becomes a co-author, sometimes creating a new piece that is not exactly what the composer intended. Computer recording of such music is more complicated, since its component intended for semantic (and therefore auditory) perception is much freer than that intended for visual perception. But the music also took the next step: "Forward, to the note without music!" and even in this case, the computer must follow the writing, suggest new ways of conveying the author's intention, help describe the writing, whatever it is: which is as mysterious and exciting as the music itself.

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