

Musical Sound Engineering and Musical Computer Instrumentation

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Abstract: *Since instrumentation is primarily a branch of musicology, the authors propose a method of cognition of instruments that is primarily musicological, which examines them from the standpoint of timbre originality and sound dynamics when playing music, and only sometimes – tangentially – organological, that is, affecting the design features of the instrument.*

The problems of scientific classification of musical instruments have not yet been completely solved: there is no single generally accepted system yet.

This issue is becoming especially relevant in connection with the rapid development of modern music computer technologies (MCT). The authors of the article present the results of consideration of modern musical and computer tools based on the historically determined process of musical instrument development

Keywords: *Instrumentation, Sound Engineering, Musical Sound Engineering, Music Computer Technology (MCT), Musical Instruments.*

1. Introduction

Everything in life is evolving, evolving. Once upon a time, wild tribes were content with primitive body movements to the sound of percussion instruments. Much later, brass, plucked, bowed instruments appeared, and on and on... It seems that in our time the sound fantasy of musicians and masters of creating musical instruments has not stopped.

Not only musical instruments were improved, but also the performing skills of the artists, who were helped by their favorite instrument to manifest themselves as artists and virtuosos in their genre. Johann Sebastian Bach was a genius at playing the harpsichord and organ and a "dusty wig" (as his dim-witted contemporaries considered him) in the art of composition. On the basis of multi-string violas, Italian masters created the enduring value of the violin and cello, and geniuses of performing on these instruments appeared: Paganini, Izai, Oistrakh, Cassado, Rostropovich, Saffron... However, it was only at the end of the 18th century that the first

piano samples appeared, and at that time, as well as in the 19th century, the geniuses of piano music became Haydn, and Mozart, and Beethoven, and Schubert, and Liszt, and Chopin... "A pot-maker's instrument on which only the loud Beethoven can be played," — These words belong to the famous French philosopher Francois-Marie Arouet (Voltaire), who disparagingly called the piano a "pot-maker's instrument" because of its specific, sharp and ringing timbre. It is difficult to perform the canonical and powerful music of Ludwig van Beethoven on it, since the harpsichord was historically intended for another era and does not have the dynamic expressiveness of the piano. (We know that Ludwig van Beethoven was a master of several instruments, but the main one was the piano, as well as his predecessors, harpsichords and harpsichords.)

The twentieth century gave rise not only to perfect pianos from famous companies, but also to brilliant composers and virtuosos of piano music from Rachmaninov, Prokofiev, Shostakovich...

The evolution of keyboards naturally leads us to the birth of instruments such as various synthesizer models in the last century – with the richest possibilities of playing them. Are we waiting for the appearance of virtuosos of performing art on synthesizers, geniuses of new instrumental music? The inexorable laws of the development of all things portend: absolutely!.

2. Music Computer Instrumentation

For a musical sound engineer-practitioner, knowledge of instrumentation is considered mandatory and necessary, as well as for a professional composer, for an arranger, for a conductor of a symphony orchestra, for anyone who considers himself an expert and a figure in the high art of MUSIC. To some extent, the universal musician's erudition in matters of musical instrumentation contributes to the realization of his professional ambitions. In the Russian six-volume Musical Encyclopedia, instrumentation is defined as "a branch of musicology that studies the origin and development of instruments, their construction, timbre and acoustic properties, and musical expressive capabilities, as well as the classification of instruments." [11, p. 523].

Just as it is important for an artist-painter to feel and understand the meaning of the numerous shades of the color palette, so it is important for a sound engineer-musician to be able to hear the most subtle nuances of the sound spectrum in the music, to realize their role in the content of a piece of music, to understand how musical sounds are born, and to preserve and convey their authenticity in sound recordings without distortion. It would be ideal for each such sound engineer to be able to professionally hear any score with his inner ear, anticipating all possible artistic problems before and during its recording.

Instrumentation as a science appeared only in the 19th century, although the description of some instruments can be found back in the ancient era.

It can be assumed that the first impulses to music were, in the primitive system, the lullabies of the mother addressed to the child. At the same time, the collective cries of hunters celebrating their victory over a strong beast could well have consolidated into a steady short song. She, in turn, may have stimulated the rhythm of dancing to the roar of percussion instruments. Of course, it is not difficult to imagine that the first musical instruments were simple products made of wood, bone and stone. Nevertheless, it is precisely the "playing" of the human voice, perhaps the most primitive and at the same time the most complex original instrument for creating music, that gives rise to think of it as the forerunner of musical instruments. The "mother mother" of all musical instruments, of course, in our opinion, is the singing voice. Isn't that how the baby's gurgling becomes his first "musical" fun, as well as playing with his voice, and only later does he begin to play with all kinds of rattles?

Since instrumentation is primarily a branch of musicology, our method of understanding instruments will be primarily musicological, which examines them from the standpoint of timbre originality and sound dynamics when playing music, and only sometimes – tangentially – organological, that is, affecting the design features of the instrument. The problems of scientific classification of musical instruments have not yet been completely solved: there is no single generally accepted system yet. For example, in 1914, the classification proposed by V. Mayon (in 1888), according to which instruments are grouped into classes according to the types of vibrators:

- chordophones (strings);
- aerophones (organs, wind instruments such as flutes, clarinets, pipes...);
- membranophones (drums, timpani...);
- idiophones (cymbals, xylophone, bells...);

Today, this system should be supplemented, for example, with various kinds of mechanical and electric musical instruments (wax rollers, gramophones, electric guitars, synthesizers...).

The authors of the modern textbook "Musical Acoustics" by I. Aldoshina and R. Pritts demonstrate an original graphic scheme explaining such a classification [1, p. 204].

The authors propose a different classification, calling it performance. Having completed the drawing of this classification, which takes into account the fact that a person's singing voice is also an instrument that gives rise to a lot of beautiful music, and where – to some extent – it is possible to trace the historical sequence of the appearance of new instruments (both in the picture of the whole and within each group), we present it with the following scheme.

3. Conclusion

Telling a blind person about shades of red (for example, from pale pink to deep cherry) It is just as useless as telling a deaf person how the sound of a longitudinal and transverse flute differs: a blind person needs to see colors not only in a picture or computer monitor, but in nature, while a deaf person needs to hear this sound not only through headphones or sound speakers, but in reality – in a real acoustic environment. Our call to musical sound engineers is to always and everywhere listen to the rich timbre of all the voices of the world, live music, live sounds, and not "canned" ones – on carbon and vinyl records, on tape, on DVDs, on other new sound media, no matter how perfect they may seem

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Work experience:

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Gennady Belov's compositions for symphony orchestra, small musical ensembles and chorus have been performed at various concerts and festivals. He has designed the Bachelor's degree program "Music Computer Technology" and the Master's degree program "Music Computer Technology in Education" accredited by the Ministry of Education of the Russian Federation. Since 2002, Gennady G. Belov has been participating in the annual International Research and Practical Conference Contemporary Musical Education organized by the Herzen State Pedagogical University of Russia and the St. Petersburg State Conservatory. His articles have been published in various scientific journals and editions. He is the chairman of the jury of all-Russian competitions, including Musical Palette and CLARINE of the 21st Century, which have been held annually in St. Petersburg since 2008



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authored with M.M. Bryantsev, I.B. Gorbunova, E.V. Kibitkina, O.Y. Prazdnichnikh, 2009); a lot of electronic educational resources in the field of computer music creative work.

His articles have been published in various scientific journals and editions, for example: Gorbunova I.B., Kameris A. Music Computer Technologies in Training a Modern Teaching Musician. *Journal of Advanced Research in Dynamical and Control Systems*. 2020. Vol. 12. No. S6. Pp. 518-531; Gorbunova I.B., Kameris A. Music Computer Education Concept for Teachers: Raising the Problem. *International Journal of Recent Technology and Engineering*. 2019. Vol. 8. No. 2 S4. Pp. 913-918; etc.

In addition to original compositions, he has vocal cycles and arrangements for orchestra and ensembles of various musical instruments, performed in various concert halls in many countries.



Irina B. Gorbunova was born in St. Petersburg (Leningrad), Russia. DipMus, Special Music Higher School of the St. Petersburg State Conservatory named after N.A. Rimsky-Korsakov; BSc in Computer Science: Information Technology, Computer Science and Multimedia, Leningrad State University, Ussurisk State Pedagogical University; MA in Education, the Herzen State Pedagogical University of Russia; PhD in Information Technology and Pedagogical Sciences, the Herzen State Pedagogical University of Russia, St. Petersburg, 1989; Doctor degree: Doctor of Pedagogical Sciences and Information Technology, the Herzen State Pedagogical University of Russia, St. Petersburg, 1999. Dr., Full Professor, Chief Researcher of the Research and Methods Laboratory Music Computer Technologies at the Herzen State Pedagogical University of Russia, St. Petersburg; hold the degree of Honorary Worker of Higher Professional Education of the Russian Federation.

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Main publications:

Gorbunova I.B., Petrova N.N. Music Computer Technologies, Supply Chain Strategy and Transformation processes in Socio-Cultural Paradigm of Performing Art: Using Digital Button Accordion. *International Journal of Supply Chain Management*. 2019. V. 8. No 6. Pp. 436-445; Gorbunova I.B., Petrova N.N. Digital Musical Instrument as a Socio-Cultural Phenomenon. *Universidad y Sociedad*. 2020. V. 12. No. 3. Pp. 109-115; Gorbunova I. B., Petrova N. N. Digital Tools in the System of Contemporary Music and Art Education. *The World of Science, Culture, and Education*. 2019. No. 6 (79). Pp. 367-370.

Natalia Petrova is a winner of all-Russian and international competitions of professional performing skills in both acoustic and digital accordion. for many years, she has been actively engaged in cultural and educational work to promote acoustic and electronic musical instrumental performance in Russia. On account of N. N. Petrova numerous arrangements and arrangements for different models of synthesizers and digital accordion (accordion), phonograms-minus for acoustic instruments, chorus, etc. In her work, Natalia organically combines new electronic music technologies and traditions of the national performing school, broadcasting in her work a new musical electronic aesthetic based on high standards of academic instrumentalism and the values of artistic culture.

She has designed professional development programs for music teachers, including "Electronic Musical Instrument," "Digital Accordion," "Musical Instrument (Bayan-Accordion)," "Musical Instrument (Synthesizer)," etc.



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