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Acoustics of concert halls with organs in Russia: trends and problems

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Over the last decades the organ music has become one of the most popular kinds of classical music in Russia. About 30 new organs were built in concert halls, and old instruments were restored or rebuilt. Acoustical properties of 12 Russian concert halls with organs (Moscow, St. Petersburg, Perm, Kazan, Astrakhan, etc.) are presented and considered in the paper. In many cases acoustics in the concert halls is not so good for the solo organ music. The reasons are discussed. It was noted that the 'optimum' reverberation time recommended by acousticians for organ music had a tendency to be longer and longer in the 20th century. Values of the average sound absorption coefficient for organ front were estimated. Some problems in organ-building connected with the concert hall acoustics are discussed.

Over the last decades the organ music became one of the most popular forms of classical music in Russia. About 30 organs were built in concert halls, and several old instruments were restored. At the moment several organs are to be built or restored in St. Petersburg, Moscow, Kaliningrad (former Koenigsberg), Khanty-Mansijsk. Over the last years several organs were moved to Russia from the European countries (Great Britain, Finland, Germany, Switzerland, and Sweden).

It is well known that the Russian Orthodox Church does not use organ in service. So the organ concerts in Russia are played usually in concert halls. Unfortunately in most cases concert halls with organs in Russia are not satisfactory for the solo organ music. The principal acoustical defect of these concert halls is insufficient values of reverberation time, and sometimes the incorrect placing of organ, disparity between organ and hall, poor quality of organ.

It is well known that the organ music requires the longest reverberation time in comparison with other forms of music. Many special features of organ compositions are connected with the long reverberation time (it was noted in [1] that J. S. Bach created his organ composition for the concrete acoustical conditions of the churches where he worked). Organ-building and organ music were formed in rooms with long reverberation time. For this reason the opinion that organ music in concert hall requires more short reverberation time than in church seems to be baseless. It is known that the organ sound may be even discomfortable in halls having short reverberation time.

It seems to be that one of the main reasons of comparatively poor quality of concert halls for organ music in Russia consists in too short values of 'optimum' reverberation time which are recommended for acoustic design of concert halls [2, 3]. Practically all halls and churches considered to have good acoustical properties for solo organ music are too 'resounding' if they are estimated by means of these recommendations. Fig.1 represents values of 'optimum' reverberation time recommended in [2, 3] (dashed line), the 'optimum' reverberation time recommended in [4] (solid line), and values of reverberation time (frequency 500-1000 cps) for well-known churches and concert halls, the reverberation times for several Russian concert halls are represented also (for occupied rooms):

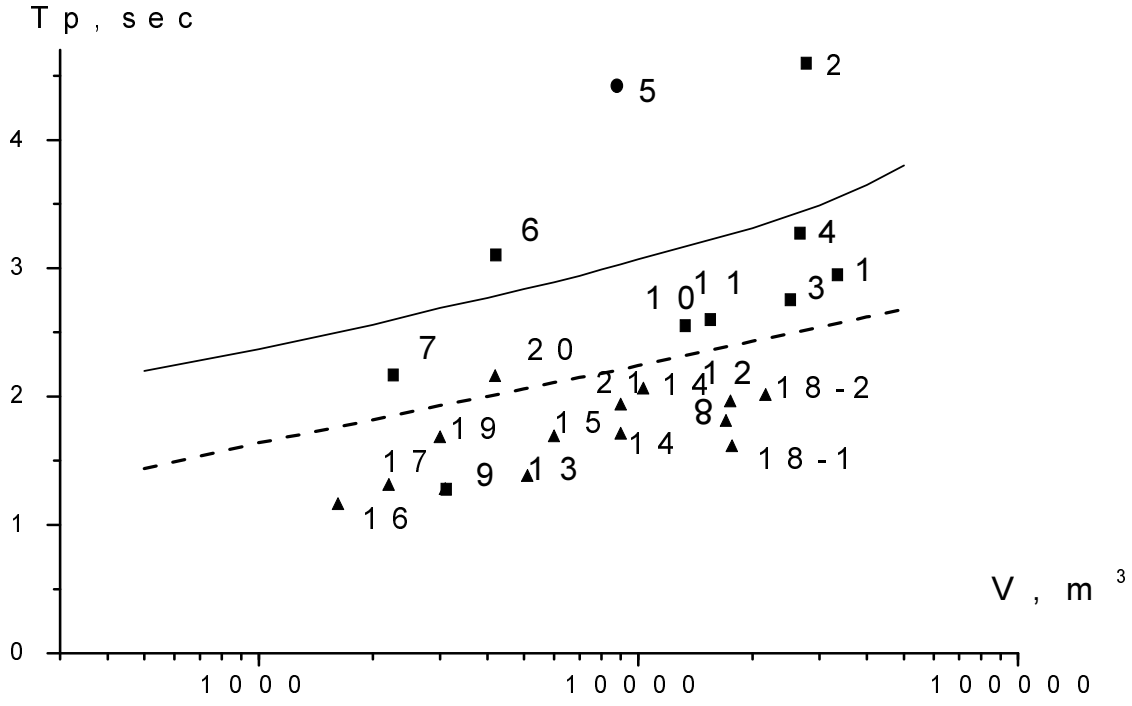

Fig.1 Reverberation time versus volume of the room:

1 - Michaeliskirche, Hamburg [5]
2 - Domkirche, Freiberg [6]
3 - Thomaskirche, Leipzig [7]
4 - Frauenkirche, Dresden [6]

5 - Domkirche, Arlesheim [6]
6 - Lukaskirche, Bonn [6]
7 - Luth. Kirche, Reinhardsgrimma [6]
8 - The 'Big' Hall of the Moscow Conservatoire [3]
9 - The 'Small' Hall of the Moscow Conservatoire [8]
10 – Fukushima Concert Hall [9]
11 – Tokyo Fine Arts and Music National University [10]
12 – The 'Big' Philharmonic Hall of the Moscow International House of Music (MIHM) [11]
13 – Chamber Hall of the MIHM [11]
14 – The 'Big' Concert Hall of the Tatarstan Republic [12]
15 – The St. Petersburg Academic Capella Concert Hall (data by M. Lannie and the author)
16 – The Nizhniy Novgorod Conservatoire [12]
17 – The Organ Hall of the Central Museum of Musical Culture (data by M. Lannie and the author)
18 – The Tchaikovsky Concert Hall (Moscow) (1 – before the repair, 2 – after repair) [13]
19 – The Organ Hall of the Perm Philharmonic Society [14]
20 – Concert Hall of the Astrakhan Conservatoire [15]
21 – The Organ Hall in Naberezhnye Chelny [16].

It follows from Fig.1 that values of reverberation time in all 'good' rooms are essentially longer than recommendations [2, 3] in spite of large amount of scatter. It is easy to see as well that recommendation [4] corresponds to 'good' rooms better than [2, 3].

It is interesting to note that the 'optimum' reverberation time for organ music had a tendency to be longer and longer in the 20th century (Fig. 2).

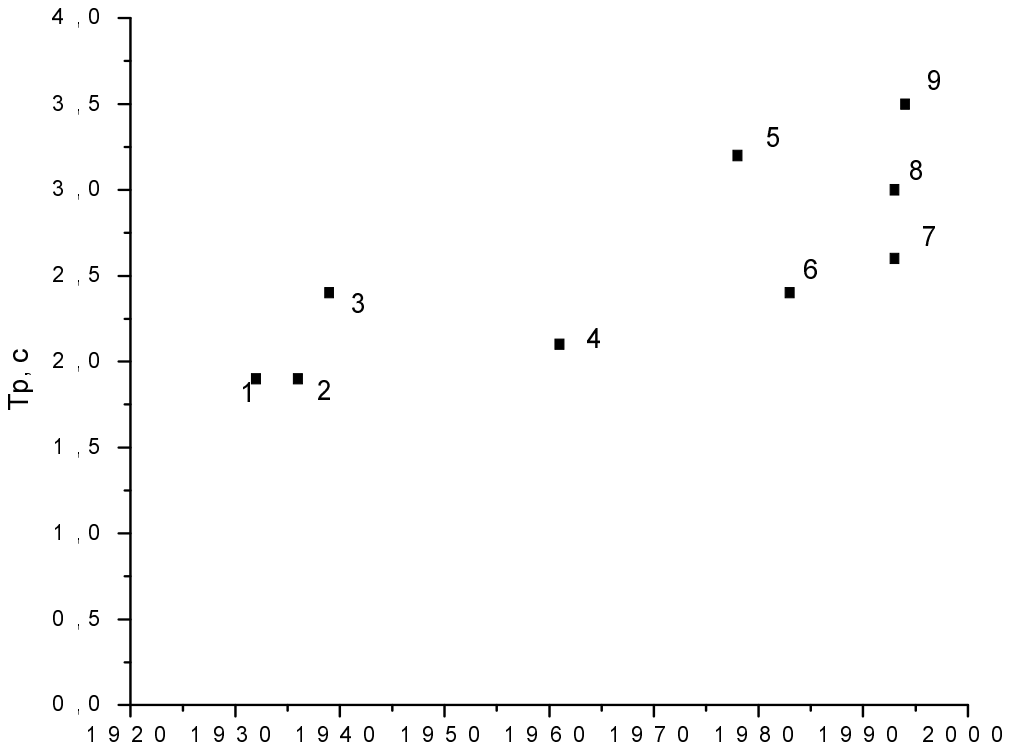

Fig.2 Optimum reverberation time for organ versus years in the 20th century (for room volume 20000 m^3):

1 - V. O. Knudsen, 1932 [17] – 1.9 sec
2 - W. Ellerhorst, 1936 [18] – 1.9 sec
3 – J. Engl, 1939 [7] – 2.4 c
4 - L. Cremer, 1961 [8] – ~2.1 sec
5 - K. B. Ginn, 1978 [4] – 3.2 sec
6 – Russian recommendations, 1983 [2, 3] – 2.4 sec
7 - W. Ahnert, F .Steffen, 1993 [19] – 2.6 sec
8 - D. Templeton et al., 1993 [20] – more than 3 sec
9 - F. A. Everest, 1994 [21] – 3.5 sec.

It is interesting to compare the recommendations for optimum reverberation time given by acousticians mentioned above with the recommendations given by experienced organ-builders and organ consultants:

W.Supper (1959) - from 2 sec to 2.5 sec for different room volume [22];
W.Adelung (1972) – from 2 sec to 3 sec for different room volume [23];
W.Oberlinger (1980) – from 2 sec for small rooms to 6 sec for large rooms [24];
J. Glatter-Goetz (1988) – from 3 sec to 7 sec [25];
H.G.Klais and Ph.Klais (1990) – from 3 sec to 4 sec [26];
W.Adelung (1991, 2003) – from 3 sec to 5 sec [27].

We can note that in most cases the values of the optimum reverberation time recommended by organ-builders and consultants are longer than values recommended by acousticians. We can note as well a tendency to more long reverberation time at the end of the 20th century.

The problem of optimum reverberation time for concert halls for solo organ music is not sufficiently clear and must be investigated more thoroughly.

One of the principal acoustical design factor is the specific room volume for one listener. This value depends on the function of auditorium. In [2, 3] the specific volume 10-12 m^3 is recommended for organ music, but in good halls for organ music the specific volume is more than this value. Brüel recommended 13-17 m^3 [8], and this value seems to be more realistic.

It is obvious for us that the Russian recommendation for the optimum reverberation time and the specific volume should be revised taking the international practice into account.

The other problem is connected with the usual functions of concert halls for classical music in Russia. In most cases concert halls with organs are used not only for organ music, but for symphonic and chamber music as well. For this reason the reverberation time in such concert halls is compromise between optimums for the organ and for the chamber music. In the best cases the reverberation time is equal to the optimum for the symphonic music, but never for the organ music. Even when the church building with the organ was used as a concert hall, its acoustics was made more "dry" in order to use it for the chamber music (Kaliningrad in Russia, Kiev in Ukraine, etc.).

It is clear that the concert hall with adjustable acoustics should be built. At the present time there are no successful examples of such concert halls in Russia, in spite of some attempts (Kazan, Moscow). Systems of the 'electronic architecture' should be used in concert halls where acoustics can not be changed by natural ways.

One of the problems in the acoustical design of large concert halls with big organs is the height of the organ. Usually it can not be less than 13-14 meters due to very long 32' pipes. In such halls the special sound reflecting elements should be installed near the organ, because the sound reflection from the ceiling is not effective enough. Unfortunately, no concert halls in Russia were designed with such special sound reflectors.

The specific acoustical feature of the organ is the very effective sound absorption. We have investigated this problem in contacts with acousticians M. Nagata, F. Kawakami, organ-builders C. Zachariassen, Suto, Ph. Klais, et al., and at the moment we have average sound absorption coefficients for the organ front which can be used for the preliminary acoustic design. These coefficients are not less than 0.4, and in most cases they are more than 0.6. The average values of the coefficient are equal to 0.55-0.7 for the traditional type of the organ front (nearly plane surface with pipes and wooden details). These values were used in our acoustic design practice and they seem to be reliable enough.

The very important problem is the correct planning of the organ in the concert hall or in the church. We are sure that the placing of the great organ near altar is not correct as a rule (such placing was usual in concert halls which were built in former churches in the USSR). It is necessary to take into consideration the mutual placing of the organ, the orchestra and the choir; because the delay of sound may prevent the performance from asynchronous playing (this problem becomes particularly important when the action of the organ is too 'flabby', for instance, due to pneumatic elements).

Sometimes organs are installed in the rooms like the theatric hall, and organ-builders try to divide the instrument into 2 parts on the left and on the right sides of the stage. This planning is not so bad if the reverberation time is long enough, but in the 'dry' acoustics such organ sounds like two different instruments having no acoustical connection between its parts (an example one can see at the Palace of Arts of the pulp and paper factory in Kondopoga, Karelia, where the 52-stop 3-manual organ was installed in 2000).

Over the last two decades about 20 old organs were moved to Russia from the European countries. The number of old organs which were moved to Russia is more than the number of new organs built in Russia during the last 20 years. But, when the organ is moved to the new concert hall, auditorium, or church, the good acoustic results are achieved very rarely. A new hall must have the acoustical parameters and function similar to those of the former hall, but this requirement is satisfied very seldom. The instance of the moving of the old English church organ one can see in the choir auditorium at the Russian Academy of Music (Moscow), the result is not impressive. The instance of the successful moving of the analogous organ we can see in the Roman Catholic Cathedral in St. Petersburg. Concerts in the latter church became very popular in spite of very modest size of the organ (II/P/10). The big organ from the Basel Lutheran Cathedral (Kuhn, IV/P/73) was moved more or less successfully to the Moscow Roman Catholic Church. We do not discuss the technical and sound quality of these "second hand" organs. Sometimes it is the only way to install the organ for the church or for the music school.

Another problem consists in the choice of organ-building firm. The most of organs in the Soviet Union were built by 'Rieger-Kloss' (Krnov) and 'A.Schuke' (Potsdam). Usually those instruments were not of special interest. Most of them were built according to the 'Orgelbewegung' ('Organ Revival') style of the 1960s – 1970s. The Russian organ culture needs more interesting instruments built in different styles, not only the primitive 'Orgelbewegung'. During the last 20 years 'Klais', 'Glatter-Goetz', 'Beckerath', 'Flentrop', 'Hugo Mayer' and other organ-building firms built organs in different styles. The biggest organ in Moscow was built in 2004 in the Moscow International House of Music (IV/P/84) by the German organ-builders Klais and Glatter-Goetz in cooperation. This organ was built in the German romantic style, and the result was met by organists with interest. The problem is the last decades practice to build "euro-organs" which have not any style and have not their own faces. Such instruments incorporate partly the German baroque style, partly the German romanticism, partly the French romanticism, and so on. Of course, such organs seem to be suitable for all kinds of organ music, but this is not a style in organ-building.

About 10 historic organs of 19th century were preserved in Russia (mainly in Moscow and St. Petersburg). Important restorations of three historic organs were made in Russia in the last 10 years. The successful restoration of the

F.Ladegast organ (1868) in Moscow was carried out in 1996-8 by the 'Vilnius Organ-Building Workshop' directed by Rimantas Gučas (Lithuania). The Sauer organ (1898, III/P/33) was restored by the Huefken organ workshop (Germany) in SS Peter @ Paul's Lutheran Cathedral in Moscow. The historic organ of the St. Petersburg Capella (E.F.Walcker @ Cie, 1891, originally it was installed in the Dutch Reformed Church in St. Petersburg and was moved to the Capella in 1927) was restored successfully in 2005-2007 by the Eule Company of Bautzen, Germany. The latter instrument was enlarged in the Walcker style to 57 stops in order to meet the acoustics of the large concert hall. Just before the restoration of the Walcker organ the Capella Concert Hall was restored (2005), and the main problem during this restoration was to preserve very good, "warm" acoustics of the hall. This problem was solved successfully.

Time goes by relentlessly. In spite of not so good results of the 20th century for the Russian organ culture, we hope that new concert halls with fine acoustics will be built in Russia in the 21st century, and new magnificent organs will be installed in these concert halls.

References

[1] T. Schultes, Untersuchungen über Raumakustik. Diss. T.H. Darmstadt, 1934

[2] Recommendations for Acoustic Design of Halls, Moscow, 1983 (in Russian)

[3] L. Makrinenko, Acoustics of Auditoriums in Public Buildings, ASA through the American Institute of Physics, 1994

[4] K. B. Ginn, Architectural Acoustics, Brüel and Kjaer, 1978

[5] F. Ingerslev, Acoustics in Contemporary Building Practice, Gosstroyizdat, Moscow, 1957 (in Russian)

[6] W. Lottermoser, Orgeln, Kirchen und Akustik. Bd. I, II, Bochinsky, Frankfurt am Main, 1983

[7] J. Engl, Raum- und Bauakustik. Akademische Verlagsgesellschaft m.b.H., Leipzig, 1939

[8] S. P. Alekseev, Acoustics of Concert Halls, Znanie, Moscow, 1969 (in Russian)

[9] M. Nagata, "Uncertain factors in acoustical design", *Music and concert hall acoustics. Conference Proceedings from MCHA 1995 / Ed. by Y.Ando and D.Noson*, London: Academic Press, 1997, P.337-344.

[10] M. Nagata, "Design Problems of a Concert Hall with an Organ", *Nagata Acoustics Inc. Technical Report No.1* (March 1999)

[11] Technical Report on the acoustics of the Moscow International House of Music, Moscow, 2003 (in Russian)

[12] P. Kravchun, M. Lannie, V. Sukhov, "Results of Rebuilding of the Concert Hall of Nizhny Novgorod Conservatoire and the Big Concert Hall of the Tatarstan Republic", *Proceedings of the 10th Session of the Russian Acoustical Society*, Vol.3, Architectural Acoustics, Moscow, 2000, P.53-56 (in Russian)

[13] M. Lannie, V. Sukhov, "Problems of Acoustics of the Tchaikovsky Concert Hall in Moscow", *Proceedings of the 16th Session of the Russian Acoustical Society*, Vol.3, Architectural Acoustics, Moscow, 2005, P.161-165 (in Russian)

[14] P. Kravchun, M. Lannie, V.Sukhov, "Acoustics of New Organ Hall in Perm", *Proceedings of the 15th Session of the Russian Acoustical Society*, Vol.3, Architectural Acoustics, Moscow, 2004, P.112-115 (in Russian)

[15] P. Kravchun, M. Lannie, "Acoustics of Two Concert Halls in Astrakhan", *Proceedings of the 15th Session of the Russian Acoustical Society*, Vol.3, Architectural Acoustics, Moscow, 2004, P.116-119 (in Russian)

[16] P. Kravchun, M. Lannie, "Acoustics of New Organ Hall in Naberezhnye Chelny", *Proceedings of the 16th Session of the Russian Acoustical Society*, Vol.3, Architectural Acoustics, Moscow, 2005, P.158-161 (in Russian)

[17] V. O. Knudsen, Architectural Acoustics, John Wiley and Sons, New York, 1932

[18] W. Ellerhorst, Handbuch der Orgelkunde. Benziger und Co., Einsiedeln, 1936

[19] W. Ahnert, F. Steffen, Sound Reinforcement Engineering, Stuttgart, S. Hirzel Verlag, 1993

[20] D. Templeton et al., Acoustics in the Built Environment, Butterworth Architecture, Oxford, 1993

[21] F. A. Everest, The Master Handbook of Acoustics, 3rd Edition, TAB Books, New York, 1994

[22] W. Supper, Kleines Orgelbrevier für Architekten, Verlag Georg D.W.Callwey, München, 1959

[23] W. Adelung, Einführung in den Orgelbau. VEB Breitkopf & Härtel Musikverlag, Leipzig, 1972

[24] W. Oberlinger, "Acoustics in churches. Its influence on organ design", *ISO Information*, 21, 3-7 (1980)

[25] J. von Glatter-Götz, "The organ and spatial acoustics", *ISO Information*, 28, 17-26 (1988)

[26] H. G. Klais, Ph. Klais, The siting and planning of organs, Johannes Klais Orgelbau, Bonn, 1990

[27] W. Adelung, Einführung in den Orgelbau, Breitkopf & Härtel, Wiesbaden, 2003