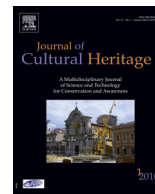




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Case study

Measurement of intelligibility and clarity of the speech in romanesque churches



Pavol Brezina*

Department of Music, Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 94901 Nitra, Slovakia

ARTICLE INFO

Article history:

Received 1st March 2014

Accepted 19 June 2014

Available online 11 July 2014

Keywords:

Acoustics

Romanesque churches

Cultural heritage

Speech intelligibility

Architecture

ABSTRACT

Intelligibility and clarity of the speech are important acoustic parameters of sacred spaces, such as churches and temples. The study focuses on the description of the acoustic characteristics of Romanesque churches with a matroneum from the 10th up to the 12th century and compares the results of measurements taken from different positions intended for speech recitation. From the complex acoustic research, the case study focuses on the presentation of the results of measurements of clarity and intelligibility of the speech via acoustic field research. The research objects are three important Romanesque churches with a matroneum in Slovakia—Christian Reformed Church in Kalinčiakovo, St. Stephen-King Church in Nitra and the Our Lady Queen of Angels Church in Sádok. The aim of the research is to highlight not just the differences but also the commonalities of the selected acoustic parameters of these churches.

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1. Introduction

The Romanesque cultural heritage is one of the primary research objects in archeology, history, restoration, art and architecture. Its extensive archaeological and historical-artistic research has recently started to increasingly encompass acoustic research, too. Firstly, it comes to describing the basic acoustic properties of the space by measuring various acoustic parameters. From the Romanesque period, among the most frequently studied spaces are ancient theatres [1] and sacred buildings [2]. In addition to the characteristics of the acoustic properties, the research also deals with virtual acoustic environment simulation, and some of the studies are devoted to the specific research of historical buildings in terms of human speech intelligibility and musical interpretation [3]. The possibility of keeping such virtual models as intangible cultural heritage has also begun to be discussed [4]. This case study is devoted to the research of intelligibility of the speech in smaller Romanesque churches with a matroneum. In churches, the speech is currently most frequently uttered from the area in front of the altar, but in the past the specific raised points, such as the pulpit, were the dominant place, especially during sermons. The measurement and comparison of the intelligibility of speeches given from selected places in the church compare the level of functionality of these places via a new scientific perspective. The primary objective of this case

study is to document the important acoustic parameters of smaller Romanesque churches, which are important historical monuments of Central Europe. Similar research has not as yet been conducted. This is also research which documents the acoustics of important cultural sites as a form of intangible cultural heritage.

2. Research objects

The selected research objects (Fig. 1) were the oldest preserved Romanesque churches in Slovakia—Christian Reformed Church in Kalinčiakovo (a), St. Stephen-King Church in Nitra (b) and the Our Lady Queen of Angels Church in Sádok (c). The history of the Christian Reformed Church (volume: 272 m³) in Kalinčiakovo dates back to when it was built in the first half of the 12th century. It is now one of the most important Romanesque buildings in Slovakia. Originally, the Roman Catholic Church dedicated to St. Anne was violently taken by the Calvinists in 1655 [5]. Reconstruction works on site were carried out in 1932, 1956 and 2003 [6]. From a construction point of view, the church consists of a Romanesque apse and a nave. St. Stephen-King Church in Nitra (volume: 316.8 m³), located in the neighbourhood of Párovce, is a characteristic single-nave building with a matroneum and a semicircular apse [7]. The church stood in this place probably in the 10th century. In the 11th and 12th century, it was rebuilt in the Romanesque style [8]. Until 1992, the church was seldom used and fell into disrepair. The change came on 1st September 1992, when it was rented to the Greek Catholic Church [9]. Several changes then took place inside the church, the most striking one being the space adaptation for

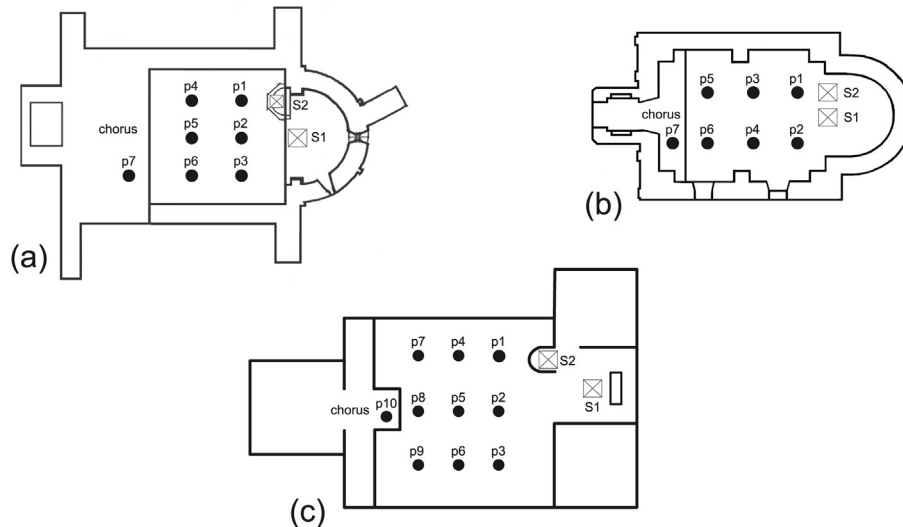
* Tel.: +421904247459.

E-mail addresses: pbrezina@ukf.sk, bluerecording@gmail.com



Fig. 1. Exterior and interior photos of churches. (a): Christian Reformed Church in Kalinčiakovo; (b): St. Stephen-King Church in Nitra; (c): Our Lady Queen of Angels Church in Sádok.

Part A



Part B

octave band centre frequencies (Hz)	125	250	500	1000	2000	4000
T₃₀ (s)						
Christian Reformed Church in Kalinčiakovo	1,35	1,30	1,33	1,27	1,17	1,08
St. Stephen-King Church in Nitra	2,19	1,98	1,70	1,36	1,14	0,96
Our Lady Queen of Angels Church in Sádok	1,25	1,36	1,37	1,34	1,25	1,10
T₂₀ (s)						
Christian Reformed Church in Kalinčiakovo	1,35	1,31	1,32	1,27	1,16	1,07
St. Stephen-King Church in Nitra	2,18	1,97	1,66	1,37	1,14	0,96
Our Lady Queen of Angels Church in Sádok	1,24	1,37	1,36	1,34	1,25	1,10

octave band centre frequencies (Hz)	125	250	500	1000	2000	4000
EDT (s)						
Christian Reformed Church in Kalinčiakovo	1,28	1,24	1,28	1,22	1,13	1,02
St. Stephen-King Church in Nitra	2,16	1,97	1,62	1,35	1,15	0,95
Our Lady Queen of Angels Church in Sádok	1,28	1,36	1,37	1,37	1,24	1,11

octave band centre frequencies (Hz)	500	1000	2000	4000
T_s (ms)				
Christian Reformed Church in Kalinčiakovo	92	85	78	70
St. Stephen-King Church in Nitra	119	94	79	64
Our Lady Queen of Angels Church in Sádok	108	101	92	78

Fig. 2. Part A: church floor plans indicating the location of sound sources (S) and microphone positions (p). (a): Christian Reformed Church in Kalinčiakovo; (b): St. Stephen-King Church in Nitra; (c): Our Lady Queen of Angels Church in Sádok. Part B: reverbation time (T₃₀, T₂₀), early decay time (EDT) and the centre of impulse response (T_s) measured values for individual churches.

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