

Acoustic Evaluation of the Reconstruction of Heinrich Mundt Pipe Organs in Prague

V. Syrový, Z. Otčenášek, J. Štěpánek

*Sound Studio of the Faculty of Music, Academy of Performing Arts Prague,
Malostranské nám. 13, 11800 Praha 1, Czech Republic, e-mail: syrovvy@hamu.cz*

The Baroque organ in the Church of Our Lady before Tyn in Prague (1670–73) was reconstructed in 1998–2000. Acoustic measurement for documentation purposes was carried out before and after the reconstruction. The diagnostic method developed enables a detailed study of the plenum and its contributing stops. Results revealed that levels and contributions of lower plenum harmonics were preserved and that higher harmonics were strengthened owing to correction of Mixtur stops.

INTRODUCTION

The organ in the Church of Our Lady before Tyn in Prague, built by Heinrich Mundt in 1670–73, is among the most famous Baroque organs in Central Europe. The organ was reconstructed as part of long-term general reconstruction of the church in 1998–2000. Its original specification was preserved together with original pipes, as well as wind-chests and action. The goal of the reconstruction was to preserve the character of instrument's original sound.

Two acoustic measurements for documentation purposes were carried out to enable comparison of the instrument's sound on July 1992 before the reconstruction, and on September 2000 after the reconstruction. The documentation method used was developed in 1991–92 [1] especially for documenting acoustic properties of rare historical organs, including measurement and diagnostic techniques.

METHOD AND RESULTS

The basis of the method is digital recording of the sound from all pipes of documented instruments and room acoustic measurement [1]. The quasi-stationary parts of the tones are recorded by three microphones placed in the typical listening position in a church, 4 m above the floor and with a 2-m span among them. Three neighbouring semitones (triads) are played simultaneously [2] and a mean amplitude spectrum along with the time signal of the first microphone for each triad is recorded. In addition to all pipe stops, a plenum sound of every organ machine is documented. The sampling rate adapts fluently to the stop foot length, as well as to the fundamental frequency in cases of stops without repetition (sliding sample rate). This assures the same discrimination of tones in the spectrum of all triads. Two microphones measure the

starting transients of C-tones of all stops, one in the position of triad measurement and one placed close to the organist. The impulse responses measured by the MLSSA measurement system [3] are used to calculate frequency dependence of reverberation time (Figure 1).

It is possible to separate the harmonics of individual tones in each triad spectrum until the 6th harmonic and calculate their levels. These values, established for the whole range of the stop, enabled a detailed view of the properties of the spectrum both in different measurements (Figure 2) and among different stops. The sound character of the instrument is most expressive in the plenum. The Mundt Great Organ plenum consists of octave and quint principal stops; thus in its spectrum the following harmonics dominate: 1, 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 24, 32, 40, 48, 64, 80, 96. Each of their frequencies fall into different third-octave bands if the band boundaries change according to fundamental frequency [4]. The levels of harmonics calculated in the whole instrument range for every plenum constituting stop were used for the assessment of the contribution of these stops to the individual harmonic of the plenum, and thus enable examination of the intoner voicing intentions. One can gain a more general view of sound character by averaging levels over the octave. Figure 3 gives an example of the results of the diagnostic procedure for averaged values in octaves C3 and C4 of the Great Organ.

CONCLUSION

The results reveal that some reconstructed pipe stops have better balanced levels of harmonics in the whole instrument range. Levels of lower harmonics of the plenum remained practically unchanged, including the size of the contribution of individual stops. The strengthening of plenum levels of higher harmonics is related to the correction of Mixtur and Cembalo pipes.

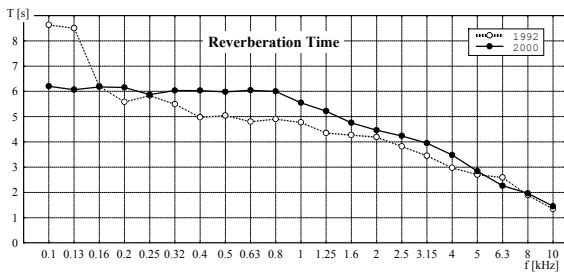


FIGURE 1. Reverberation time in the Church of Our Lady before Tyn measured before (1992) and after the church's reconstruction (2000).

ACKNOWLEDGMENT

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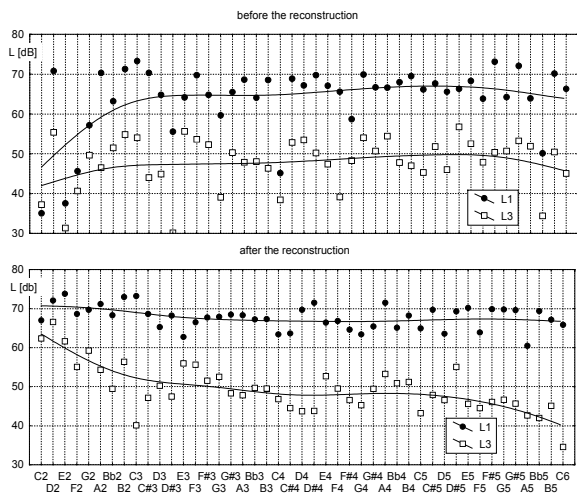


FIGURE 2. Levels of the first (L1) and third (L3) harmonic of Bourdonflauta 16' closed pipe stop with least square fit, before and after the reconstruction.

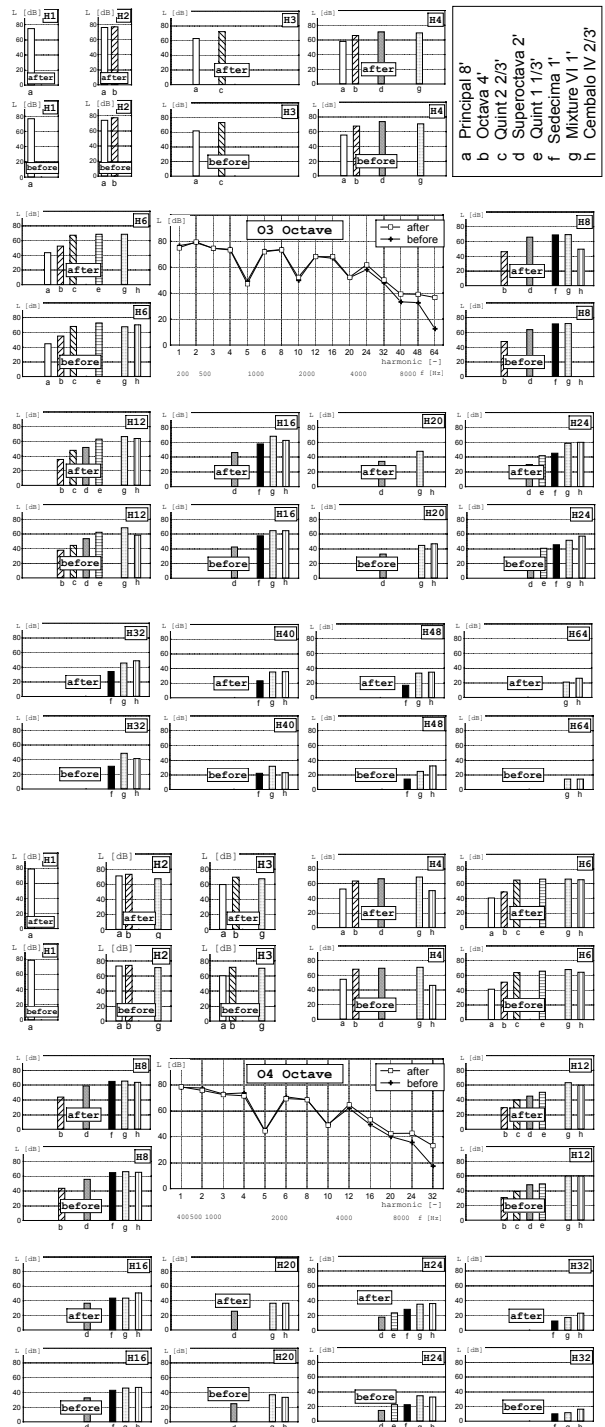


FIGURE 3. Mean levels of harmonics of Great organ plenum and its constituting stops for octaves C3 and C4 before and after the reconstruction.